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CAVİT ARSLAN

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## Effect of Dietary Probiotic Supplementation on Growth Performance in the Rock Partridge (*Alectoris graeca*)

Cavit ARSLAN

Department of Animal Nutrition, Faculty of Veterinary Medicine, University of Kafkas, 36300, Kars – TURKEY  
email: carslan42@hotmail.com

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**Abstract:** This study was conducted to determine the effect of dietary probiotic supplementation on growth performance in the rock partridge. One hundred 1-day-old chicks were used. They were divided into 2 groups and each group was divided into 5 replicate groups containing 10 chicks. One group served as the control, while the other group was the treatment group fed 0.15% probiotic (*Lactobacillus bulgaricus*) in the diet. The experimental period was 12 weeks with the first 6 weeks as the starter period and the last 6 weeks as the grower period. There were no statistical differences between the groups in growth performance at the end of the study. Live weight (g), cumulative feed consumption (g) and average feed conversion ratio (kg feed / kg gain) for the control and probiotic groups were 396.3, 2682 and 7.78 and 392.6, 2549 and 7.36, respectively, at the end of the study. In conclusion, under good hygienic conditions probiotic supplementation may not be necessary for improving partridge performance .

**Key Words:** Probiotic, growth performance, rock partridge

### Probiyotik İlavasının Kaya Kekliklerinin Büyüme Performansı Üzerine Etkisi

**Özet:** Bu çalışma, rasyona probiyotik ilave edilmesinin kaya kekliklerinin büyüme performansına etkisini belirlemek amacıyla yapılmıştır. Araştırmada 100 adet bir günlük yaşta kaya keklığı civcivi kullanılmıştır. Civcivler iki ana gruba ayrılmış, her grup kendi içinde 10 civcivden oluşan 5 alt gruba ayrılmışlardır. Gruplardan biri kontrol olarak kullanılırken, diğer grubun rasyonuna % 0,15 probiyotik (*Lactobacillus bulgaricus*) ilave edilmiştir. Araştırma ilk 6 haftası başlangıç, son 6 haftası büyütme olmak üzere 12 hafta sürdürülmüştür. Araştırma sonu itibarıyla büyüme performansı bakımından gruplar arasında farklılık görülmemiştir. Kontrol ve probiyotik grubunda canlı ağırlık (g), kümülatif yem tüketimi (g) ve ortalama yemden yararlanma oranı (kg yem / kg canlı ağırlık artışı) sırasıyla 396,3; 2682; 7,78 ve 392,6; 2549; 7,36 olarak bulunmuştur. Sonuç olarak, hijyenik şartlarda yapılan keklik besisinde probiyotik ilave edilmesinin performansı iyileştirici bir etki göstermediği için kullanımı tavsiye edilebilir bulunmamıştır.

**Anahtar Sözcükler:** Probiyotik, büyüme performansı, kaya keklığı

### Introduction

Partridges are game birds in the wild and are raised for hunting tourism. Recent studies have shown that the partridge, especially the rock partridge, can also be raised for meat production (1-5). The desire for products of exotic animals (e.g., quail, partridge, pheasant, ostrich) has increased and they have become available in markets for human consumption in recent years.

The average mature live weight of rock partridges varies between 350 and 450 g under farm conditions (3-5). This bird completes its growth around the end of 12 weeks of life and is usually slaughtered at the age of 10-12 weeks as feed efficiency declines after 12 weeks of life (2-5).

Probiotics are defined as “live microorganisms or specific products of their metabolism which beneficially affect the host animal by improving its intestinal microbial balance” (6,7). The modes of action of probiotics are still unclear despite the following suggestions: beneficial changes in gut flora with reductions in the population of *Escherichia coli*, lactate production with subsequent changes in intestinal pH, low redox potential, production of antibiotic-type substances, production of enzymes, competition for adhesion receptors in the intestine, competition for nutrients, reduction of toxin release and immunostimulation (7-9).

There are contradictory results concerning whether the growth performance of poultry is improved by

probiotics. Roth and Kirchgessner (10) noted that probiotic supplementation (*Streptococcus faecium* M 74) did not affect live weight, but significantly decreased feed intake and feed conversion in broiler chickens. No positive response was observed in live weight, feed intake or feed conversion, when diets with *Lactobacillus casei* (11) and *Lactobacillus acidophilus* (12) were fed to broiler chickens. It is reported that *Saccharomyces cerevisiae* supplementation to quail rations did not affect growth performance (13). In contrast, Arslan and Saatci (14) found a positive response on live weight, feed consumption and feed efficiency in quail fed diets with *Lactobacillus bulgaricus* via both the feed and drinking water.

Antibiotics and hormones have been used in feeds for stimulation of animal performance. However, these promoters have undesirable side effects such as toxicity, allergy, cancer, drug resistance, and residues in food. Their use in practice is therefore either diminished or banned. The use of natural growth promoters has increased in many countries over the last 15-20 years (15). However, the research on feeding partridges, especially related to feed additives, is limited.

The use of probiotics in commercial poultry production is still new. No literature about probiotic usage in partridge feeding could be found. The present study was conducted to evaluate the effect of dietary probiotic supplementation on the growth performance of the rock partridge (*Alectoris graeca*).

## Materials and Methods

### Animals, Treatment and Management

One hundred 1-day-old unsexed rock partridge chicks were divided into 2 groups, each with 5 subgroups, and 10 chicks were allocated into each subgroup. The study lasted 12 weeks: the first 6 weeks as the starter period and the last 6 weeks as the grower period. The treatments were a diet containing no probiotic (control group) and a diet supplemented with 0.15% probiotic (probiotic group), which included *Lactobacillus bulgaricus*  $1 \times 10^7$  CFU/g (Biostart, Bimpeks, Kimya Sanayi ve İthalat İhracat Tic. Ltd. Şti. İstanbul-Turkey). The diets were formulated to meet the recommendations of Coşkun et al. (16) for partridges (Table 1). The temperature of the brooder with continuous lighting was maintained at 34 °C initially and was then reduced by 3 °C/week until the

desired temperature (21 °C) was reached. This temperature was maintained for the rest of the feeding period. On day 22 of the study, the partridges were transferred to the feeding cages, made from metal wire. They had free access to feed (mash form) and water during the study.

### Data collection

Individual live weights of the partridges were recorded fortnightly. Feed consumption was determined at the same time and the feed conversion ratio (feed / gain) was calculated on a subgroup basis.

### Chemical analyses of diets

The dry matter, crude protein, crude fibre, ether extract, and ash content of diets were determined according to AOAC procedures (17).

### Statistics

The results were statistically analysed using the t test in SPSS. Statistical differences were set at  $P < 0.05$ .

## Results

Live weight, live weight gain, feed consumption and feed conversion ratio were not significantly affected by probiotic supplementation. The pooled results are given in Table 2. During the starter period the partridges quickly gained weight and had lower feed conversion ratios. After this period, live weight gain and feed conversion ratio gradually reduced.

## Discussion

The average hatching live weight of chicks at the beginning of the experiment was similar between the groups: 12.9 and 12.1 g in the control and probiotic groups, respectively. Hatching live weight of partridge chicks was in agreement with other research on rock partridges (2,4,5).

Probiotic supplementation did not affect live weight gain during the 12 week experimental period (Table 2). Live weight was 396.3 and 392.6 g at the end of the experiment in the control and probiotic groups, respectively. These results are higher than those of Kırıkçı et al. (2) and similar to those of Çetin (3) and Arslan et al. (4,5). Some previous studies reported that there were no significant effects of probiotics composed of different

Table 1. Ingredients and nutrient compositions of diets, %.

Ingredient	Starter period		Grower period	
	Control	Probiotic	Control	Probiotic
Corn	48.10	48.00	47.90	47.75
Soybean meal	35.00	35.00	27.00	27.00
Fish meal	7.00	7.00	2.00	2.00
Barley	6.95	6.90	12.00	12.00
Wheat bran	....	....	7.90	7.90
Limestone	1.20	1.20	1.40	1.40
Dicalcium phosphate	1.15	1.15	1.20	1.20
Salt	0.25	0.25	0.25	0.25
Vit. Min. Premixes <sup>1</sup>	0.35	0.35	0.35	0.35
Probiotic	....	0.15	....	0.15
Chemical analysis				
Dry matter	92.32	92.33	91.56	91.60
	% of DM			
Metabolisable energy <sup>2</sup> , kcal/kg	2800	2799	2700	2699
Crude protein	25.11	25.10	20.05	20.04
Ether extract	2.88	2.86	2.67	2.66
Crude fibre	3.58	3.57	4.17	4.14
Ash	6.02	6.02	5.11	5.10

<sup>1</sup> Provided per kg concentrate: Vitamin A, 21,000 IU; Vitamin D3, 4200 IU; Vitamin E, 52.5 mg; Vitamin K3, 4.38 mg; Vitamin B1, 5.25 mg; Vitamin B2, 12.25 mg; Vitamin B6, 7 mg; Vitamin B12, 0.03 mg; Folic acid, 1.75 mg; D-Biotin, 0.08 mg; Vitamin C, 87.5 mg; Niacin, 70 mg; Cal-D-Pantothenat, 14 mg; Choline chloride 218.75 mg, Fe, 140 mg; Zn, 105 mg; Cu, 14 mg; Co, 0.35 mg; I, 1.75 mg; Se, 0.26 mg; Mn, 140 mg.

<sup>2</sup> Provided by calculation.

bacterial cultures on the live weight of broiler chicks and quails (6,13,18).

During the whole experimental period, no statistical difference was found in feed consumption between the 2 groups (Table 2). Cumulative feed consumption was 2682 and 2549 g for the control and probiotic groups, respectively. Partridges in the probiotic group consumed slightly less feed than the control group, but their live weight gain was similar to that of the control group. Therefore, the feed conversion ratio was better in the probiotic group than in the control group. The average feed conversion ratio was 7.78 and 7.36 in the control and probiotic groups, respectively. This indicated that the use of a probiotic slightly decreased feed consumption and improved the feed conversion ratio. This may be considered beneficial for the breeder. On the other hand,

it can be concluded that due to the dramatic decrease in live weight gain and poor feed conversion after 10 weeks, rock partridges should be slaughtered at the end of 10 or 12 weeks. The feed consumption and feed conversion results in this study were similar to previous results reported for rock partridges (3-5). Yeo and Kim (11) and Buenrostro and Kratzer (12) showed that supplementation with different *Lactobacillus* spp. did not alter feed consumption or conversion in broiler chicken. Kahraman et al. (6) found similar feed conversions of broilers supplemented with different 0.075% or 0.15% bacterial culture combinations (*S. faecium*, *S. cerevisiae*, *L. acidophilus*) compared to the controls. In contrast, supplementation of *S. faecium* in broiler chicken rations (10) and *Lactobacillus bulgaricus* in quail rations (14) significantly decreased feed intake and increased feed

Table 2. Live weight, live weight gain, feed consumption and feed conversion ratio of partridges (mean  $\pm$  s $\bar{x}$ ).

Group	Week Relative to Hatching						
	Hatching	2	4	6	8	10	12
	Live weight, g						
Control	12.9 $\pm$ 0.2	47.2 $\pm$ 0.8	109.8 $\pm$ 1.6	188.8 $\pm$ 3.9	283.4 $\pm$ 2.8	357.0 $\pm$ 4.5	396.3 $\pm$ 1.3
Probiotic	12.1 $\pm$ 0.2	44.0 $\pm$ 1.1	105.8 $\pm$ 1.1	185.9 $\pm$ 1.8	275.3 $\pm$ 2.2	355.4 $\pm$ 3.9	392.6 $\pm$ 2.7
	NS	NS	NS	NS	NS	NS	NS
	Live weight gain, g						
Control		2.45 $\pm$ 0.1	4.47 $\pm$ 0.1	5.64 $\pm$ 0.4	6.75 $\pm$ 0.4	5.26 $\pm$ 0.1	2.80 $\pm$ 0.3
Probiotic		2.27 $\pm$ 0.1	4.41 $\pm$ 0.1	5.72 $\pm$ 0.1	6.39 $\pm$ 0.1	5.72 $\pm$ 0.4	2.66 $\pm$ 0.3
		NS	NS	NS	NS	NS	NS
	Feed consumption, g/day/bird						
Control		6.54 $\pm$ 0.2	18.54 $\pm$ 0.9	27.92 $\pm$ 0.6	39.03 $\pm$ 0.4	47.62 $\pm$ 0.8	51.94 $\pm$ 1.5
Probiotic		5.78 $\pm$ 0.2	13.77 $\pm$ 0.8	26.54 $\pm$ 0.7	41.33 $\pm$ 0.8	46.47 $\pm$ 1.5	48.22 $\pm$ 0.9
		NS	NS	NS	NS	NS	NS
	Feed conversion ratio kg feed/kg gain						
Control		2.69 $\pm$ 0.2	4.15 $\pm$ 0.2	5.06 $\pm$ 0.4	5.88 $\pm$ 0.3	9.06 $\pm$ 0.5	19.34 $\pm$ 1.5
Probiotic		2.55 $\pm$ 0.1	3.12 $\pm$ 0.2	4.64 $\pm$ 0.4	6.48 $\pm$ 0.2	8.21 $\pm$ 0.3	19.14 $\pm$ 2.1
		NS	NS	NS	NS	NS	NS

NS: Not significant ( $P > 0.05$ )

conversion. No information is available on the use of probiotics in partridge feeding, and so no actual comparison with this study is possible. The differences between the studies can be attributed to species, composition and doses of probiotic, management conditions and the ration composition of the diets used.

In this study, live weight, feed consumption and feed conversion ratio did not differ between the groups. This may be attributed to the optimal hygienic conditions in

which the experiment was carried out. Evidence already exists that under good hygienic conditions probiotics have less effect on the performance of broilers (19,20).

In conclusion, dietary probiotic supplementation at the 0.15% level did not significantly affect growth performance, but slightly decreased feed intake and improved the feed conversion ratio. Probiotic supplementation may not be required under optimum hygienic conditions for partridge feeding.

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