The Effect of Withdrawing Growth Promoting Antibiotics from Broiler Chickens: A Long-Term Commercial Industry Study

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Primary Audience: Nutritionists, Veterinarians, Researchers, Broiler Producers

SUMMARY

A comprehensive study with close to 7 million growing broilers spanning 3 yr and 158 paired-houses was conducted in two different geographic locations under industry conditions. A limited number of farms, most having tunnel-ventilated, dark-out facilities and all having similar equipment were selected to enhance repeatability over time. Equal numbers of birds from different breeder flocks were placed in the trial and control houses. The control treatment used the current field feed coccidiostat, roxarsone, and growth-promoting antibiotics (GPA) program, and the trial was identical to the control treatment with no GPA. The average age of all flocks in the entire trial was 52 d of age. Removal of GPA from the feed resulted in an average reduction in livability of 0.2% on the Delmarva Peninsula (DMV) and 0.14% in North Carolina (NC), an average decrease in body weight of 0.03 lb on DMV and 0.04 lb in NC, and an average increase in feed conversion ratio of 0.016 on DMV and 0.0.012 in NC. Skin color scores and field condemnations were not significantly negatively impacted by removing GPA. Both male and female body weights were less uniform without GPA. Placing new litter on farms resulted in only temporary improvement in field performance of birds given no GPA. The pattern of difference for feed conversion between trial and control over time was different between geographic locations. This study clearly shows that making a decision to withdraw GPA should not be made with only limited data conducted in one location or over a short time.

Key words: broiler, growth-promoting antibiotic, paired-house field trial, live performance

2002 J. Appl. Poult. Res. 11:431–436

DESCRIPTION OF PROBLEM

The withdrawal of GPA from broiler feeds has been the subject of global controversy since the early 1990s and the banning of Avoparcin in the UK in 1995. Concern has been expressed by segments of the medical community, veterinary community, regulatory agencies, and activist groups of reduced efficacy of medically important antibiotics in humans due to foodborne transmission of antimicrobial-resistant salmonella and campylobacter from contaminated food products to humans [1, 2, 3, 4, 5]. The purpose of this study was to determine

[1] Presented as part of the Informal Nutrition Symposium "Making Sense of Scientific Research and Applying It Properly" at the 91st Annual Meeting of the Poultry Science Association, Newark, Delaware, August 11–14, 2002.

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TABLE 1. The effect of no growth-promoting antibiotics (GPA) on body weights, feed conversion, and color scores of broilers over time on the Delmarva Peninsula (trial without GPA minus control with GPA)

Set of 10 trials[A]	Livability differential (%)	Average weight differential	Feed conversion differential[B]	Adjusted feed conversion differential[C]	Color score[D]
1 (10/8/98–2/17/99)	–0.3	0.01	0.001	0.001	0.04
2 (12/30/98–5/14/99)	0.1	0.02	0.012	0.01	–0.04
3 (4/1/99–8/17/99)	–0.51	–0.01	0.007	0.007	0.01
4 (7/1/99–12/6/99)	–0.1	0.03	0.006	0.003	–0.01
5 (10/21/99–2/14/00)	0.1	–0.06	0.011	0.017	–0.01
6 (1/3/00–4/21/00)	–0.1	–0.07	0.024	0.03	–0.01
7 (3/14/00–7/5/00)	0.2	–0.04	0.038	0.042	–0.06
8 (5/23/00–9/13/00)	–0.3	–0.10	0.032	0.041	–0.17
9 (8/01/00–12/7/00)	–0.1	–0.06	0.024	0.030	0.00
10 (10/23/00–2/21/01)	–0.3	0.07	0.005	–0.002	–0.03
11 (1/4/01–5/29/01)	0.3	–0.07	0.021	0.028	–0.05
12 (4/16/01–9/6/01)	–0.2	–0.09	0.013	0.023	0.08
Cumulative average (120 trials)	–0.2	–0.03	0.016	0.019	–0.02

[A]Placement date of the first flock in group – movement date of the last flock in group.
[B]Feed conversion = (lb feed/lb body weight gain).
[C]Body weight of 0.10 lb = 0.01 feed conversion.
[D]Color scores were as follows: 1 = highest to 5 = lowest.

the effect of withdrawing growth-promoting antibiotics (GPA) from broiler feeds repeatedly on the same farms over a long period in two geographic locations on economically important criteria.

MATERIALS AND METHODS

Animals and Housing

This study was conducted in different geographic locations. One was on the Delmarva Peninusla (DMV) and the other was eastern NC. The majority of houses were 40 ft wide and 400 ft long or 40 ft wide and 500 ft long. Placement density in the trial and control houses were identical and ranged from 0.73 to 0 .77 ft^2 per bird, depending on the design of the house and geographic location. A majority of houses were tunnel-ventilated with dark-out curtains. Each paired-house was identical in size and feeding, water, and ventilation equipment. The number of chicks placed from each of the respective breeder flocks was kept equal in the control and trial houses on each farm. Standard industry practices were maintained regarding temperature and lighting regimes for each facility. The majority of birds placed in each facility were Perdue breed. The average age at processing in both geographical locations was 52 d.

TABLE 2. The effect of no growth-promoting antibiotics (GPA) on body weight, feed conversion, and color score of broilers over time in North Carolina (trial without GPA minus control with GPA)

Set of 10 trials[A]	Livability differential (%)	Average weight differential	Feed conversion differential[B]	Adjusted feed conversion differential[C]
1 (10/7/99–8/21/00)	–0.30	–0.10	0.002	0.012
2 (7/7/00–1/11/01)	0.00	–0.06	0.017	0.023
3 (11/21/00–7/16/01)	–0.20	0.00	0.008	0.008
4[D] (5/21/01–9/19/01)	–0.10	0.01	0.022	0.021
Cumulative average (37 trials)	–0.14	–0.04	0.012	0.016

[A]Placement date of the first flock in group – movement date of the last flock in group.
[B]Feed conversion = (lb feed/lb body weight gain).
[C]Body weight of 0.10 lb = 0.01 feed conversion.
[D]Set of seven trials.

TABLE 3. The effect of no growth-promoting antibiotics (GPA) on body weight uniformity[A] in 47-d-old broilers

Sex	Metric	Control[B]	Trial	Differential (trial minus control)
Male	SD	0.4234	0.5198	0.0964
	CV	8.5371	10.4465	1.9094
Female	SD	0.3936	0.4434	0.0498
	CV	9.7088	10.8731	1.1643

[A]Each table value is based on 250 individually weighed birds.
[B]Control = with GPA; Trial = without GPA.

On DMV there was a total of 13 Farms used with an average of 9.23 consecutive repetitions of the trial and control on the same farm. The first farm was placed on October 8, 1998, and the final farm was settled on September 6, 2001. In North Carolina (NC), there were six farms with an average of 6.17 consecutive repetitions of the trial and control on the same farm. The first farm was placed October 7, 1999, and the last farm was settled on September 19, 2001.

Feeding Regimes and Dietary Treatments

In each geographic location, the control houses in each pair were fed the field coccidiostat program, roxarsone, and GPA program that was in place at that time. The trial houses were fed identical feeds without the GPA program. The GPA program included various combinations of bacitracin methylene disalicylate, zinc bacitracin, flavomycin, and virginamycin in the starter, grower, and withdrawal feeds. All diets were corn-soy based and were nutritionally balanced for the Perdue breed. The coccidiostat, roxarsone, and GPA programs were rotated approximately every 4 mo during the course of this study.

Data Recorded

Percentage livability, average live weight, feed conversion, weight-adjusted feed conversion (using 0.10 lb of final weight for each 0.01 of feed conversion), color scores, and total condemnations were recorded.

TABLE 4. The effect of no growth-promoting antibiotics (GPA) on farm and total condemnations at Delmarva[A] (trial minus control)[A]

Set of 10 Trials	Air sacculitis	Septicemia	Leukosis	Inflammatory process	Tumors	Farm condemnations (Total)	Total condemnations[B]
1	–0.07	–0.07	–0.16	–0.06	–0.06	–0.42	–0.42
2	–0.06	–0.03	–0.03	0.00	–0.03	–0.15	–0.14
3	0.03	0.08	–0.06	0.05	–0.05	0.03	0.15
4	0.00	–0.01	0.00	0.03	0.00	0.00	0.04
5	–0.02	0.03	0.01	0.03	0.00	0.05	0.13
6	0.05	–0.09	0.10	0.00	–0.02	0.03	0.01
7	0.00	0.23	0.02	0.02	0.03	0.29	0.31
8	0.01	–0.10	–0.08	0.00	–0.03	–0.02	–0.15
9	0.01	0.25	0.02	0.01	0.04	0.33	0.44
10	0.00	0.12	0.02	0.01	0.01	0.01	0.15
11	0.00	0.06	0.02	0.00	0.01	0.10	0.08
12	0.00	0.00	0.01	0.00	0.01	0.00	–0.20
Cumulative Avg.	–0.01	0.04	–0.01	0.00	–0.01	0.01	0.03

[A]Control = with GPA; Trial = without GPA.
[B]Total condemnations include farm and plant condemnations.

TABLE 5. The effect of no growth-promoting antibiotics (GPA) on farm and total condemnations in North Carolina[A] (trial minus control)

Farms (n)	Air sacculitis	Septicemia	Leukosis	Inflamatory process	Tumors	Farm condemnations (Total)	Total condemnations[B]
6	0.03	–0.03	0.00	–0.10	0.02	–0.08	–0.07
10	0.01	–0.05	0.00	0.01	0.00	–0.03	–0.13
9	0.00	–0.04	0.00	0.06	–0.14	–0.11	–0.17
6	0.00	–0.06	0.00	0.00	0.02	–0.06	–0.11
Cumulative average (31)	0.01	–0.05	0.00	0.00	–0.03	–0.08	–0.12

[A]Control = with GPA; Trial = without GPA.
[B]Total condemnations include farm and plant condemnations.

Bird Weight Uniformity Check

One paired-house trial on DMV was checked for bird uniformity. A total of 250 males and 250 females were individually weighed in the trial and control houses. Means, standard deviations, and coefficients of variation were calculated for each group.

Effect of Changing to New Litter

A total of six individual farms on DMV were tracked for the impact of changing to new litter in the house on the differential response between the trial and control treatments. The three consecutive previous flocks prior to litter removal were compared to the three consecutive flocks following new litter replacement. Livability, weight gain, and weight-adjusted feed conversion were observed.

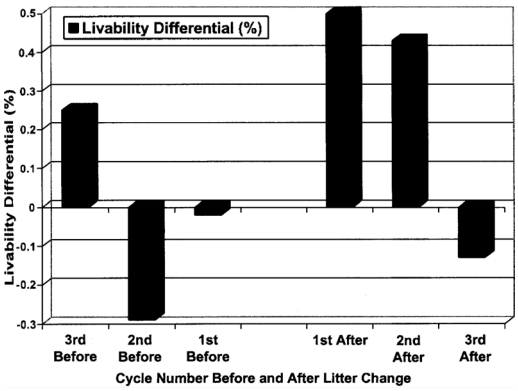

FIGURE 1. The Effect of changing to new litter and growth-promoting antibiotics (GPA) on broiler livability [trial (without GPA) minus control (with GPA)].

Plant Data

Farm- and plant-related condemnations were observed. Air sacculitis, septicemia and toxemia, leukosis, inflammatory process, and tumors were tracked for the farm related condemnations. Contamination, bruises, over scald, and cadavers were tracked for plant-related condemnations. Color scores were also recorded, using a system where 1 = best color and 5 = worst color, for 100 individual birds for each control and trial house in this study.

RESULTS AND DISCUSSION

Table 1 shows the difference between the trial and control in 12 groups of 10 paired-houses. Each set of 10 paired-house comparisons incorporated between 400,000 to 500,000 birds. Over the course of 120 trials in a 3-yr period, it can be shown that the average livability was negatively affected by only 0.2% with the removal of the GPA from the diet. In any set of 10 paired-house trials, the worst livability negative impact difference was 0.5% between the trial and control, whereas the best showed a positive impact on livability of 0.3%.

Average body weight, on the other hand, was not negatively affected by removal of the GPA until after about the first year. Starting with the fifth series of 10 flocks, a fairly consistent negative impact on weight gain was observed. The only exception to that trend was the 10th series of 10 flocks.

Actual feed conversion was not adversely affected much more than 0.01 lb feed/lb of gain until after the first year. After that, a consistent increase in feed conversion was noted without

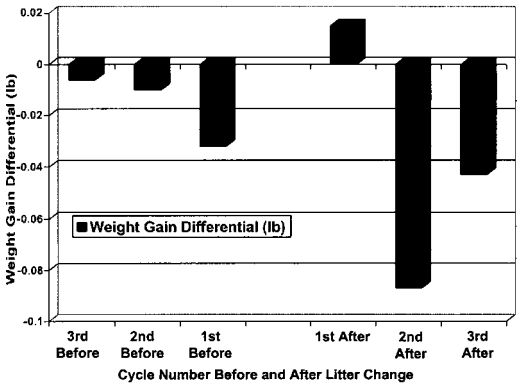

FIGURE 2. The effect of changing to new litter and growth-promoting antibiotics (GPA) on broiler weight gain [trial (without GPA) minus control (with GPA)].

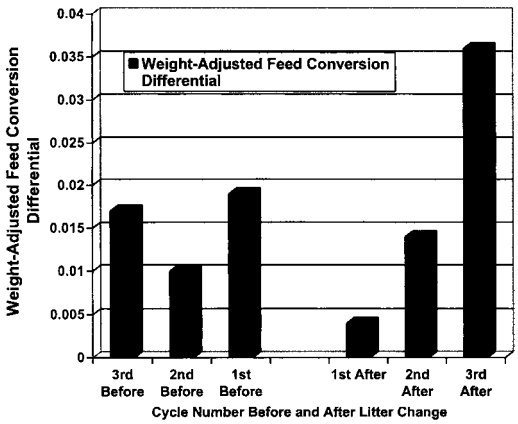

FIGURE 3. The effect of changing to new litter and growth-promoting antibiotics (GPA) on weight-adjusted feed conversion (0.10 lb of body weight = 0.01 feed conversion). Trial (without GPA) minus control (with GPA).

GPA until the 10th cycle, at which it began to decline and plateau. Weight-adjusted feed conversion followed the same trend as actual feed conversion although the increase began one cycle earlier due to the drop in weight gain in the 5th series of 10 flocks.

Color scores, on a scale of 1 to 5, were amazingly uniform between the trial and control throughout the entire study on DMV with the final differential being only 0.02 between the trial and control groups.

Table 2 shows the broiler data from NC. Although there were fewer repetitions than on DMV, the relative impact on livability was only 0.14% between the trial and control. The impact of no GPA on average weights manifested itself differently in NC than on DMV with an immediate negative effect on weight gain in the first set of 10, and then appeared to improve over time. The actual feed conversion increased by an average of 0.012 when GPA were removed; weight-adjusted feed conversion increased by 0.016.

The lack of any substantial difference in mortality in either geographic location was coupled with no field observations or veterinary reports of any outbreaks of dermatitis, necrotic enteritis, or dysbacteriosis, which have been reported in the UK and European Union following the ban of GPA [6, 7, 8].

Table 3 shows the impact of omission of feed GPA on market-age broiler body weight uniformity in the DMV geographic location. The removal of GPA resulted in lower uniformity (higher coefficients of variation) of males and females in this trial.

Table 4 shows the impact of no GPA on farm and total condemnations in the processing plant on DMV. Over the course of the entire study, the data show there was little if any difference in farm condemnations with or without GPA.

Table 5 shows farm and total plant condemnations in NC. This set of data shows that removing GPA had no negative effect on total plant condemnations, and, in fact, it shows a slightly positive effect.

The lack of any substantial difference with septicemia, toxemia, or inflammatory process in the plant further supports the lack of any observations in the field of dermatitis, necrotic enteritis, or dysbacteriosis. There were also no reports of extreme intestinal fragility or abnormal reports of fecal failures between the trial and control groups during the course of this trial.

Figure 1 shows the impact of changing to new litter and GPA on broiler livability. The data showed some improvement in livability in the first and second cycles without the GPA. However, it appeared that any improvement in livability after changing to new litter without GPA was short lived, as the effect declined after the second cycle.

Figure 2 shows the impact of changing to new litter and GPA on broiler market weight

gain. These data showed no improvement in weight gain with no GPA with new litter. If anything, the data suggest that the weight gain difference between no GPA and GPA became greater after the birds are put on new litter.

Figure 3 shows that although there was minimal improvement in weight-adjusted feed conversion in the first cycle after changing the litter with no GPA, conversions became progressively worse over time. Overall, the data indicate that any impact of changing litter in an attempt to improve performance and livability with no feed GPA was, at best, a short-term gain.

CONCLUSIONS AND APPLICATIONS

1. Removal of GPA from the feed of poultry in a commercial setting for approximately 3 yr showed a differential response in two different geographic locations. Weight-adjusted feed conversion showed little difference initially with the removal of GPA at one location followed by a consistent decline in performance. However, at a second location there was more of a consistent loss of performance throughout the entire trial.
2. Removal of GPA resulted in a small but consistent decrease in weight uniformity in male and female broilers.
3. Removal of GPA over the course of the study resulted in no reports of field outbreaks of dermatitis, necrotic enteritis, or dysbacteriosis. This finding was consistent with the finding of no significant differences in septicemia or inflammatory process in the plant with birds not fed GPA compared to those given GPA. Total farm condemnations were not affected by removal of GPA.
4. Addition of new litter to farms receiving multiple consecutive cycles of flocks with no GPA caused only temporary improvement in live performance.
5. It is important not to rely on limited data from a single location over a short period when making a decision of whether or not to remove GPA from the diets of broilers.

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Acknowledgments

The authors thank Michael Griffin, Diane Linton, Richard Tudor, and Christina Kostrzebski for all of their extremely hard work and dedication to the collection of all data in this trial.