Supplementing Market Broiler Rations with Lactobacillus and Live Yeast Culture

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Story In Brief

An eight-week feeding trial was conducted to observe the effect that the addition of a lactobacillus supplement and/or a live yeast culture to a broiler ration had on feed consumption, body weight gain, efficiency of feed conversion, and degree of pigmentation. Four experimental rations were fed: the broiler ration unsupplemented; the broiler ration supplemented with lactobacillus; the broiler ration supplemented with live yeast culture; and the broiler rations supplemented with both lactobacillus and live yeast culture. The lactobacillus supplement and the live yeast culture, alone and in combination, were added at dietary levels of 2.5 percent, respectively, to a nutritionally well balanced broiler ration. Body weight and feed consumption were recorded weekly. At the end of eight weeks, 10 males and 10 females from each ration were dressed and scored on skin and fat pigmentation, and degree of fat deposition.

A field trial involving 30,000 broilers, in which the same lactobacillus supplement was used, was conducted concurrently to the eight-week feeding trial. The results from both feeding trials were essentially the same.

No significant differences in body weight gain among the broilers fed the four rations were observed at any time throughout the course of the eight-week feeding trial. However, feed consumption and efficiency of feed conversion, on a cumulative basis, were significantly lower for the broilers fed the lactobacillus supplemented rations during the first four weeks of the experiment. In addition, visual scoring of the dressed broilers indicated that degree of pigmentation was greater when lactobacillus was fed, and that both degree of pigmentation and amount of fat deposition were superior when a combination of lactobacillus and live yeast culture was used.

Although differences in body weight gain were not significant among the broilers which were fed the four experimental rations, it must be pointed out that the broiler ration which was selected and used was one which produced

maximum weight gains and a high efficiency of feed conversion under commercial feeding conditions. Further research will need to be conducted to determine if comparable results can be obtained with broiler rations which may be nutritionally marginal, and which are lower in cost.

Introduction

Broiler chickens are among the most efficient converters of raw feed nutrients into meat from both a nutritional and an economic standpoint when compared to other types of livestock. Modern advances in feed ingredient processing procedures, in the development of new feed ingredients, and in ration formulation have played an important role in bringing this about. However, increases in feed ingredient prices coupled with diminishing returns to the broiler producer during recent years have intensified the search, along these same lines, for additional ways and means of reducing ration cost or increasing efficiency of feed conversion or both.

Some micro-organisms have been shown to enhance the ability of the small intestine to absorb food nutrients by improving the environment within the intestinal tract, and, in so doing, to bring about an increase in efficiency of feed conversion. Lactobacillus, which falls into this category, has been stabilized in a beadlet form or inpregnated on a soybean oil meal carrier in a stabilized form, so that it can be used effectively to supplement rations for poultry, cattle, hogs, and dogs. It is theorized that once the stabilized micro-organism reaches the intestine it becomes active and multiplies. It replaces the so called harmful intestinal bacteria, and the overall condition of the intestinal tract is improved. As a result of this action, it is thought that nutrient digestion and absorption are enchanced, and food nutrients are utilized more efficiently. It is speculated that rations which contain relatively poor quality feed ingredients or those that are marginal from a dietary nutrient standpoint might be used with greater efficiency under these conditions.

Very few feeding trials have been conducted with lactobacillus supplemented rations in which modern commercial broiler rations, and the broiler breeds and crosses as they are bred today were used. There is a growing interest in this type of product for use in Oklahoma and Arkansas, and research data on growth performance are needed.

The purpose of this feeding trial was to determine the nutritive value of a lactobacillus supplement when added to a standard broiler ration currently being used under commercial growing conditions. A live yeast culture was included since research work at Oklahoma State University has shown the value of this product in improving efficiency of nutrient utilization in broiler rations. An eight-week feeding period was utilized although it is recognized that broilers are usually marketed at an earlier age. Data were collected on growth performance at weekly intervals which permitted a comparative evaluation to be made at ages younger than eight-weeks.

Materials and Methods

A total of 1200 Cornish x White Rock broilers (600 males and 600 females) were randomly assigned to 40 floor pens (6 x 12 feet) with 30 males or 30 females in each of 20 pens. Management procedures during the eight-week growing period were similar, insofar as possible, to those currently recommended under commercial production conditions.

The standard commercial broiler rations which were used consisted of a starter ration (24 percent protein), and a finisher ration (22 percent protein). The starter ration was fed during the first four weeks of the feeding trial, and the finisher ration the final four weeks. Both of these rations conformed to nutrient requirements as recommended for use in commercial broiler rations. The formulas are given in Table 1.

Four experimental rations were formulated from these commercial rations and were fed with five pens of males and five pens of females, each receiving one of the four rations. Ration 1 served as a control and was not supplemented with either the lactobacillus supplement or live yeast culture. Rations 2, 3, and 4 were supplemented with live yeast culture, lactobacillus, and a combination of the two, respectively. A dietary level of 2.5 percent was used for each ingredient whether it was used singly or in combination. The lactobacillus was added to the ration in the form of a supplement that utilized

Table 1. The commercial broiler starter and finisher rations which were modified in the formulation of the four experimental rations fed in the eight-week feeding trial

Ingredients	Starter (percent)	Finisher (percent)
Tallow, feed grade	5	5
Corn, ground yellow	39.35	45.25
Milo, ground	14.6	14.1
Soybean oil meal (44%)	29	25
Fish meal (menhaden)	4	4
Feather meal	2	2
Meat and bone scrap (50%)	4	2.5
dl Methionine	0.15	0.12
Phosphorus supplement (Ca 31-P 18)	0.6	0.7
Calcium carbonate	0.5	0.5
Salt	0.3	0.3
Trace mineral mix[1]	0.1	0.1
Vitamin supplement[2]	0.3	0.3
Choline choride - 50	0.07	0.07
Coban[3]	0.1	0.1
Florafil[4]	0.0	0.0012

[1]Provides in the mixed feed: Manganese 120 ppm, Zinc 80 ppm, Iron 60 ppm, Copper 10 ppm, and Iodine 1 ppm.
[2]Contains per pound of vitamin mix: Vitamin A 1, 600,000 I.U., Vitamin D_3 600000 I.U., Vitamin E 3400 I.U., Riboflavin 1000 mg., Niacin 3000 mg., Pantothenic Acid 3200 mg., Choline 80,000 mg., Menadione 400 mg., Folic Acid 200 mg., Thiamin 436 mg., Pyridoxine 486 mg., Biotin 20 mg., and Vitamin B_{12} 1.6 mg.
[3]A coccidiostat.
[4]A marigold petal extract of xanthophylls.

soybean oil meal as a carrier. The lactobacillus supplement replaced an equivalent amount of soybean oil meal, and the live yeast culture an equivalent amount of ground corn.

Feed consumption and body weight were recorded at weekly intervals on a per pen basis. At the termination of the experiment, two broilers from each of the 40 pens were selected at random and New York dressed. This procedure provided 10 males and 10 females from each of the four rations or treatments. Each of the eight groups (10 males or 10 females) were visually scored for pigmentation and fat deposition. Appropriate statistical analyses were applied to the data (both weekly and cumulative) involving the response variables of body weight, body weight gain, feed consumption, and units of feed per unit of gain.

A field trial was conducted concurrently with the eight-week feeding trial. This field trial involved two broiler houses which were divided into two pens each with a broiler capacity of 7500 broilers per pen. Two pens of broilers were fed an unsupplemented broiler ration, while the broilers in the other two pens were fed the broiler rations supplemented with lactobacillus. The broiler lines which were used were K_2xY and K_2xT_1 from Peterson Farms, Inc. Records were kept on mortality, total body weight, feed consumption, and dressed market grades. Calculations were made to determine percent mortality, average body weight, feed conversion, feed efficiency, and feed cost per broiler. The field trial covered a feeding period of 52 days from September 30, 1976 through November 21, 1976.

Results and Discussion

Data on body weight in pounds, and pounds of feed consumed per pound of body weight at weekly intervals during the eight-week feeding period are presented in Tables 2 and 3, respectively. There was no statistically significant

Table 2. Body weight by weeks in pounds

Ration number	Sex	1	2	3	4	5	6	7	8
1 Unsupplemented	Males	0.30	0.69	1.20	1.92	2.68	3.49	4.39	5.35
	Females	0.29	0.63	1.09	1.68	2.29	2.95	3.62	4.26
2 + live yeast culture	Males	0.30	0.69	1.22	1.92	2.70	3.52	4.37	5.25
	Females	0.29	0.63	1.08	1.67	2.27	2.93	3.58	4.20
3 + lactobacillus	Males	0.29	0.68	1.20	1.90	2.68	3.51	4.34	5.28
	Females	0.29	0.65	1.10	1.68	2.29	2.95	3.61	4.27
4 + live yeast culture and lactobacillus	Males	0.30	0.69	1.20	1.93	2.72	3.57	4.42	5.26
	Females	0.28	0.62	1.07	1.65	2.26	2.90	3.54	4.19
LSD		± 0.01	0.02	0.03	0.04	0.05	0.08	0.11	0.14

Table 3. Efficiency of feed conversion in pounds of feed per pound of body weight by weeks

Ration number	Sex	1	2	3	4	5	6	7	8
1 Unsupplemented	Males		1.49	1.62	1.73	1.85	1.98	2.08	2.17
	Females		1.56	1.65	1.79	1.91	2.06	2.18	2.33
2 + live yeast culture	Males		1.51	1.60	1.69	1.81	1.94	2.06	2.18
	Females		1.55	1.65	1.77	1.90	2.05	2.18	2.23
3 + lacotbacillus	Males		1.47	1.57	1.69	1.80	1.93	2.07	2.18
	Females		1.51	1.63	1.77	1.91	2.04	2.19	2.33
4 + live yeast culture and lactobacillus	Males		1.47	1.59	1.69	1.84	1.95	2.07	2.21
	Females		1.50	1.63	1.75	1.89	2.03	2.17	2.32
LSD		±	0.05	0.04	0.03	0.04	0.03	0.04	0.05

differences in body weight among the broilers fed the four experimental rations.

On the basis of pounds of feed required per pound of gain during any given week, there were no statistically significant differences in the efficiency with which the four rations were utilized. However, the cumulative values for pounds of feed per pound of broiler when compared at the end of the second, third, and fourth weeks of the growing period indicated that the broilers, as a group, which were fed Rations 3 and 4 (supplemented with lactobacillus) required significantly ($p<0.05$) less feed per pound of meat produced than did the broilers, as a group, which were fed Rations 1 and 2 (no lactobacillus). The greatest efficiency of feed conversion came during the first two weeks with a gradual decrease taking place during weeks three and four. Thus it appears likely that the benefit derived from the feeding of the lactobacillus in terms of increased efficiency of feed conversion comes during the early part of the growing period from day-old through the fourth week.

It must be pointed out, however, that the commercial broiler rations which were fed produce body weight gains and efficiencies of feed conversion which compare favorably with the best growth performance obtained under commercial production conditions. Perhaps from the standpoint of the nutritional adequacy of these rations, and from the growth potential of the broiler cross which was used, very little improvement in growth performance could be expected. It has been suggested that the results might have been different if rations with marginal dietary nutrient levels and lower ingredient cost had been used. Further feeding trials will have to be conducted to determine if this line of reasoning is valid.

The relative degree of pigmentation and fat deposition among the broilers fed the four experimental rations is summarized in Table 4. Lactobacillus brought about the greatest degree of pigmentation in both males and females, but did not produce maximum fat deposition. The females fed a combination

Table 4. Comparison of fatness and pigmentation scores among the broilers fed the four experimental rations

Ration number	Sex	Color	Fatness
1 Unsupplemented	Males	3	3
	Females	3	3
2 + live yeast culture	Males	4	4
	Females	4	4
3 + lactobacillus	Males	1	2
	Females	1	2
4 + live yeast culture and lactobacillus	Males	2	2
	Females	1	1

Scores range from 1 through 4 for both color and fatness; 1 denotes deep yellow color or good fat covering; 4 denotes pale yellow color or relatively poor fat covering.

of lactobacillus and live yeast culture were superior in both color and fatness. It should be pointed out that the broilers fed Ration 2 were relatively well covered with fat, and rated a score of 4 only on the basis of a comparision with the other three groups. It is possible that the deeper color in the broilers fed Rations 3 and 4 may have led the grader to score them higher on fat deposition. It can be concluded that lactobacillus produces a superior degree of pigmentation, and in combination with live yeast culture gives a distinct advantage insofar as color and finish are concerned on a grade basis.

Data from the field trial are summarized in Table 5. There were no differences in growth performance among the broilers fed the two rations. However, it was noted that on a pigmentation basis the broilers fed the lactobacillus had a much deeper color. The opinion was expressed by the processor, that for this reason, these broilers might bring a premium on eastern markets. This production of a greater degree of pigmentation by the lactobacillus is in line with the results which were obtained in the eight-week feeding trial. Feed conversion on a pound of feed per pound of broiler basis in the field trial was probably lower with the lactobacillus fed broilers early in the growing period, as it was in the eight-week feeding trial, but it had disappeared by the time the broilers were marketed.

Further research needs to be done in order to determine the value of lactobacillus, live yeast culture, and a combination of these two feed ingredients in low cost broiler rations. At the present time the primary advantage in using a lactobacillus supplement appears to be in promoting pigmentation. The value of live yeast culture in relation to phosphorus utilization has been reported previously.

Table 5. Summary of the data obtained in the 52 - day field trial

Pen	Line	Number broilers	Mortality (percent)	Total body weight (lbs.)	Average body weight (lbs.)	Feed cons. (lbs.)	Feed conv. (lbs.)	Feed eff. (lbs.)	Feed cost per lb. broiler (cents)	Grades (percent) A	B	C
				Unsupplemented								
NE	$K_2 \times Y$	7,314	2.48	31,020	4.24	63,000	49.24	2.03	15.15	62.0	9.2	24.6
NW	$K_2 \times T_1$	7,295	2.73	29,850	4.09	60,190	49.59	2.01	15.09	65.0	8.6	22.5
NE & NW		14,609	2.61	60,870	4.17	123,190	49.42	2.02	15.12	63.5	8.9	23.6
				Supplemented								
SW	$K_2 \times Y$	7,295	2.73	30,380	4.16	62,260	48.80	2.04	15.31	62.8	8.4	24.5
SE	$K_2 \times T_1$	7,293	2.76	29,940	4.10	60,090	49.83	2.00	15.03	63.2	9.1	23.7
SE & SW		14,588	2.75	60,320	4.13	122,350	49.32	2.02	15.17	63.0	8.8	24.1