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Fatty acid composition of broiler chicken meat after the combined use of antibiotic and oak bark extract

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ABSTRACT

With the increase in consumption of poultry products, the requirements for their quality, especially for nutritional and biological value, also increased. As the experience and scientific achievements of recent years shows, these indicators are quite manageable, that is, you can create products with predetermined properties. The aim was to study the combined use of chlortetracycline and Quercus cortex extract. The quantitative ratios of lipids and fatty acids in poultry meat are the main criteria of its quality, and fatty acids are of great importance. Together with essential polyunsaturated fatty acids, the composition and quantitative content of saturated fatty acids are of great importance in the muscle tissue, it plays an important role in providing the necessary ratio of unsaturated and saturated compounds. Under the influence of chlortetracycline and Quercus cortex extract, ambiguous changes in fatty acid composition are observed; primarily, it is due to changes in enzymatic complex of poultry digestive tract and changes in the intestinal microflora. Based on the conducted research, it can be concluded that fatty acid composition of broiler chickens can be corrected adding antibiotic in different ratios and concentrations together with Quercus cortex extract.

Keywords: *bark extract, antibiotic, fatty acid, composition*.

1. INTRODUCTION

In the Russian Federation, meat production has recently been one of the most dynamic sectors of domestic poultry and livestock production. Considering the latest statistical data for the recent years the level of poultry meat has increased among the countries of the world by 33% and by 36% in Russia due to the rearing of broiler chickens, in particular [1-2].

With the increase in consumption of poultry products, the requirements for their quality, especially for nutritional and biological value, also increased. As the experience and scientific achievements of recent years shows, these indicators are quite manageable, that is, you can create products with predetermined properties [3-5].

With the increase in consumption of poultry products, the requirements for their quality, especially for nutritional and biological value, increased, too. As the experience and scientific achievements of recent years show, these indicators are quite manageable, i.e. you can create products with the predetermined properties [6-8].

Recently, works discussing the problems and new possibilities of using synthetic preparations and natural substances in the diet of farm animals have appeared. A broad class of antibiotics, extracts, and preparations obtained from oak bark [9-11] can be considered as an example of combined use.

The aim was to study the combined use of chlortetracycline and Quercus cortex extract.

2. MATERIALS AND METHODS

Experimental studies were performed under the conditions of the Common Use Center for Scientific Equipment of the FSBI BST RAS; in vivo experiments (Gallus gallus) were carried out. For the experiment, 120 heads of 7-day broiler chickens were selected (Smena-8, 4 groups, n = 30). The control group - basic diet (BD); group I- BD + Quercus cortex extract; group II - BD + antibiotic based on 20% chlorotetracycline (at this stage of research, 100% dosage was used in accordance with the recommendations of the manufacturer); group III - BD + antibiotic + Quercus cortex extract.

The poultry housing and experimental procedures met the requirements of the instructions and recommendations of the Russian regulations (Order of the USSR Ministry of Health1 755 of August 12, 1977) and “The Guide for Animals” (National Academy Press, Washington, D.C., 1996). Drinking a lot.

Before slaughter, birds were kept on a starvation diet (except for drinking water) for 12 hours. They were weighed before and after slaughter; individual tissues and organs of experimental birds were also weighed. In the process of carcass processing, average muscle tissue samples were formed for each head, which were used to determine the chemical and elemental composition of body tissues. Homogenized samples were dried at a temperature of 60-70 ° C and stored in test tubes with a ground-in lid.

Studies of biochemical parameters included determination of the chemical composition of tissue, including the mass fraction of fat according to GOST 23042-86; ash - according to GOST 15113-77; protein - by the Kjeldahl method - according to GOST 23327-78 with preliminary mineralization of samples; determination of amino nitrogen in samples by the The Sørensen formol titration; determination of the mass fraction of moisture - according to GOST 15113.8-77.

The fatty acid composition of muscle tissue lipids was determined by gas chromatography on “Kristall Lux 400” with ZEBRON capillary column. Sample analysis was carried out for 50 minutes

at temperature from 60°C to 200°C. Separation of fatty acids was identified comparing with a mixture of fatty acids of the company Supelco TM Component FAME Mix.

Statistical processing of the data was carried out using the Statistica 10.0 software package. Data are presented as: mean (M) ± standard error of mean (m). Reliable results were considered at P≤0.05.

3. RESULTS

fatty acids in the necessary quantities. Fats with higher levels of unsaturated fatty acids promote better assimilation of protein nitrogen.

The biological value of broiler fat is characterized by a higher content of unsaturated fatty acids - linoleic, linolenic, palmitic, etc. The share of unsaturated fatty acids in poultry meat is 5–20 times higher than in beef and mutton.

Analysis of the data presented in Table 1-2 shows that the amount of fatty acids in the meat from the pectoral muscles is inferior to the number of fatty acids in that from the femoral muscles, on average, by 0.1-0.2%, in comparison with the control group.

Comparing saturated fatty acids in the pectoral and femoral muscles, the amount of saturated fatty acids in the femoral muscles of the experimental groups is less than in the pectoral muscles, so in group I by 4.6%, group II - by 2.6%, III - by 1.7%, in the control group the level of the latter remained unchanged.

Comparing the level of unsaturated fatty acids, the opposite pattern was found; in particular, in groups I and II an increase by 3.6% and 2.6% in the level of unsaturated fatty acids wew observed, respectively. In the control and group III, the level of saturated fatty acids was at the same level.

According to the content of unsaturated fatty acids in pectoral muscles of the studied bird, significant changes were observed in the group I, namely, an increase in palmitic acid level by 9.8%, stearic acid by 28.2% and arachidic acid 4.3 times (p≤0.05) , relative to the control group (table 1). In II and III experimental groups, the level of palmitic and gondoinic acids increased, in absolute terms, from 18.9% to 19.8% and from 1.4% to 1.9%, respectively, relative to the control. On the contrary, the content of stearic and arachidic fatty acids decreased by 0.1% relative to the control group, however, it should be noted that all changes were insignificant.

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The content of saturated fatty acids in the pectoral muscles of broiler chickens of the first group was significantly reduced, so the oleic acid by 1.5% and linoleic - by 4.6% (p≤0.05), relative to the control.

Table 1. Fatty acid composition of the pectoral muscles, **%.**

%	Groups			
	Control	**I**	**II**	**III**
Unsaturated fatty acids				
Palmitinic	18,9±0,23	20,4±0,26*	19,8±0,20	19,8±0,23
Stearic	7,9±0,21	11,0±0,16*	7,4±0,13	7,8±0,17
Arachidic	0,3±0,22	1,3±0,23*	0,2±0,17	0,2±0,12
Gondoinic acid (cis-11-eicosenoic acid)	1,4±0,17	1,3±0,27	1,9±0,25	1,8±0,19
Saturated fatty acids				
Palmitoleic	1,9±0,21	1,9±0,20	2,6±0,22*	2,8±0,25*
Oleic	33,9±0,22	32,4±0,26*	33,5±0,16	33,0±0,26
Linoleic	34,2±0,21	29,6±0,23*	33,8±0,28	34,5±0,27
Linolenic	1,4±0,10	1,9±0,18	0,8±0,11*	1,9±0,14

Note: * - p≤0.05 – significant differences with control

In the second experimental group, the level of palmitoleic acid increased significantly by 0.7% (p≤0.05), while linolenic acid, on the contrary, and decreased by 0.6% (p≤0.05) relative to the control group. The joint inclusion of antibiotic and oak bark extract in the poultry diet also led to a significant increase in the palmitoleic acid content by 0.9% (p≤0.05) relative to the control.

According to the content of unsaturated fatty acids in femoral muscles of broiler chickens, there is a significant increase in gondoic acid in groups I and II by 1.5% and 1.2%, (p≤0.05), respectively, relative to the control (Table 2).

The level of palmitic acid was significantly reduced in group II by 2.3% and in group III by 1.2% (p≤0.05) and stearic acid in group II by 1.3% (p≤0.05), relative to control group.

Considering saturated fatty acids, we observe a significant decrease in oleic acid in the II and III experimental groups by 3.4% and 5.8% (p≤0.05), respectively, relative to the control. The level of linoleic acid decreased in group I by 1.7% (p≤0.05) and increased in groups II and III by 4.9% and 3.2%, respectively, compared with the control.

Agricultural poultry lipids, unlike other animal fats, are indispensable to humans. The content of essential fatty acids of the

poultry is more favorable for human; with age, the content of essential fatty acids decreases, so, fat of broilers is more valuable in biological terms than fat of adult birds.

Currently, scientists from various countries are studying the active use of so-called extracts of various plants as phytobiotics, both as a main additive and in combination with other substances. Many papers have been published showing plant extracts and their essential oils enhance growth characteristics of poultry and improve the quality of meat (BečkováR, 2010; Brenes, 2010).

Thus, Ramiah at al (2014) in their work showed that the use of 0.5% solution of garlic extract improves the condition of the fatty acid composition of poultry. This effect was previously described in Onibi GE (2009). Koreleski (2007) described different effects of sage and rudbeckia extracts. A dosage of 560 mg added to poultry feed contributed to a change in fatty acid profile in breast. Adding sage extract to the diet increased the level of stearic acid, arachidonic acid and reduced the level of poly-saturated fatty acids in comparison with the control.

Table 2. Fatty acid composition of femoral muscles, %.

%	Groups			
	Control	I	II	III
Unsaturated fatty acids				
Palmitinic	20,3±0,26	20,9±0,25	18,0±0,20*	19,1±0,21*
Stearic	7,4±0,3	7,0±0,28	6,1±0,18*	7,4±0,27
Arachidic	0,5±0,20	0,7±0,20	0,9±0,27	0,6±0,20
Gondoinic acid (cis-11-eicosenoic acid)	0,5±0,15	2,0±0,26*	1,7±0,23*	0,8±0,18
Saturated fatty acids				
Palmitoleic	3,2±0,17	3,5±0,23	3,5±0,29	3,2±0,25
Oleic	34,5±0,18	33,9±0,24	31,1±0,21*	32,1±0,17*
Linoleic	32,3±0,16	30,6±0,27*	37,2±0,29*	35,5±0,22*
Linolenic	1,3±0,21	1,4±0,24	1,5±0,24	1,3±0,20

Note: * - p≤0.05 – significant differences with control

And the addition of lemon and hawthorn extracts contributed to an increase in the antioxidant activity of fatty acids in meat, which increased the shelf life of the product [12-14]. In general, it can be noted that the additional inclusion of both antibiotic and oak bark extract have a different effect on fatty acid composition of meat. Based on the research, it can be stated unequivocally that substances contained in Quercus cortex extract, such as phenolic compounds, tannins and other substances, have strong antioxidant properties, which in turn leads to a change in the fatty acid profile of muscle tissue of bird [15].

4. CONCLUSIONS

The quantitative ratios of lipids and fatty acids in poultry meat are the main criteria of its quality, and fatty acids are of great importance. Together with essential polyunsaturated fatty acids, the composition and quantitative content of saturated fatty acids are of great importance in the muscle tissue, it plays an important role in providing the necessary ratio of unsaturated and saturated compounds. Under the influence of chlortetracycline and Quercus cortex extract, ambiguous changes in fatty acid composition are observed; primarily, it is due to changes in the enzymatic complex of poultry digestive tract and changes in the intestinal microflora. Based on the conducted research, it can be concluded that fatty acid composition of broiler chickens can be corrected adding antibiotic in different ratios and concentrations together with Quercus cortex extract.

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