METABOLIC EFFECT OF CITRIC ACID IN BROILER CHICKENS

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ABSTRACT

The aim of the present study was to investigate the effect of citric acid inclusion on selected metabolic parameters (glucose, cholesterol, triglycerides) of broiler chickens. Broiler chickens hybrid Ross 308 (n=120) were divided into 2 groups: control (C) and experimental group (E). From each group 10 chickens were randomly selected. Experimental animals received citric acid per os in water in single dose 0.25% for 42 days. Average values of selected parameters of the metabolic profile were determined in blood serum by using an analyser Microlab 300 (Merck, Germany). Significant decrease (p<0.05) of serum triglycerides in citric acid group when compared with the control group was recorded. Citric acid had no harmful influence on the parameters of metabolic profile of broiler chickens. The research on the field of organic acid will be worthy of further investigation.

Keywords: citric acid, metabolic parameters, broiler chickens

INTRODUCTION

Organic acids have been used for a long time as food additives and preservatives for preventing food deterioration and extending the shelf life of perishable food ingredients. Specific organic acids have also been used to control microbial contamination and dissemination of food born pathogens in preharvest and postharvest food production and processing (Ricke, 2003). Under the current production systems, broiler chickens are exposed to various pathogenic microorganisms. The problems caused by these pathogenic microorganisms have traditionally been prevented by the use of vaccines and antibiotics. However, new regulations and negative consumer perceptions concerning the use of antibiotics in animal production have led to the development of products that consumers consider “natural.” With varying degrees of success, several natural alternatives have been developed as substitutes for antibiotics: prebiotics (Xu et al., 2003), direct fed microbials (probiotics) (Higgins et al., 2010), yeast cell wall derivatives (Benites et al., 2008), organic acids (Chowdhury et al., 2009), and plant oils and extracts (Mitsch et al., 2004). Several studies support the statement that the addition of citric acid to broiler rations improved weight gain (Afsharmanesh and Pourreza, 2005; Nezhad et al., 2007), increased feed consumption (Moghadam et al., 2006), and improved feed efficiency (Abdel-Fattah et al., 2008). Its addition, its use increased retention of phosphorus (Brenes et al., 2003; Liem et al., 2008), tibia ash (Rafaez-Livingston et al., 2005; Martinez-Amezquita et al., 2006), and toe ash (Atapattu and Nelligaswatta, 2005) in broiler chicks. It also decreased pH of cecal digesta, crop and gizzard (Andryss et al., 2003), and intestine (Deuli et al., 2003) in broiler chicks and improved immune responses by broilers (Rahmani and Speer, 2005; Abdel-Fattah et al., 2008). Considering the above statements, this study was designed to determine the effect of citric acid on some parameters of metabolic profile in broiler chickens.

MATERIAL AND METHODS

Animals and experimental design

The experiment was conducted on broiler chickens, hybrid Ross 308 (n=120). Each group included 60 chickens. Chickens were divided into two groups (control – C and experimental group E). Experimental chickens received an organic acids inclusion in water in concentration 0.2 % (E group). The group of chickens received feed mixture without organic acid addition served as control.
The citric acid is known as effective chelate minerals. Nezhad et al. (2007) reported that the addition of citric acid to a broiler diet improved feed efficiency. In the present study consumption of citric acid during 42 days caused significant (P<0.05); C effect of citric acid on feed consumption of broiler chicks were significant and similar results were found by Atapattu and Nelligawatta (2005).

### RESULTS AND DISCUSSION

The citric acid is known as effective chelate minerals. Nezhad et al. (2007) reported that the addition of citric acid to a broiler diet improved feed efficiency. In the present study consumption of citric acid during 42 days caused significant (P<0.05) decrease in serum triglycerides content. Of the others metabolic traits, macromineral digestibility and bone mineral density of broiler chicks. The citric acid treatment increased the dry matter and gross energy and protein digestibility significantly. Moghadam et al. (2006) found that the beneficial effects of citric acid on feed consumption of broiler chicks were significant and similar results were found by Atapattu and Nelligawatta (2005).

### Table 1 Diet composition of feed mixture KKZ HYD-01 and HYD-02

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>KKZ HYD-01</th>
<th>KKZ HYD-02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (g.kg⁻¹)</td>
<td>917.3</td>
<td>913.3</td>
</tr>
<tr>
<td>Crude protein (g.kg⁻¹)</td>
<td>211.3</td>
<td>199.7</td>
</tr>
<tr>
<td>Fat (g.kg⁻¹)</td>
<td>25.5</td>
<td>23.0</td>
</tr>
<tr>
<td>Starch (g.kg⁻¹)</td>
<td>413.0</td>
<td>434.8</td>
</tr>
<tr>
<td>Total sugar (g.kg⁻¹)</td>
<td>49.5</td>
<td>31.7</td>
</tr>
<tr>
<td>ME (MJ)</td>
<td>11.689</td>
<td>11.555</td>
</tr>
<tr>
<td>Ca (g.kg⁻¹)</td>
<td>12.121</td>
<td>8.207</td>
</tr>
<tr>
<td>P (g.kg⁻¹)</td>
<td>7.833</td>
<td>6.834</td>
</tr>
</tbody>
</table>

- ME - metabolizable energy, Ca - calcium, P - phosphorus

### Table 2: Metabolizable Energy, Ca and P in different diets

<table>
<thead>
<tr>
<th>Ingestible (kJ/L)</th>
<th>KKZ HYD-01</th>
<th>KKZ HYD-02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolizable energy</td>
<td>12.121</td>
<td>11.555</td>
</tr>
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</tr>
</tbody>
</table>

### Figure 1

**Figure 1** Effect of citric acid on the performance and utilization of phosphorus and cholesterol in broiler chickens a-b the dissimilar letters mean significant differences in the rows (P<0.05); C - control group; E - experimental group

### CONCLUSION

Reports concerning the effect of organic acids on broiler performance are inconclusive. In the literature, positive effects of different organic acids on feed utilization or dressing percentage have been reported (Dibner and Buttinn, 2002), but Rafacz-Livington et al. (2005) did not find any positive effects on performance in response to supplementation of different organic acid blends. This study showed that the selected metabolic parameters were not negatively affected by citric acid.

### Acknowledgments

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### REFERENCES


