Effect of EM on Growth, Egg Production and Waste Characteristics of Japanese Quail

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Abstract

A study was conducted to determine the effects of EM supplied in drinking water and feed on growth, egg production and waste characteristics of Japanese quail. The effect of EM on the growth of 1,000 day-old quail was assessed using a completely randomized design with four treatments: a control; EM added in drinking water at 1:5,000; EM (in the form of fermented compost or bokashi) added in feed at 1:100 (i.e., 1%) and EM added in both drinking water and feed. The effect of EM on egg production involved 400 pullet quail randomly selected from the earlier study and evaluated using the same experimental design and treatments. Results after 4 weeks showed no significant effects of EM on growth, feed efficiency and mortality rate of growing quail. For egg production, EM supplied in either drinking water or feed had no significant effect on growth, laying performance, and feed efficiency of pullet quail. However, EM had a significant effect on egg quality as noted by a darker colored yolk. Pullet quail that received EM in feed and in both feed and drinking water produced manure that was significantly reduced in malodors. Chemical analysis showed that this corresponded to a lower level of total volatile solids, which is an indicator of malodors. Manure of pullet quail that received EM in feed contained a higher level of crude protein.

Introduction

The Japanese quail (*Coturnix coturnix japonica*) has been widely used as a laboratory animal, since it grows rapidly, matures at an early age and is a prolific egg producer. Presently, there is considerable interest in Japanese quail for commercial production in Thailand. The principal constraint to intensive production of this particular species is proper management of waste materials as well as dust, noxious gases and malodors. The lack of timely and efficient management of quail manure, especially under the hot and humid conditions of the tropics can have adverse effects on quail performance. Apparently, there is little information available on the most effective management practices for controlling malodors in rearing facilities.

Recently, a study by Chantsavang et al. (1996) at the National Swine Research and Training Center, Kasetsart University, showed that Effective Microorganisms (EM) a mixed culture inoculant of beneficial microorganisms was effective for treating the waste effluent and reducing the level of malodors from an experimental pig farm. In this study, the EM was added to the wash water that flushed the pig manure and urine into an effluent holding pond.

There are several reports in the literature which indicate that certain cultures of microorganisms added to feed or drinking water can improve the production performance of some avian species. For example, Tortuero (1973) reported a positive response when *Lactobacillus acidophilus* was added to the drinking water of broilers and leghorn chicks. Frances et al. (1978) found no significant improvement in body weight and feed efficiency when a *Lactobacillus* culture was added to the diet of turkey poults. In a study by Miles et al. (1981a), the addition of *Lactobacillus acidophilus* and other lactobacilli to the feed of bobwhite quail chicks had no significant effect on their growth, feed efficiency or mortality. In another study on laying bobwhite quail, Miles et al. (1981b) found no significant effect of feeding a *Lactobacillus* culture on feed consumption, egg production, fertility or hatchability of fertile eggs.

In view of these conflicting reports, the present study was conducted to determine the effects of EM supplied in drinking water and feed on the production performance and waste characteristics of Japanese quail.

Experimental Procedures

The study was divided into two experiments to evaluate the effects of EM on growth and egg production of Japanese quail. In the growth experiment (duration: 4 weeks), 1,000 day-old Japanese quail were assigned to a completely randomized design consisting of 4 treatments each with 5 replicate pens of 50 chicks per pen. Each pen had dimensions of 90 x 45 x 30 cm with supplemental heat provided by a 100-watt electric light bulb. Feed and water were freely available during the 4-week growing period. All birds received a growing diet with 26 percent protein treatment; total composition is reported in Table 1. In the control treatments the birds were fed the same growing diet but without EM. In the second, third and fourth treatments, the birds were fed the growing diet supplemented, respectively, with EM in drinking water at a dilution of 1:5,000; EM in feed in the form of fermented compost or bokashi at a level of 1:100 (i.e., 1%); and EM both in drinking water at 1:5,000 and in feed at 1:100. Body weight gain and feed conversion ratios were calculated after 2 and 4 weeks, while mortality was recorded daily.

Table 1. Composition of Growing and Laying Diets of Japanese Quail.

Ingredients	Growing diet (%)	Laying diet (%)
Corn	50	29
Rice bran	-	10
Broken rice	-	8
Leucaena leaf meal	3	4
Soybean meal	27	23.5
Fish meal	16	16
Dicalcium phosphate	-	3
DL-methionine	0.1	-
Vit.-min.premix	1	1
Salt	0.3	0.5
Oyster shell	1	5
Bone meal	1.6	-

In the egg production experiment (laying period: age 4 to 12 weeks), 400 pullet quail (randomly selected from thc earlier experiment) were assigned to the same experimental design and treatments. The laying diet contained 24 percent protein with the total composition reported in Table 1. The birds were maintained in 90 x 45 x 25 cm pens each containing 20 pullet quail. Feed and water were freely supplied. Body weight, feed consumption, mortality, egg weight and hen-day egg production were recorded, including number of days to first egg, and 50 and 80 percent egg production. For egg quality traits, the eggs were collected after 8 and 12 weeks of the laying period. Five eggs from each group were measured for eggshell thickness and were graded for yolk color using a Roche Yolk Color Fan (numbered from 1 to 15 with increasing degrees of color from light yellow to orange). At the end of the experiment (12 weeks), fecal samples from birds in each replication were analyzed for waste characteristics at the Central Laboratory, Kasetsart University, Bangkok, and for nutritional quality at the Nutritional Laboratory, Department of Animal Science, Kasetsart University, Bangkok.

Results and Discussion

Growth and Performance

Effects of EM supplied in drinking water and feed on production performance of growing Japanese quail are summarized in Table 2. There were no marked differences in mean body weight gain during 2 and 4 weeks of growth by quail chicks when diets were formulated with and without EM. At the end of 4 weeks, the mean weight gain of quail chicks on the control diet was 85.2 grams while those that received EM in drinking water, in feed and in both drinking water and feed were 86.9, 86.8 and 89.9 grams, respectively. These values were not significantly different, nor were the feed consumption values after 2 and 4 weeks. While the feed conversion efficiency after 2 and 4 weeks for quail chicks fed diets supplied with EM was better than the control, the differences were not significant. There were no significant differences among treatments for mortality after 2 and 4 weeks of the experiment.

Table 2. Effect of EM Applied to Drinking Water and Feed on the Performance of Growing Japanese Quail (0 to 4 weeks).

Parameters	Control	EM applied to:		
		Water	Feed	Water and feed
Weight gain (g)				
0 to 2 weeks	50.0	49.3	49.2	56.3
0 to 4 weeks	85.2	86.9	86.8	89.8
Feed intake (g)				
0 to 2 weeks	103.6	100.4	100.6	101.6
0 to 4 weeks	287.7	288.6	290.6	286.4
Feed conversion				
0 to 2 weeks	2.12	2.07	2.05	2.03
0 to 4 weeks	3.38	3.32	3.35	3.19
Mortality (%)				
0 to 2 weeks	0.40	0.80	0.40	0.00
0 to 4 weeks	0.80	1.80	0.80	0.00

Data presented are mean values.
There were no significant differences due to treatments.

Table 3. Effect of EM Applied to Drinking Water and Feed on the Performance of Laying Japanese Quail (4 to 12 weeks).

Parameters	Control	EM applied to:		
		Water	Feed	Water and feed
Body weight (g)				
4 weeks	99.5	98.5	99.8	101.0
6 weeks	136.5	138.6	139.0	139.3
12 weeks	159.2	158.8	160.6	158.7
Weight gain (g)	59.7	60.3	60.8	57.7
Age to produce (days)				
First egg	36.8	37.4	35.4	36.8
50% egg production	47.6	45.0	45.4	46.4
80% egg production	52.8	53.8	53.7	53.0
Hen-day egg production (%)				
8 weeks	33.8	32.1	34.3	31.6
12 weeks	87.1	79.4	87.0	81.1
Livability (%)				
4 to 8 weeks	100.0	100.0	98.0	99.5
8 to 12 weeks	94.0	99.0	94.0	98.0

There were no significant differences due to treatments.

Egg Production and Quality

Effects of EM on growth, hen-day egg production, ages to produce first egg, 50 and 80 percent egg production, and livability of laying Japanese quail are summarized in Table 3. There were no significant differences between treatment means for any of these parameters. The experimental data for egg weight, egg quality and feed efficiency for the control and EM-supplemented treatments are presented in Table 4. Except for egg yolk color, statistical analysis showed that there were no significant differences among treatments for the other production parameters. A significant influence of EM supplementation was noted in egg quality. Pullet quail that received EM in their water and feed gave a darker yolk color. At 8 weeks of age, the egg yolk color score was 4.14 for the control group compared with 5.80, 6.40 and 6.84 for groups supplemented with EM in water, in feed and in both water and feed, respectively. At 12 weeks of age, the egg yolk score for the control group was 5 .52, while the scores for the EM treatments were significantly different at 6.32, 6.72 and 6.96, respectively. Eggshell thickness increased slightly at 8 and 12 weeks of age with EM in water and/or in feed.

Table 4. Effect of EM Applied to Drinking Water and Feed on Egg Weight, Egg Quality, and Feed Efficiency of Laying Japanese Quail.

Parameters	Control	EM applied to:		
		Water	Feed	Water and feed
Egg weight (g)				
8 weeks	9.8	9.9	9.7	9.7
12 weeks	10.7	10.0	10.5	10.6
Egg yolk color				
8 weeks	4.14c	5.80b	6.40ab	6.84a
12 weeks	5.52c	6.32b	6.72ab	6.96a
Egg shell thickness (mm)				
8 weeks	0.22	0.22	0.23	0.23
12 weeks	0.23	0.23	0.23	0.23
Feed intake (g)				
4 to 8 weeks	22.5	22.4	23.0	22.7
8 to 12 weeks	28.2	26.5	29.0	27.0
Feed/100 eggs (kg)				
8 weeks	6.3	6.2	6.4	6.4
12 weeks	3.2	3.4	3.4	3.4

Treatment means in a row sharing a common letter are not significantly different at the 5% level of probability.

Table 5. Effect of EM Applied to Drinking Water and Feed on the Waste Characteristics and Nutritional Values of Japanese Quail Manure.

Parameters	Control	EM applied to:		
		Water	Feed	Water and feed
Waste characteristics				
Moisture (%)	78.5	76.4	78.3	78.0
COD (mg/g)	1073bc	939c	1699a	1328b
BOD (mg/g)	335b	254a	470a	368b
TS (mg/g)	1150a	1228a	1049b	1041b
TVS (mg/g)	815	902	681	671
Nutrient values				
Crude protein (%)	19.2	20.9	21.6	21.4
Crude fat (%)	1.8	1.3	1.9	2.0
Fiber (%)	8.0	8.2	8.0	8.2
Ash (%)	37.8	38.1	36.7	36.9

Treatment means in a row sharing a common letter are not significantly different at the 5% level of probability.
COD = chemical oxygen demand
BOD = biochemical oxygen demand
Ts = total solids
TVs = total volatile solids

Waste Characteristics

The waste characteristics of treated and untreated quail manure are reported in Table 5. The chemical oxygen demand (COD) values of quail manure were 1073, 939, 1699, and 1328 mg/g of dry manure for the control and three EM treatments, respectively, while the biochemical oxygen demand (BOD) values for the four treatments were 335, 254, 470, and 368 mg/g of dry manure, respectively. In each case the highest values were obtained for EM applied to feed compared with the other treatments. Nevertheless, results of statistical analyses show that the observed values of COD and BOD were not consistent among the treatment groups. Total volatile solids (TVS) is an indicator of malodorous compounds in waste materials. Chemical analyses show that the TVS values decreased markedly in the manure of pullet quail which received 1 percent EM in their feed. TVS values for the control and EM applied in drinking water treatments were 815 and 902 mg/g of dry manure, respectively, while the values for EM applied to feed and to both feed and drinking water were 681 and 671 mg/g, respectively.

The nutritional values of quail manure resulting from the control and EM treatments are also reported in Table 5. While differences were not significant, the manure from quail that received EM-treated feed had a higher level of crude protein. These values were 21.6 and 21.4 percent, respectively, compared with 19.2 percent for the control and 20.9 percent for the group that received only EM in their drinking water.

Summary and Conclusions

The addition of EM in drinking water at a dilution of 1:5,000 and/or in feed at 1:100 was neither detrimental nor significantly beneficial to the growing and laying performance of Japanese quail. Except for an egg quality trait, i.e. egg yolk color, there were no statistically significant differences among treatments with respect to growth, feed efficiency, egg production and mortality of Japanese quail. Birds which received EM in their drinking water and/or feed produced a significantly darker yolk color than the control birds. Chemical analysis showed that total volatile solids (TVS), an indicator of malodors, decreased substantially in the manure of pullet quail that received 1 percent EM in their feed. The manure from these birds had a higher content of crude protein compared with the control group and those with EM applied only to drinking water.

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