FEEDING BROILER CHICKENS WHEAT AND CORN DIETS CONTAINING DIFFERENT LEVELS OF BUTYRIC ACID

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Abstract

In this study the effect of different levels of butyric acid on the performance of broiler chicken were tested. The experimental design consisted of 4 dietary treatments with 4 replicated pens, each with 10 birds. The broilers were housed in floor pens with a floor area (of 1m²) with controlled light (23h/d from 0 to 7; 18h/d from 7 to 15; 16h/d from 15 to 28 and 23h/d from 28 to 42day). All chickens received wheat 10% and corn 47.15% based starter feed during the first 3 weeks followed by a grower feed containing 30% wheat and 31% corn based diets. Birds randomly assigned to 1 of 4 feeding groups: control(C)(0% butyric acid in both starter and grower feed), T1(0.25% butyric acid in both starter and grower feed), T2(0.25% butyric acid in starter and 0.1% butyric acid in grower feed), T3(0.25% butyric acid in starter and 0% butyric acid in grower feed). Supplementing diet with butyric acid had no significant effect on feed intake, body weight and feed conversion ratio in either the starter (1-21d), grower/finisher (21-42d) or the whole experimental period (1-42d). However the only significant difference was found in feed intake between treatment2 and control birds in growing and whole experimental period. In a conclusion, although the T2 birds had numerically lower FCR than other experimental treatments, but the difference were not significant.

Keywords: broiler, butyric acid, performance, wheat.

Introduction

Research has grown over the past years aimed at alternative means to manipulate the gastrointestinal microflora in production livestock.

Motivation for testing these alternatives comes from the European Union ban on the inclusion of antibiotics in diets of poultry and growing public concerns about the increasing prevalence of resistance to antibiotics in disease causing bacteria (Yang et al., 2009; Gunal et al., 2006). Among the candidate replacements for antibiotics are short chain fatty acids such as acetate, propionate and butyrate. Recent research has shown the positive effects of SCFAs on the control of salmonella enteritidis (Van Immerseel et al., 2002; Van Immerseel et al., 2005) and their growth promoting effect on the beneficial intestinal microflora (Dibner and Buttin, 2002; Van Immerseel et al., 2004; Hansen et al., 2007). Amongst SCFAs, butyric acid is considered the prime enterocytes energy source (Antongiovanni et al., 2007). Moreover, positive beneficial effects of butyric acid and butyric acid glycerides on performance and carcass traits have been reported by Leeson et al. (2005) and Antongiovanni et al. (2007).

The objective of this study was evaluating the effect of butyric acid on the performance of broiler chickens.

Material and Method

One hundred and sixty day old Ross (308) chicks were obtained from a commercial hatchery. Four dietary treatments were randomly assigned to sixteen pens (10 birds per pen with 4 pens per treatment). The broilers were housed in floor pens with a floor area of 1 m² with controlled light (23h/d from 0 to 7; 18h/d from 7 to 15; 16h/d from 15 to 28 and 23h/d from 28 to 42day). Isocaloric and isonitrogenous diets were formulated to the Ross breeder’s requirements for starter (1-21d-old) and growing/finishing (21-42d-old) periods. The bulk of the base diet (control diet) was corn (47.5% and 31%), wheat (10% and 30%), soybean meal (32.97% and 27.93%), soybean oil (3% and 4%), meat meal (4% and 4%), plus synthetic amino acids, minerals, trace minerals and vitamins respectively for the 1-21d-old and 21 to 42d-old growing periods (Table 1). The additive used in the present study was a blend of mono-, di- and tri-glycerides of butyric acid with “baby C4” commercial name. The 4 treatments differed in terms of quantity of butyric acid added to the diet: The control treatment (0% butyric acid in both starter and grower feed), T1 (0.25% butyric acid in both starter and grower feed), T2 (0.25% butyric
acid in starter and 0.1% butyric acid in grower feed) and T3 (0.25% butyric acid in starter and 0% butyric acid in grower feed). Feed and water were provided ad libitum. Feed intake, weight gain and feed conversion ratio were measured weekly. The experimental design was a completely randomized design with pen as the experimental unit, and results were analyzed by a one-way ANOVA using the GLM procedure of SAS (2001). Means were separated by using Duncan’s multiple range test when the F-test was significant (p<0.05).

Results and Discussion

In table 2 it can be seen that there were no significant differences among treatments in body weight gain (BWG), feed conversion ratio and mortality in either the starter (1-21d), grower/finisher (21-42d) or the whole experimental period (1-42d). These results are in agreement with those of Izat et al. (1990), Vale et al. (2004), Cave (1984) and Gunal et al. (2006) who reported that supplementation of an organic acid did not have any effect on weight gain and feed conversion ratio. The similar results were also found by Leeson et al. (2005) who observed that the addition 0.2% and 0.4% butyric acid had no effect on body weight or weight gain in either starter or grower/finisher periods. However, the results on the beneficial effect of some organic acid on weight gain and FCR were reported by other researchers (Runho, 1997; Antongiovanni et al., 2007). In another study dietary sodium butyrate supplementation at the level of 500 mg/kg increased body weight gain from 0 to 21 days and improved FCR during the period from 0 to 42 days (p<0.05) (Zhonghong and Yuming, 2007). There are some reports that high levels of organic acids have detrimental effects on performance of broiler. Cave (1984) reported that increasing levels of propionic acid depressed feed intake, weight gain and increased mortality. In the present study cumulative feed intake as shown in table 2 was decreased (p<0.05) by feeding T2 diet during the grower (21-42d) and whole growth period (0-42d) as compared to the control and T1 diets. However body weight gain and FCR during the whole growth period (0-42 d) was not affected by the significant difference in feed consumption during the same period.

The observed different effects of a butyric acid in this study compared with the results of the other studies may be associated with experimental diets (inclusion of wheat) environmental conditions. Several researchers reported that when chicks were housed in a clean environment, organic acids were unaffected on performance (Miller, 1987).

In conclusion, birds grow well with corn-wheat based diets containing up to 0.2% acid butyric during the starter and 0.1% during the growth period.

Acknowledgment

The authors are grateful to Sanadam Pars Company for help with providing butyric acid (baby C4) and partly funding this work.

References


Table 1. Ingredients and nutrient content of the basal diet

<table>
<thead>
<tr>
<th>Item</th>
<th>Starter</th>
<th>Grower / finisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Corn</td>
<td>47.14</td>
<td>31</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>32.8</td>
<td>27.93</td>
</tr>
<tr>
<td>Soybean oil</td>
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<td>4</td>
</tr>
<tr>
<td>Meat meal</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>limestone</td>
<td>1.04</td>
<td>0.81</td>
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<tr>
<td>Dicalcium phosphate</td>
<td>1.18</td>
<td>1.12</td>
</tr>
<tr>
<td>salt</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Vitamin premix*</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Mineral premix**</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>DL-Methionine</td>
<td>0.14</td>
<td>0.25</td>
</tr>
<tr>
<td>L-Lysine</td>
<td>0</td>
<td>0.19</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Calculated values

- Metabolizable energy (kcal/kg): 2919, 3150
- Crude protein (%): 21.65, 20
- Energy/crude protein: 134.8, 157.5
- Calcium (%): 1.0, 0.9
- Average phosphorus (%): 0.5, 0.45
- Sodium (%): 0.16, 0.16
- Lysine (%): 1.17, 1.25
- Methionine + cystine (%): 0.82, 0.88

*Vitamin premix provided the following per 2.5 kg of diet: vitamin A 15,000 IU, vitamin D3 1,500 IU, vitamin E 20 mg, vitamin K3 5 mg, vitamin B1 3 mg, vitamin B2 6 mg, niacin 25 mg, Ca-D-pantothenate 12 mg, vitamin B6 5 mg, vitamin B12 0.03 mg, folic acid 1 mg, D-biotin 0.05 mg, choline chloride 400 mg and carophyll-yellow 25 mg. **Trace mineral premix provided the following per kg of diet: Mn 80 mg, Fe 60 mg, Zn 60 mg, Cu 5 mg, Co 0.2 mg, I 1 mg and Se 0.15 mg.
<table>
<thead>
<tr>
<th></th>
<th>Dietary treatments</th>
<th>± SEM</th>
<th>P-value</th>
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<tbody>
<tr>
<td></td>
<td>C</td>
<td>T₁</td>
<td>T₂</td>
</tr>
<tr>
<td><strong>1-21 days</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Body weight (gr)</td>
<td>487.88</td>
<td>487.50</td>
<td>452.00</td>
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<tr>
<td>Body weight gain (gr)</td>
<td>444.88</td>
<td>444.25</td>
<td>408.75</td>
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<tr>
<td>Feed intake (gr)</td>
<td>729.64</td>
<td>749.48</td>
<td>677.25</td>
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<tr>
<td>FCR</td>
<td>1.646</td>
<td>1.692</td>
<td>1.658</td>
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<td><strong>21- 42 days</strong></td>
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<tr>
<td>Body weight (gr)</td>
<td>1746.54</td>
<td>1744.06</td>
<td>1642.53</td>
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<tr>
<td>Body weight gain (gr)</td>
<td>1567.17</td>
<td>1622.19</td>
<td>1529.53</td>
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<td>Feed intake (gr)</td>
<td>3196.5⁺</td>
<td>3177.0⁺</td>
<td>2879.1⁺</td>
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<tr>
<td>FCR</td>
<td>2.053</td>
<td>1.962</td>
<td>1.884</td>
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<tr>
<td><strong>1- 42 days</strong></td>
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<td></td>
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<tr>
<td>Body weight (gr)</td>
<td>2234.42</td>
<td>2231.56</td>
<td>2094.53</td>
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<tr>
<td>Body weight gain (gr)</td>
<td>2012.04</td>
<td>2066.44</td>
<td>1938.28</td>
</tr>
<tr>
<td>Feed intake (gr)</td>
<td>3926.1⁺</td>
<td>3926.5⁺</td>
<td>3556.3⁺</td>
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<tr>
<td>FCR</td>
<td>1.956</td>
<td>1.903</td>
<td>1.835</td>
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<tr>
<td>Mortality (%)</td>
<td>2.5</td>
<td>0</td>
<td>0</td>
</tr>
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</table>

C: 0% butyric acid in both starter and grower feed,
T₁: 0.25% butyric acid in both starter and grower feed,
T₂: 0.25% butyric acid in starter and 0.1% butyric acid in grower feed,
T₃: 0.25% butyric acid in starter and 0% butyric acid in grower feed.
The rows by different superscripts are significantly different (p<0.05).