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Flawed assumptions lead to faulty results

J. GRAHAM[a], J. Boland[b] and E. Silbergeld[a] ([a]Johns Hopkins Bloomberg School of Public Health, [b]The Johns Hopkins University) recently published an economic evaluation of performance results that were contained in a paper published by H. Engster, D. Marvil and B. Stewart-Brown in 2002. The objective of the research in the original paper published by Engster et al. was to measure the effect on broiler performance of removing a growth-promoting antibiotic (GPA) from poultry feed.

The Engster et al. research paper was reviewed in detail in a 2003 poultry Bottom Line of Nutrition column (*Feedstuffs*, Feb. 3, 2003).

The research was a field study consisting of paired-house comparisons of a commercial control feed and the same feed with GPAs removed (test feed). Nearly 7 million broilers were involved, most of the Purdue breed.

The two houses in each paired-house comparison were as nearly identical as possible in regard to size; water, feed and ventilation equipment; number of chicks placed from each breeder flock; density (from 0.73 to 0.77 sq. ft. per chick), and management practices. The average age at processing was 52 days. The first paired-house comparison was placed Oct. 7, 1999, and the last was settled Sept. 19, 2001. One hundred twenty comparisons were conduced on the Delmarva Peninsula, while 37 comparisons were in the North Carolina area.

The control feed was the current field feed. It varied in composition during the research. The feed medication program consisted of the current field coccidiostat, roxarsone and a GPA. Most of the time, the coccidiostat was an ionophore (personal communication). The GPA was the current field GPA, which was either bacitracin methylene disalicylate, zinc bacitracin, flavomycin or virginamycin, in the starter, grower and withdrawal feeds. The coccidiostat, roxarsone and GPA programs were rotated approximately every four months during the course of the study. The test feed was identical to the control feed but with the GPA removed.

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1. Effect of removing GPA on bodyweight and feed conversion[1]

Set of 10 trials[2]	Livability, %	Average weight	Feed conversion[3]	Adj. feed conversion[4]
Delmarva Peninsula area				
1. (Oct. 8, 1998, to Feb. 17, 1999)	-0.30	0.01	0.001	0.001
2. (Dec. 30, 1998, to May 14, 1999)	0.10	0.02	0.012	0.010
3. (April 1, 1999, to Aug. 17, 1999)	-0.51	-0.01	0.007	0.007
4. (July 1, 1999, to Dec. 6, 1999)	-0.10	0.03	0.006	0.003
5. (Oct. 21, 1999, to Feb. 14, 2000)	0.10	-0.06	0.011	0.017
6. (Jan. 3, 2000, to April 21, 2000)	-0.10	-0.07	0.024	0.030
7. (March 14, 2000, to July 5, 2000)	0.20	-0.04	0.038	0.042
8. (May 23, 2000, to Sept. 13, 2000)	-0.30	-0.10	0.032	0.041
9. (Aug. 1, 2000, to Dec. 7, 2000)	-0.10	-0.06	0.024	0.030
10. (Oct. 23, 2000, to Feb. 21, 2001)	-0.30	0.07	0.005	-0.002
11. (Jan. 4, 2001, to May 29, 2001)	0.30	-0.07	0.021	0.028
12. (April 16, 2001, to Sept. 6, 2001)	-0.20	-0.09	0.013	0.023
Cumulative average (120 trials)	-0.10	-0.03	0.016	0.019
North Carolina area				
1. (Oct. 7, 1999, to Aug. 21, 2000)	-0.30	-0.10	0.002	0.012
2. (July 7, 2000, to Jan. 11, 2001)	0.00	-0.06	0.017	0.023
3. (Nov. 21, 2000, to July 16, 2001)	-0.20	0.00	0.008	0.008
4. (May 21, 2001, to Sept. 19, 2001)[5]	-0.10	0.01	0.022	0.021
Cumulative average (37 trials)	-0.14	-0.04	0.012	0.016
Arithmetic average (157 trials)	-0.11	-0.03	0.015	0.018

[1]Results are reported as the difference between test house and control house results (test house without GPA minus the control house).
[2]Placement date of the first flock in the group - movement date of the last flock in the group.
[3]Feed conversion = (lb. feed/lb. bodyweight gain)
[4]Bodyweight of 0.01 lb. = 0.01 feed conversion.
[5]Set of seven trials.

2. Estimates of parameters used for economic analysis

Parameter	Estimate
Cost of feed, $/ton	190.00
Cost of GPAs, $/ton of feed	1.25-3.00
Payment to growers, $/lb. of chicken	0.0358-0.0460
Average mortality rate per rotation, %	5.0
Average condemnation rate, %	0.75
Average feed conversion ratio	1.95
Average market liveweight, lb. per chicken	5.02

The authors measured livability, live weight, feed conversion and color score. Bodyweight uniformity and condemnations were also taken, as well as the effect of changing litter.

Table 1 shows the results for percent livability, average weight, feed conversion and adjusted feed conversion in groups of 10 paired-house trials. A negative number for livability or weight shows that the control (with GPA) had a better livability or a heavier weight than the test house without GPA. The reverse is true for feed conversion, where a positive number shows that the control house has a better (lower) feed conversion.

The results are relatively consistent and favor the control houses that received GPA. Of the 16 sets of 10 paired houses (the fourth set from North Carolina contained only seven comparisons), 10 sets had improved livability for the control houses receiving GPA, nine sets had heavier weights when GPA was included in the feed and all 16 sets had improved feed efficiency when GPA was included in the feed.

When the feed efficiency was corrected for weight, 15 of the 16 sets of houses still showed improved feed efficiency when GPA was included in the feed. I have added the arithmetic average, which shows an average improvement in livability of 0.11%, an average increase in weight of 0.03 lb. and an average improvement in

feed efficiency of 0.015.

Engster et al. did not apply any economics to the responses and did not suggest any economic conclusions.

Graham et al. chose the paper published by Engster et al. to perform an economic analysis. Based on the analysis performed by Graham et al., they stated, "The net effect of using GPAs was a lost value of 0.93 cents per chicken (about 0.45% of total cost). Based upon these data, the authors found no basis for the claim that the use of GPAs lowers the cost of production."

Graham et al. went on to conclude, "Based on the industry study and the resulting economic impact, the use of GPAs in U.S. poultry production should be reconsidered."

It appears that the economic calculations are based on fatally flawed assumptions, and the results and conclusions are, therefore, wrong.

There were no economic numbers in the paper published by Engster et al. In order to perform the economic analysis, Graham et al. developed estimated parameters from multiple sources. At least seven sources are given in their paper. The estimated parameters are shown in Table 2.

The first clue that something is amiss is that the table of estimates does not include any number for the value of a market weight chicken. The only value parameter is the grower payment.

Graham et al. described their method of calculation in great detail. They summarized their calculations as follows, "Based on these data, the use of GPAs increases the market value of the chickens by an amount on the order of 0.16 cents per chicken but increases the growing cost by a larger amount of 0.69 cents. For the Delmarva Peninsula, withdrawing GPAs from the feed increases the net value of the flock by 0.09-0.97 cents per chicken."

What did Graham et al. use as the value of a chicken? They appeared to have used the grower payment. I made a simple calculation of the increased value of including GPAs in the feed. Calculating 0.1% greater livability of a 5.02 lb. chicken is equal to 0.00502 lb. per chicken, plus an average increased weight of 0.03 lb. per chicken is equal to a total increased weight of 0.03502 lb. per chicken. Multiplying the 0.03502 more pounds of chicken times 4.09 cents/lb. (the average estimated grower payment) results in an increased value of 0.14 cents per chicken (not much different from the 0.16 cents per chicken calculated by Graham et al.).

However, the grower payment is an unreasonable number to use for the value of a chicken. A much more reasonable value to use for the live chicken is 25 cents/lb. When the additional weight (0.03502 lb.) is multiplied by 25 cents/lb., the result is 0.8755 cents per chicken. This result is 5.47 times the value (0.16 cents per chicken) calculated by Graham et al. (keep this number in mind).

Using their number for the increased cost of growing the chicken (increased cost of feed), including GPAs in the feed increased the net value of the chicken (over and above the cost of the GPA) on average by 0.18 cents per chicken (0.87 cents minus 0.69 cents). That is equivalent to $1,800 for 1 million chickens.

It appears almost certain that Graham et al. used the grower payment to represent the value of the chicken when the real value of a chicken is more than five times greater.

This could represent a simple oversight — an unintended mistake. However, it is clear from their paper that Graham et al. understood that the grower payment only represented a small portion of the total value of the chicken. The authors said, "The change in total revenue received by the grower is used to estimate the change in the market value of the unprocessed chickens. (Note that market value is actually significantly greater than grower pay since the latter reflects only value added by the grower and does not include costs borne by the processor.)."

A few paragraphs later, the authors said, "The change in payment to the grower is taken as a proxy for the change in the payment to producers for the flock." Proxy means substitute, alternative, stand-in. It appears that the authors clearly knew the grower payment was only a small portion of the total value of the chicken, but they used it anyway to represent the total value of the chicken in their calculation of increased value.

Was this an inadvertent mistake or an intentional abuse of numbers to support a predetermined conclusion?

F. Jones has published an invited review on A Broad View of Arsenic in the most recent issue of the *Poultry Science* journal. In a section on arsenic exposure, Jones wrote, "Silbergeld (2004) commented on the Lasky et al. (2004) study via a letter to the editor of the journal (*Environmental Health Perspectives*) stating that the true risks associated with arsenic exposure were probably underestimated. Silbergeld also did a press release, which was subsequently propagated by the media (O'Brien, 2004). However, as other scientists later examined Silbergeld's conclusions, a calculation error was discovered whereby the arsenic concentration was overestimated by 7,000% (Bernard, 2005). Although Silbergeld acknowledged the calculation error in a follow-up letter to the journal editor, subsequent press releases were apparently not done (Silbergeld, 2005)."

Silbergeld is the junior author on the paper under review. Is Silbergeld mathematically challenged, or does Silbergeld have a political agenda?

The authors stated in their conclusions, "This economic analysis is the first study to the authors' knowledge utilizing large-scale empirical data collected by U.S. industry in which it is demonstrated that the use of GPAs in poultry production is associated with economic losses to the producers."

This statement should have been a red flag to the authors. I have never seen any report that reputed to show, suggest or allege that it was cheaper to grow broilers without the use of GPAs. The authors should be held to a higher standard that they take special care to ensure the accuracy of their report when they propose conclusions that are totally at odds with previous reports. To use less care is scientifically unacceptable. The intentional or negligent issuance of statements that harm a person, company or industry is a tort actionable by law.

The Bottom Line

Engster et al. showed that, under their research conditions, the addition of GPAs resulted in small but consistent improvement in performance.

An economic analysis of the Engster et al. research published by Graham et al. claimed that the inclusion of GPAs in the feed increased the cost of broiler production. However, the economic analysis appeared to be based on the flawed assumption that grower payment could be used as a proxy for the value of the live chicken. Clearly, the grower payment is only a small portion of the real value of the live chicken — about 25 cents/lb. When a more realistic number was used for the value of the live chicken, the calculated cost of growing broilers was lower when GPAs were included in the feed.

References

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