EFFECT OF INCLUSION OF PHYTOGENIC ADDITIVES, ORGANIC ACIDS AND PROBIOTICS IN BROILER DIET ON CHEMICAL COMPOSITON AND MEAT QUALITY

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Abstract – The inclusion of phytogenic additives, organic acids and probiotics in broiler diet on chemical composition and meat quality were examined in present paper. The experiment was conducted on broilers hybrid ROSS (n = 32000) divided in four groups. First group (control - C) was fed with commercial broiler feed mixture, while in second (E1), third (E2) and fourth (E3) group phytogenic additives, organic acid and probiotics were included, respectively. Fattening of broilers lasted for 40 days. Food and water were provided ad libitum in the floor fattening system.

The lowest protein content value (24.9%, E2), was significantly lower (*p<0.05*) than protein content from group E3 (25.4%) and control group (25.7%), but not significantly different with values of protein content obtained in group E1. Obtained values for free fat, moisture and total ash content were not significantly different (*p>0.05*).

Based on pH value and brightness parameter (L*) breast meat in all groups was "normal quality" according to applied criteria. Values of this parameters between groups were not statistically significant (*p>0.05*).

Key Words –broiler feeding, nutritive value, technological quality parameters

I. INTRODUCTION

Poultry production was the fastest growing livestock industry in recent years [1, 2, 3, 4]. But, in order to achieve gains, efficient and economical production, safety and quality, beside necessary nutrient, in the last few decades, antibiotics have been added to poultry diets. However, because pathogenic bacteria resistance development and potential negative consequences on public health, antibiotics as growth promoters are forbidden in the European Community [5, 6, 7, 8].

The ban on antibiotic usage in Europe lead to increasing researchers interest in finding alternatives to antibiotics for poultry production such as enzymes, organic or inorganic acids, herbs, essential oils, immunostimulators, microelements, probiotics and prebiotics [8, 9, 10, 11].

Phytogenic additives are a group of natural growth promoters, derived from herbs, spices or other plants [10, 11, 12, 13]. In recent years, the use of phytogenic compounds has increased because their potential role as natural alternatives to antibiotic growth promoters in animal nutrition [12]. Phytogenic additives enhance broiler performance and health, and have beneficial effects on: feed intake, broiler growth performance, digestive function, feed conversion, gut health parameters, body weight gain [11, 12, 14]. Also, may have a beneficial effect on carcass and stored meat quality [15, 16].

Organic acids have been used for a long time as food additives to prevent food deterioration and extend the shelf life of perishable food ingredients [17]. The supplementation of organic acids in the diet of broilers enhanced nutrient utilization, growth, and feed efficiency [18], and can prevent bacteria and fungal growth [10, 13]. Organic acid supplementation have been reported to decrease colonization of pathogens and production of toxic metabolites, improve digestibility of protein and minerals like Ca, P, Mg and Zn. Dietary supplementation of organic acids increases the body weight and feed conversion ratio in broiler chicken [8, 19], as well as increased growth performance, reduced diseases and management problems [20].

Probiotics beneficially affect the host animal by improving its intestinal balance. They create gut conditions that suppress harmful microorganisms

and favor beneficial ones, reduce disease risk, boost immune function and increase resistance to infection. Beyond the maintenance of health, they have been shown to improve the growth performance of poultry [11].

Thus, the aim of this study was to determine the influence of phytogenic additives, organic acids and probiotics in broilers diet on chemical composition and meat quality.

II. MATERIALS AND METHODS

The experiment was carried on 32000 broilers, hybrid ROSS. Broilers were divided in four groups, control group (C) and three experimental groups (E1, E2 and E3) and fed under the same conditions in the period of 40 days. Broilers from control group were fed with commercial mixture, while in broilers diet of experimental group E1 phytogenic additives (Biomin P.E.P) were added, of experimental group E2 organic acids (Biotronic SE forte) were added and of experimental group E3 probiotics were added. During the entire broiler growing period water and feed were provided *ad libitum*.

Chemical composition (protein, free fat, moisture and total ash) of breast meat was determined according to the ISO recommended standards [21-24]. Technological quality was evaluated by the determinations of pH and colour. The pH was measured using the portable pH meter Testo 205 (Testo AG, USA) equipped with a combined penetration tip with temperature probe. Breast meat color was determined on the fresh cross section 24 hour p.m. using Minolta Chroma Meter CR-400, and color characteristics were presented in CIE L*a*b* system (lightness L*, redness and greenness - a*, yellowness and blueness - b*).

III. RESULTS AND DISCUSSION

Mean values of breast meat chemical composition from control and experimental groups are shown in Table 1. Protein content varied from 24.9 (E2) to 25.4% (E3) in experimental groups, and 25.7% in control group. The lowest protein content value, determined in group E2, was significantly lower ($p<0.05$) than vales of protein content obtained in group E3 and control group, but not significantly different with values of protein content obtained in group E1. Regardless above mentioned differences, protein content obtained in control and experimental groups from this experiment was higher than protein values normally obtained for chicken breast meat [25, 26].

Table 1 Chemical composition of breast meat from control and experimental groups

Group	Protein (%)	Free fat (%)	Moisture (%)	Total Ash (%)
C	25.7^{a} ±0.34	0.31^{ns} ±0.02	74.1^{ns} ±0.60	1.35^{ns} ±0.07
E1	$25.3^{a,b}$ ±0.13	0.33^{ns} ±0.02	74.1^{ns} ±1.12	1.38^{ns} ±0.05
E2	24.9^{b} ±0.57	0.34^{ns} ±0.02	74.3^{ns} ±0.57	1.39^{ns} ±0.02
E3	25.4^{a} ±0.26	0.32^{ns} ±0.02	74.0^{ns} ±0.62	1.37^{ns} ±0.03

Free fat content varied from 0.32 to 0.34% in experimental groups and 0.31% in control group. Obtained vales for free fat content were not significantly different ($p>0.05$).

Moisture content varied from 74.0 to 74.3% in experimental groups and 74.1% in control group. Obtained vales for moisture content were not significantly different ($p>0.05$).

Total ash content varied from 1.37 to 1.39% in experimental groups and 1.35% in control group. Obtained vales for total ash content were not significantly different ($p>0.05$).

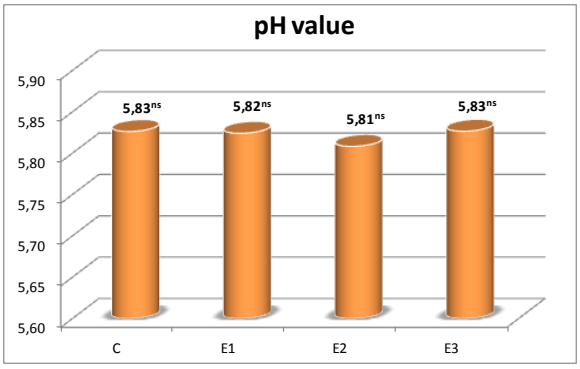

Figure 1. pH vaules of breast meat from control and experimental groups

Mean pH values of breast meat from control and experimental groups are shown in Figure 1. pH values were between 5.81 and 5.83 in experimental groups and 5.83 in control group.

Obtained pH vales were not significantly different ($p>0.05$).

Based on pH value as quality parameter and quality criteria 5.7 < pH < 6.1 breast meat in all groups was of "normal" quality [25, 27].

Colour characteristics L*, a* and b* of breast meat surface and fresh cross from control and experimental groups are shown in Table 2.

Colour brightness parameter (L*) of breast meat varied from 50.3 to 53.1 in experimental groups and 52.1 in control group on the surface and from 49.8 to 52.9 in experimental groups and 51.8 in control group on fresh cross. Obtained values between groups were not statistically significant ($p>0.05$).

Based on the brightness parameter (L*) and criteria for PSE chicken meat quality (L*>57) [27, 29]. meat from control and experimental groups were of "normal" quality.

Table 2 Colour characteristics L*, a* and b* of breast meat surface and fresh cross from control and experimental groups

Group	L*	a*	b*
	surface		
C	$52.1^{ns}\pm2.26$	$2.53^{ns}\pm0.69$	$6.14^{a.b}\pm0.90$
E1	$50.3^{ns}\pm2.50$	$2.42^{ns}\pm0.92$	$5.11^{a}\pm1.39$
E2	$53.1^{ns}\pm4.13$	$2.08^{ns}\pm0.91$	$7.07^{b}\pm2.03$
E3	$51.5^{ns}\pm4.05$	$2.16^{ns}\pm0.80$	$6.24^{a.b}\pm1.29$
	fresh cross		
C	$51,8^{a,b}\pm2,12$	$2,26^{ns}\pm0,65$	$5,70^{a,b}\pm1,18$
E1	$49,8^{b}\pm2,42$	$2,48^{ns}\pm0,92$	$5,38^{a}\pm1,17$
E2	$52,1^{a}\pm3,04$	$2,12^{ns}\pm1,05$	$6,50^{a,b}\pm1,46$
E3	$52,9^{a}\pm1,91$	$2,06^{ns}\pm0,48$	$6,81^{b}\pm1,35$

Share of red colour (a*) of breast meat varied from 2.08 to 2.42 in experimental groups and 2.53 in control group on the surface and from 2.06 to 2.48 in experimental groups and 2.26 in control group on fresh cross. Obtained values between groups were not statistically significant ($p>0.05$).

Share of yellow colour (b*) of breast meat varied from 5.11 to 7.07 in experimental groups and 6.14 in control group on the surface and from 5.38 to 6.81 in experimental groups and 5.70 in control group on fresh cross. Obtained values between groups E1 and E2 on the surface and between E1 and E3 on fresh cross were statistically different ($p<0.05$).

IV. CONCLUSION

The lowest protein content value (24.9%, E2), was determined in group with organic acid addition, which was significantly lower ($p<0.05$) than protein content from group with probiotic addition (25.4%) and control group (25.7%).

Content of free fat, moisture and total ash were not significantly different ($p>0.05$) between examined groups.

Based on pH values and brightness parameter (L*) breast meat in all groups was of "normal quality" according to applied criteria. Values of this parameters between groups were not statistically significant ($p>0.05$).

Based on the obtained results it can be concluded that inclusion of phytogenic additives, organic acids and probiotics can be successfully applied in broilers diet in terms of chemical composition and meat quality.

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