# Cinnamomi Aetheroleum, Energy Profile and Broiler Chickens' Production Quality

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**Abstract**

We carried the experiment with broiler chickens. The experiment consisted of control and trial groups, containing different portions of *Cinnamomi aetheroleum* (0.1; 0.05; 0.025%) in feed mixtures. The triglycerides content in the blood serum was 0.69 mmol/l at 0.1% proportion of C*innamomi aetheroleum,* 0.64 mmol/l at 0.05% proportion and 0.70 mmol/l at 0.025% proportion of C*innamomi aetheroleum.* The differences of triglycerides content in the blood serum among groups were statistically significant (P<0.05). The glucose content in the blood serum of broiler chickens was 15.63 mmol/l at 0.1% proportion of C*innamomi aetheroleum*, 14.73 mmol/l at 0.05% proportion and 11.13 mmol/l at 0.025% proportion of C*innamomi aetheroleum.* The differences of glucose content in blood of broiler chickens were statistically significant among groups (P<0.05). The cholesterol content in the blood serum of broiler chickens was 4.20 mmol/l at 0.1% proportion of C*innamomi aetheroleum*, 3.71 mmol/l at 0.05% proportion and 3.50 mmol/l at 0.025% proportion of C*innamomi aetheroleum.* The differences of cholesterol content in blood of broiler chickens among groups were statistically significant (P<0.05). The effect of different proportions of *Cinnamomi aetheroleum* was not statistically significant (P>0.05) to broilers body weight and fat content in meat.

**Keywords**: blood serum, broiler, *Cinnamomi aetheroleum,* glucose, cholesterol, triglycerides.

## 1. Introduction

The growing demand of consumers for healthy, nutritious and fully valued food is increasing the pressure on producers to innovate and develop used techniques and technologies of food processing, leading to production of safer food with high nutritional and sensory quality.

Internationally, the issue of antimicrobial use in animal production and concerns about antimicrobial resistance continue to be actively reviewed by the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) of the United Nations, as well as the World Organization for Animal Health (OIE) [1]. WHO first published global principles for the containment of antimicrobial resistance in food-producing animals in 2000 [2].

Following the prohibition of the feed antibiotics use at the present time, the tendency is to search alternatives. One of the possibilities is essential oils [3].

Essential oils are aromatic and volatile oily liquids obtained from plant material. They are normally formed in special cells or groups of cells, found in leaves and stems, and commonly concentrated in one particular region such as leaves, bark or fruit [4]. Although the antibacterial properties of essential oils have been long recognized, the recent interest in alternative naturally derived antimicrobials has lead to a renewed scientific interest in these substances.

Cinnamon (Cinnamomi aetheroleum) is known as an appetite and digestion stimulant and its antimicrobial properties are mainly related to its cinnamaldehyde content followed by eugenol and carvacrol [5].

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Cinnamaldehyde and eugenol have been reported to possess antibacterial activity against a wide range of bacteria [6], antioxidant properties [7] and inhibitory properties against Aspergillus flavus [8]. Investigational uses of cinnamon bark include use as a hypoglycemic and cholesterol lowering agent [9], promotion of wound healing [10], antimicrobial agent [11], and an anti-inflammatory compound [12].

A number of studies have been carried out to investigate the effect of cinnamon [13, 14] on broiler performance and meat acceptability but the results have not been consistent. The blood parameters are shown as a major indicator of physiological, pathological and nutritional conditions of the organism and the changes in blood components compared to normal values may be used for the interpretation of the metabolic condition of the organism as well as the quality of feeding [15].

The lipid content in the poultry meat depends significantly on species, as well as on age, method of nutrition and other factors. Biological importance of fats is a result of their indispensability for human, since they are receiving them in the form of triglycerides, phospholipids, glycolipids, which are a reservoir of energy, a carrier of fat soluble vitamins and source of essential fatty acids. The production of functional food for human consumption is currently on the top of the human as well as agricultural and food research. From this perspective, poultry meat is a very suitable commodity [16, 17-22]. The object of this study was to evaluate the results of an experiment with broiler chickens. We focused on the effects of *cinnamomi aetheroleum* as an alternative to feed antibiotics.

## 2. Materials and methods

We carried the experiment with broiler chickens *Ross 308*, in poultry farm for 24 000 broilers kept on deep litter using the Liptaiová breeding technology [23]. In the front part of the feeder building an area was reserved for our own model experimental technology of fodder and water feeding. Table 1 showed arrangement of experiment. The trial lasted 40 days and consisted of control and trial groups.

Feed mixtures of the control group did not include *cinnamomi aetheroleum.* We used *Cinnamomi aetheroleum* premix in feed mixtures of trial groups. Essential oil is made of cinnamon crust (*Cinnamomi cortex)* of Ceylon cinnamon (*Cinnamonum zeylonicum)* of the insoluble part in alcohol, according to the procedure specified by the Slovak Pharmaceutical Code [24].

**Table 1.** Scheme of experiment

| Type of broilers | Feed mixture (Phase of feeding) | Group | The experimental active substance in feed mixture |
|---|---|---|---|
| Ross 308 | starter (day 1 - 18)<br>grower (day 19 - 31)<br>finisher (day 32 - 40) | control | - |
| | | trial 1 | 0.1% of Cinnamomi aetheroleum |
| | | trial 2 | 0.05% of Cinnamomi aetheroleum |
| | | trial 3 | 0.025% of Cinnamomi aetheroleum |

At the end of the experiment, the weight of 40 days old chicks was measured by the instrument type Kern ECB 20K20 and the fat content in chicken meat was determined by fat extractor DET-Gras N.The values of blood biochemical parameters of broiler chickens were determined by automatic clinical analyzer Microlab 300. The blood serum for biochemical analysis was separated from blood samples by centrifugation at speeds 3000/min. for 30 minutes. In blood serum were determined parameters of energy profile of triglyceride, cholesterol and glucose.

**Table 2.** The body weight of broiler chickens (g)

| Group | Mean | SD | $c_v$ (%) | trial 1 | trial 2 | trial 3 |
|---|---|---|---|---|---|---|
| control | 1734.92 | 246.92 | 14.23 | - | - | - |
| trial 1 | 1746.40 | 254.21 | 14.56 | | - | - |
| trial 2 | 1738.40 | 222.55 | 12.80 | | | - |
| trial 3 | 1760.80 | 279.79 | 15.89 | | | |
| F - test | $2.69^{-}$ | | | | | |

SD – standard deviation,

$c_v$ – coefficient of variation

$^{-}$P>0.05 statistically not significant

## 3. Results and discussion

The average body weight of broiler chickens fed with the feed mixture with a share of *cinnamomi aetheroleum* 0.1% was 1746.40 g at the end of the experiment, 1738.40 g with 0.05% share of *cinnamomi aetheroleum* and 1760.84 g with share of 0.025% *cinnamomi aetheroleum*. In the control group, in which the broiler chickens were fed with feed mixture without any *cinnamomi aetheroleum*, the average body weight of broiler chickens was 1734.92 g. Differences in body weight of broiler chickens at the end of the experiment were not statistically significant (P>0.05). Body weight results of broiler chickens are comparable to data presented by Para et al. [25] (1.6 - 1.8 kg). In experiment by Toghyani et al. [26], who also used cinnamon essential oils, the broiler chickens weight was 1987 g, respectively 2111 g at the end of the experiment, which is higher value than the average weight in our experiment.

**Table 3.** The fat content in the chicken meat (g/100 g)

| Group | Mean | SD | $c_v$ (%) | trial 1 | trial 2 | trial 3 |
|---|---|---|---|---|---|---|
| control | 9.80 | 4.31 | 43.96 | - | - | - |
| trial 1 | 9.90 | 1.95 | 19.68 | | - | - |
| trial 2 | 9.50 | 1.83 | 19.30 | | | - |
| trial 3 | 10.45 | 1.52 | 14.54 | | | |
| F - test | $0.18^{-}$ | | | | | |

SD – standard deviation, $c_v$ – coefficient of variation
$^{-}$P>0.05 statistically not significant

The average fat content in meat of broiler chickens was 9.90 g/100 g within the feed mixture with the share of 0.1% *cinnamomi aetheroleum*, 9.50 g/100 g with the share of 0.05% *cinnamomi aetheroleum* and 10.45 g/100 g with the share of 0.025% *cinnamomi aetheroleum*. In the control group, the average fat content in meat of broiler chickens was 9.80 g/100 g. Differences in fat content in meat of broiler chickens were not statistically significant (P>0.05). Fat content in chicken meat with skin was 11.07 g/100 g according to Bodwell and Anderson [27], which was a higher value than the fat content of meat with skin in our experiment. Higher values of fat 10.83 - 13.63 g/100 g were presented by Haščík et al. [28] within their experiment.

Biochemical parameters of energy profile.

**Table 4**. The content of triglycerides (mmol/l)

| Group | Mean | SD | $c_v$ (%) | trial 1 | trial 2 | trial 3 |
|---|---|---|---|---|---|---|
| control | 0.53 | 0.12 | 21.82 | - | - | + |
| trial 1 | 0.69 | 0.18 | 26.52 | | - | - |
| trial 2 | 0.64 | 0.14 | 22.32 | | | - |
| trial 3 | 0.70 | 0.08 | 11.60 | | | |
| F - test | $3.85^{++}$ | | | | | |

SD – standard deviation, $c_v$ – coefficient of variation
$^{-}$P>0.05 statistically not significant, $^{+}$P<0.05 statistically significant

The average content of triglycerides in the blood of broiler chickens was 0.69 mmol/l within the share of 0.1% of cinnamomi aetheroleum, 0.64 mmol/l with the share of 0.05% cinnamomi aetheroleum and 0.70 mmol/l with the share of 0.025% cinnamomi aetheroleum. In the control group, the average content of triglycerides in the blood of broiler chickens was 0.53 mmol/l. Differences in the content of triglycerides in the blood of broiler chickens were statistically significant (P<0.05) between control group and the group with a share of 0.025% cinnamomi aetheroleum.

Our results of triglycerides content are comparable to the results of other authors. In the experiment with cinnamon essential oil by Toghyani et al. [26], the triglycerides content in the blood serum of broiler chickens was 0.53 and 0.45 mmol/l and according to Kamaran [29], the values of triglycerides content in the blood serum was 0.54, 0.57, 0.59 and 0.64 mmol/l.

**Table 5.** The content of glucose (mmol/l)

| Group | Mean | SD | $c_v$ (%) | trial 1 | trial 2 | trial 3 |
|---|---|---|---|---|---|---|
| control | 14.91 | 1.53 | 10.24 | + | - | + |
| trial 1 | 15.63 | 1.21 | 7.74 | | - | + |
| trial 2 | 14.73 | 2.51 | 17.06 | | | + |
| trial 3 | 11.13 | 1.13 | 10.11 | | | |
| F - test | $17.02^{+++}$ | | | | | |

SD – standard deviation, $c_v$ – coefficient of variation
$^{-}P>0.05$ statistically not significant, $^{+}P<0.05$ statistically significant

The average content of blood glucose in the blood of broiler chickens was 15.63 mmol/l within the share of 0.1% cinnamomi aetheroleum, 14.73 mmol/l with the share of 0.05% cinnamomi aetheroleum and 11.13 mmol/l with the share of 0.025% cinnamomi aetheroleum. In the control group, the average content of glucose in the blood of broiler chickens was 14.91 mmol/l. Differences in the glucose content in the blood of broiler chickens were statistically significant ($P<0.05$) between the control group and the group with a share of 0.1% cinnamomi aetheroleum, between the control group and the group with a share of 0.025% cinnamon oil and between groups with a share of 0.1% and 0.025 and between groups with a share of 0.05 and 0.025% of cinnamomi aetheroleum.

**Table 6.** The content of cholesterol (mmol/l)

| Group | Mean | SD | $c_v$ (%) | trial 1 | trial 2 | trial 3 |
|---|---|---|---|---|---|---|
| control | 4.25 | 0.61 | 14.43 | - | - | + |
| trial 1 | 4.20 | 0.51 | 12.09 | | - | + |
| trial 2 | 3.71 | 0.57 | 15.43 | | | - |
| trial 3 | 3.50 | 0.30 | 8.58 | | | |
| F - test | $6.19^{+++}$ | | | | | |

SD – standard deviation, $c_v$ – coefficient of variation
$^{-}P>0.05$ statistically not significant, $^{+}P<0.05$ statistically significant

The average content of cholesterol in the blood of broiler chickens was 4.20 mmol/l within the share of 0.1% cinnamomi aetheroleum, 3.71 mmol/l with the share of 0.05% cinnamomi aetheroleum and 3.50 mmol/l with the share of 0.025% cinnamomi aetheroleum. In the control group, the average content of cholesterol in the blood of broiler chickens was 4.25 mmol/l. In the control group, the value of the standard deviation was 0.61 mmol/l and a coefficient of variation was 14.43. Differences in cholesterol content in blood of broiler chickens were statistically significant ($P<0.05$) between control group and the group with a share of 0.025% cinnamomi aetheroleum and between groups with a share of 0.1 and 0.025%. These levels of cholesterol in the blood serum of broiler chickens were lower compared to the results within the experiment by Kamaran [29] 4.05, 4.26, 4.50, 4.52 mmol/l.

## 4. Conclusions

In our experiment, we examined the effect of feed mixtures with a different share of cinnamomi aetheroleum on the body weight of broiler chickens, the fat content in meat and biochemical parameters of the energy profile. Body weight of broiler chickens in the control group was lower (1734.92 g) compared to the body weight of broiler chickens in experimental groups (1476.40 g, 1738.40 g, 1760.80 g). Differences in body weight of broiler chickens at the end of the experiment were statistically not significant ($P>0.05$). The lowest fat content in meat was 9.5 g/100 g within the share of 0.05% cinnamomi aetheroleum. Increasing share of cinnamomi aetheroleum to 0.1% statistically not significant ($P>0.05$) increased the fat content to 9.9 g/100 g, respectively the decreased share of 0.025% of cinnamomi aetheroleum statistically not significant ($P>0.05$) increased the fat content to 10.45 g/100g. The content of triglycerides in the blood serum of broiler chickens in the control

group was lower compared to the experimental groups. The differences in the triglycerides content was statistically significant ($P<0.05$) highest value of cholesterol content was within the control group and the value of cholesterol content decreased gradually statistically significant ($P<0.05$) from group with 0.1% of *cinnamomi aetheroleum* to group with the share of 0.025% *cinnamomi aetheroleum*.

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