Effects of Avilamycin on Performance of Broiler Chickens*

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ABSTRACT

The benefits of feeding avilamycin (Surmax®/Maxus®, Elanco Animal Health) to broiler chickens were demonstrated in a floor pen study (two trials) in which avilamycin was fed at 10 ppm in a 45-day growout. Final live weight of broilers fed avilamycin was significantly (P ≤ 0.01) heavier (90 g) than that of control broilers fed for an equal number of days. Feed conversion was numerically but not significantly improved by avilamycin. Dressing percentage (hot eviscerated carcass weight/live weight) of broilers fed avilamycin was significantly improved (P ≤ 0.01) relative to that of control broilers fed for an equal number of days.

INTRODUCTION

Avilamycin is an oligosaccharide antibiotic of the orthosomycin group. It is an ester of dichloroisoverninic acid produced by fermentation of Streptomyces viridochromogenes. Avilamycin is currently approved for use in broiler chickens and swine in several countries in Latin America, Asia, Europe, and the Pacific Rim but is not approved for use in the United States or Canada. In these countries, it is approved for use in poultry rations for improved growth performance (i.e., increased weight gain and improved feed conversion). Avilamycin is rapidly and extensively metabolized by the gastrointestinal tract and can be used in broilers without the need for a preslaughter withdrawal period.

There are several proposed mechanisms for the performance-enhancing effects of avilamycin. Wellenreiter et al 1 have shown that some of the mechanism revolves around a glucose sparing effect, a reduction in lactate production, and increased volatile fatty acid (VFA) production and absorption in the lower gut of the broiler. Jamroz et al 2 demonstrated that avilamycin increases nitrogen retention and reduces nitrogen excretion in broilers, thus creating a “protein sparing” effect. Elwinger et al 3,4 showed that the antibacterial properties of avilamycin significantly reduce the population of Clostridium perfringens (a bacterium that can cause severe enteritis and subsequent performance loss and/or mortality) in the gut of the broiler. Watkins et al 5 demonstrated that avilamycin also has good in vitro activity against C. perfringens.

Adding avilamycin in the feed has been es-
tablished as a method of improving weight gain and feed conversion in broilers. A summary of 43 broiler performance studies showed that avilamycin improves bird performance. Attempts have also been made to measure the impact of avilamycin on broiler dressing percentage. Two of these studies indicate that avilamycin had a positive impact of increasing dressing percentage.

In animal production (broilers, beef, swine), dressing percentage has been thought to increase as the live weight of the animal increases. According to Engster, increased dressing percentage in broilers is highly correlated (correlation coefficient 0.98) with heavier live weight, but only if the heavier birds are concomitantly increasing in age. The correlation between dressing percentage and live weight for birds of the same age is quite low (correlation coefficient 0.09).

Previous researchers collected carcass data as a secondary measurement in their studies. It was felt that a more definitive study needed to be conducted to investigate whether the effect of increased dressing percentage seen in previous studies was as a result of feeding avilamycin or was secondary to increased broiler weight or age at slaughter. To achieve this, researchers at Elanco Animal Health designed a study to reconfirm the performance characteristics of avilamycin and determine its effect on carcass dressing percentage.

**MATERIALS AND METHODS**

The study consisted of two trials; one trial was conducted in the United States and the other in Canada. Pen was the experimental unit with 30 (US) to 50 (Canada) birds per pen. An equal number of each sex was allotted to each pen. Each trial used a randomized complete block design with a total of 12 pens per treatment in the US trial and four pens per treatment in the Canadian trial. Each bird was individually identified through growout and processing. Water and feed were provided ad libitum, and all feed contained monensin sodium (Coban®/Elancoban®, Elanco Animal Health) at 100 ppm throughout the trials for the prevention of coccidiosis.

The following three treatments were used:

1. Control for 45 days
2. Avilamycin at 10 ppm for 45 days
3. Control for 48 days

The study was designed to provide for both an equal time (45 days) and an equal weight comparison between the control and avilamycin treatments. It was judged that the birds fed avilamycin for 45 days would be approximately equal in live weight to the 48-day control birds. The equal weight comparison would provide additional information on the ability of avilamycin to increase dressing percentage.

Final bird weights were collected at days 45 and 48 as indicated above for the respective treatment groups. Feed consumption was monitored and recorded throughout the trials. These values were used in the calculations for final weight and feed conversion.

Feed was withdrawn from the birds 10 hours before obtaining final live weights, as is standard in commercial broiler production, to reduce risk of intestinal rupture and subsequent contamination of the carcass. All birds were processed according to standard procedures, including removing feathers, head, feet, and viscera (including heart, liver, and gizzard). Most of the fat pad was removed during processing in the US but not in Canada.

Hot carcass weight was obtained before placing the carcasses in an ice bath. The carcasses were allowed to remain in the ice bath for at least 45 minutes before cutup. All birds within a block were treated the same and chilled for a
similar period to allow for similar water uptake. Carcasses were allowed to drip for several minutes before obtaining the chilled carcass weight. After obtaining the chilled carcass weight, the weight of the skinless, boneless whole breast muscle (including both pectoralis major and minor) was obtained. Data were analyzed using a mixed model analysis, Proc Mixed SAS®. Outcomes of the statistical analyses are given in the tables.

RESULTS

Ending Live Weight

Ending live weight data are presented in Table 1. Broilers fed avilamycin at 10 ppm were significantly ($P \leq 0.01$) heavier than control birds at the end of 45 days (equal time). Control broilers continued for an additional 3 days were significantly ($P \leq 0.01$) heavier than broilers fed either of the treatments that ended at 45 days.

Feed Conversion

Feed conversion data are presented in Table 2. Broilers fed avilamycin at 10 ppm had numerically but not significantly improved feed conversion relative to the respective control birds at the end of 45 days. As expected, both 45-day treatments had significantly ($P \leq 0.01$) improved feed conversion compared with the 48-day control treatment.

Dressing Percentage

Hot carcass weight is measured after the bird has had head, feet, feathers, and viscera removed. This weight was used in the calculation.
of dressing percentage to avoid any confounding effect of water that could be retained in the carcass after the 45-minute chilling process. Hot carcass weights and dressing percentage data are presented in Tables 3 and 4, respectively. The data indicate that broilers fed avilamycin at 10 ppm for 45 days had significantly ($P \leq 0.01$) heavier hot carcass weights and improved dressing percentage compared with the 45-day (equal time) control broilers. Dressing percentage of broilers fed avilamycin at 10 ppm for 45 days was not different from that of control broilers fed for 48 days, though the 48-day control broilers were significantly heavier and 3 days older than the 45-day avilamycin-fed broilers.

Engster’s data suggests that the avilamycin-fed broilers would not be expected to have an increased dressing percentage relative to the 45-day control birds because no functional relationship can be shown for dressing percentage and live weight for birds of the same age (i.e., 45 days). Engster shows that dressing percentage increases approximately 0.1% for each day increase in age between 46 and 95 days. The 48-day control birds had an increased dressing percentage of 0.5% compared with the 45-day control birds, thus showing that the data from this study fit the basic premise of the Engster model.

Data from the two trials were evaluated to determine the correlation between live weight and dressing percentage within each treatment. The correlation coefficients obtained are consistent with those obtained by Engster (Table 5). Because of the demonstrated lack of functional relationship between dressing percentage and live weight of birds of the same age for

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### Table 3. Hot Carcass Weights

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number</th>
<th>Hot Carcass Weight (g)</th>
<th>Treatment Comparison</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-d Control</td>
<td>16</td>
<td>1734&lt;sup&gt;a&lt;/sup&gt;</td>
<td>45-d Control vs. 45-d Avilamycin</td>
<td>.0006</td>
</tr>
<tr>
<td>45-d Avilamycin</td>
<td>16</td>
<td>1811&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48-d Control</td>
<td>16</td>
<td>1892&lt;sup&gt;c&lt;/sup&gt;</td>
<td>48-d Control vs. 45-d Avilamycin</td>
<td>.0003</td>
</tr>
</tbody>
</table>

<sup>a,b,c</sup>Means with common superscript symbols are not significantly different, $P \leq 0.05$.

<sup>†</sup>Linear contrast comparison between treatments indicated.

<sup>‡</sup>Probability associated with linear contrast comparison.

### Table 4. Dressing Percentage<sup>‡</sup>

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number</th>
<th>Dressing %&lt;sup&gt;‡&lt;/sup&gt;</th>
<th>Treatment Comparison</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-d Control</td>
<td>16</td>
<td>70.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>45-d Control vs. 45-d Avilamycin</td>
<td>.0241</td>
</tr>
<tr>
<td>45-d Avilamycin</td>
<td>16</td>
<td>71.6&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
</tr>
<tr>
<td>48-d Control</td>
<td>16</td>
<td>71.4&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>48-d Control vs. 45-d Avilamycin</td>
<td>.6307</td>
</tr>
</tbody>
</table>

<sup>*Hot carcass weight divided by live weight.</sup>

<sup>a,b</sup>Least squares means.

<sup>‡</sup>MMeans with common superscript symbols are not significantly different, $P \leq 0.05$.

<sup>†</sup>Linear contrast comparison between treatments indicated.

<sup>‡</sup>Probability associated with linear contrast comparison.
both Engster’s data\(^7\) and the data from the current trial, the significant dressing percentage advantage for avilamycin is a true treatment effect and is not simply caused by an increase in live weight of the birds fed avilamycin.

**Boneless Breast**

Boneless breast weight data are presented in Table 6. The data indicate that boneless breast weight significantly (\(P \leq 0.01\)) increased as the broilers became heavier. Engster\(^7\) demonstrated that breast lean as a percentage of the carcass increases as live weight increases with a concomitant increase in age (correlation coefficient of 0.95). The correlation coefficient of breast lean yield and live weight is very low (0.25) for birds of the same age. The result of feeding avilamycin to broilers was an increase in boneless breast of approximately 20 g (a nearly identical result in both US and Canadian trials) compared with the equal time (45-day) control birds. Thus approximately 20 g of the approximately 90 g of extra live weight of the birds fed avilamycin was breast muscle. However, the data presented in Table 7 indicate that boneless breast as a percentage of the chilled carcass did not change in response to the feeding of avilamycin.

**DISCUSSION**

The weight gain response observed in this study is consistent with previous reports. The lack of a significant improvement in feed conversion disagrees with the results from Wellenreiter.\(^1\) This is not an unusual finding in a growth performance study. More meaningful
assessments of weight gain and feed conversion are gained from pooled analysis of multiple trials, as was shown by Wellenreiter. According to the data from Engster, who has run myriad studies evaluating the correlation of dressing percentage to bird age and weight, there should have been no difference in dressing percentage of the 45-day avilamycin birds and the 45-day control birds. However, the data indicate a 0.7% increase in dressing percentage for the broilers fed avilamycin. The 48-day control birds did have a higher (0.5%) dressing percentage than the 45-day control birds as expected because of both a heavier body weight and being 3 days older. This supports Engster’s data that older birds have a higher dressing percentage and confirms that the birds from this study performed as expected with regard to Engster’s model. The higher dressing percentage of equal-age avilamycin birds shows a drug-related effect instead of a physiologic growth effect.

Although not specifically designed as a part of the materials and methods of the trials, additional analyses were performed on the data to confirm the dressing percentage results from the avilamycin-fed group. These additional analyses were based on the concept of evaluating the effect of the drug on dressing percentage based on equal weight comparisons between the treated and control birds. Although this study was designed with pen as the experimental unit, the additional analyses compared and then matched individual bird weights of the avilamycin-fed and control birds. The arithmetic difference for dressing percentage was calculated for each pair. These differences were then used in nonparametric analyses. The 45-day birds fed avilamycin were compared with both the 45-day control birds and the 48-day control birds.

The analyses confirmed that a greater number of the equal weight pairs (allowable range considered equal weight was 4 to 10 g) showed a higher dressing percentage for the avilamycin-fed birds than for the control birds for both the 45-day equal-age comparison (P=.02) and for the 45-day avilamycin-fed birds compared with the 48-day control birds (P=.06). This analysis supports the conclusion that dressing percentage improvement is a result of feeding avilamycin.

Table 8 lists the economic benefit of performance improvements achieved in avilamycin-fed, 45-day birds compared with 45-day control birds. The economic benefit is generated from the more saleable meat of avilamycin-treated birds. This economic advantage could provide as much as a 4 to 1 return on investment. The assumptions used to derive the economic impact are included in Table 8 (data are based on approximate US feed and

### Table 7. Boneless Breast as Percentage of Chilled Carcass Weight

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number</th>
<th>Percentage*</th>
<th>Treatment Comparison†</th>
<th>P Value‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-d Control</td>
<td>16</td>
<td>22.04</td>
<td>45-d Control vs. 45-d avilamycin</td>
<td>.1935</td>
</tr>
<tr>
<td>45-d Avilamycin</td>
<td>16</td>
<td>22.20</td>
<td>48-d Control vs. 45-d avilamycin</td>
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<td>48-d Control</td>
<td>16</td>
<td>22.22</td>
<td></td>
<td></td>
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</table>

*Least squares means.
†Means with common superscript symbols are not significantly different, P≤.05.
‡Probability associated with linear contrast comparison.
saleable meat prices). The actual economics will vary country to country, but the relative return on investment will remain constant.

**CONCLUSION**

Data from this study support previous studies by reaffirming the growth performance benefit of feeding avilamycin to broiler chickens. In addition, this study demonstrates that feeding avilamycin resulted in a heavier hot carcass weight, a greater dressing percentage, and a heavier boneless breast when equal-age comparisons were made. Based on this study, avilamycin could be considered a beneficial component of a broiler production system in countries where the product is commercially available for use in livestock production.

**REFERENCES**


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**TABLE 8. Economic Analysis (US $)***

<table>
<thead>
<tr>
<th>Economic Factor</th>
<th>Avilamycin, 10 ppm 45 Days</th>
<th>Control 45 Days</th>
<th>Avilamycin Economic Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat Value</td>
<td>$1,763,000</td>
<td>$1,683,000</td>
<td></td>
</tr>
<tr>
<td>Feed Cost</td>
<td>$955,000</td>
<td>$918,000</td>
<td></td>
</tr>
<tr>
<td>Return</td>
<td>$808,000</td>
<td>$765,000</td>
<td>$43,000 ($0.043/bird)</td>
</tr>
</tbody>
</table>

*Assumptions: Flock size—1 million birds; $195/metric ton—nonmedicated feed cost; $.96/kg—whole bird price.