JMBFS
Journal of Microbiology, Biotechnology and Food Sciences
International peer-reviewed scientific online journal

Published by Faculty of Biotechnology and Food Sciences

THE PH VALUE OF BROILER BREAST AND THIGH MUSCLES AFTER ADDITION PROBIOTIC, BEE POLLEN AND PROPOLIS INTO THEIR FEED MIXTURE

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doi: 10.15414/jmbfs.2015.4.special3.52-54

ARTICLE INFO

Received 2. 12. 2014
Revised 10. 12. 2014
Accepted 11. 12. 2014
Published 2. 2. 2015

Regular article

OPEN ACCESS

ABSTRACT

The present experiment was conducted to evaluate the broiler´s Ross 308 breast and thigh muscles pH value after addition probiotic, bee pollen and propolis as supplemental diet. A total of 180 chicks in one day old, which were divided into 6 groups (30): control group T1 (2 g probiotic), T2 (4 g probiotic), T3 (500 mg. kg^{-1} natural bee pollen), T4 (500 mg. kg^{-1} propolis extract) and T5 (600 mg. kg^{-1} propolis extract). At the end of the experimental period (42 days) the broiler has been slaughtered to determinate the pH value by using pH meter equipped with an electrode calibrated (Grif 209L apparatus). The results show that the pH value after 45 minutes was lower in the experimental groups compared to control group and there were found significant differences ($P \leq 0.05$) between the control group with experimental groups, similarly the pH value after 2 hours in breast muscles was higher in the control group compared to experimental groups, but in the thigh the experimental groups (T1, T2, T3 and T5) were higher than control group except (T4) group. Otherwise, the pH value after 24 hours was higher in the experimental groups compared to the control except (T4, T5) in the thigh. From the present study, we conclude that the pH value after 24 hours was higher value in the experimental groups compared to the control group and the bee pollen in the amount (500 mg. kg^{-1}) was given the highest value of pH value.

Keywords: Broiler Ross 308, probiotic, bee pollen, propolis, pH value

INTRODUCTION

Worldwide consumption of poultry meat is growing up as in developed well as in developing countries, in 1999 the world production of broiler chickens reached 40 billion and expects continued growth until 2020 **(Bilgili, 2002)**. The rate of pH decline has been dependent on the activity of glycolytic enzymes just after death; the ultimate pH is determined by the initial glycogen reserves of the muscle **(Janz et al., 2002)**. A low pH is associated with poor water-holding capacity and poor functionality **(Owens et al., 2000; Woelfel et al., 2002)** and a high pH is associated with poor shelf life because it is a more favourable environment for bacteria **(Janz et al., 2002)**. The normal pH after one hour is about (6.9 – 7.1) and pH after 24 hours is about (5.7 – 5.9) **(Ingr, 1996; Čuboň et al., 2005; Haščík et al., 2009)**.

Bee pollen has been used for many years in both traditional medicine and supplementary nutrition, as well as in alternative diets, mainly due to its nutritional properties and health benefits **(Serra et al., 1997; Isla et al., 2001; Almeida-Muradian et al., 2005)**. As alternative substitutions in nutrition, bee products (pollen, propolis or their extracts) may be employed, because they can have positive influence on health state, economic use of feed and quality of product **(Prytzyk et al., 2003; Wang et al., 2004; Haščík et al., 2005a, b, 2007; Angelovičová et al., 2006, 2008; Shalmany and Shivazad, 2006; Seven et al., 2008)**. Several plant supplements contain substances, which increase the gluttony and digestion **(Barreto et al., 2008)**.

A popular alternative to the use of antibiotics has been the use of probiotics which have been used in poultry for "competitive/exclusion" of bacterial pathogens **(Barrow, 1992)**. The positive effects of probiotics on animals can result either from a direct nutritional effect of the probiotic, or a health effect, with probiotics acting as bioregulators of the intestinal microflora and reinforcing the host's natural altitude defines. There have been numerous studies in humans and animals with the ability of probiotics to change the types and numbers of gut microflora **(Endo, 1999; Saulnier, 2007)**. **Gong et al. (2002)** define probiotics as health-promoting bacteria inhabiting the gastrointestinal tract of humans and animals.

The present was objected to study the effect addition probiotic, bee pollen and propolis as supplements diet on the broiler breast and thigh muscles pH value.

MATERIAL AND METHODS

Animals and diets

The experiment was implemented at the test poultry station of Slovak University of Agriculture in Nitra. The tested chickens were broiler Ross 308. The experiment content 180 chicks in one day-old, which were divided into 6 groups (n=30): control group, T1, T2, T3, T4 and T5 for 42 days. The chickens were bred in cage conditions. Each cage was equipped with feed dispenser and water intake was ensured ad libitum through a self-feed-pump. The temperature was controlled during the fattening period and it was 33 °C at the first day and every week was reduced about 2 °C and final temperature was 19 °C. The lighting during the experimental period was continuous. Each group was fed by the same starter complete feed mixture (CFM) HYD-01 (loose structure) from 1st day to 21st days of their age, and from the 22nd to 42nd days of their age, chickens were fed by a complete feed mixture (CFM) HYD-02 (loose structure), in all investigated groups of the experiment. The complete feed mixture HYD-01 and HYD-02 has been produced without antibiotic preparations and coccidiostatics (Table 1). However, they were added to experimental groups such as T1 (2 g probiotic through drinking water), T2 (4 g probiotic through drinking water), to the T3 were added natural bee pollen in the amount (500 mg.kg^{-1}) into feed mixture and to (T4, T5) were added propolis extract in the amount (500, 600 mg.kg^{-1}) respectively into feed mixture.

Sample analysis

At the end of the fattening period from each experimental group were selected 20 pieces randomly of chickens for slaughter analysis (10 male pieces and 10 female pieces) to determined pH (45 minutes, 2 and 24 hours after slaughtering) by using a pH meter equipped with an electrode calibrated (Grif 209L apparatus) at pH 4.0 and 7.0 before measuring. The pH is easier measured by probe method by inserting a thin electrode directly into the muscle after incision of the muscle. The experimental analysis was evaluated at Department for evaluation and processing of animal products at Faculty of Biotechnology and Food Sciences Slovak University of Agriculture in Nitra.

Statistical analysis

The results of meat performance (arithmetic mean, standard deviation) were statistically analysed by the statistic program Statgraphics Plus version 5.1 (AV Trading Umex, Dresden, Germany). For the determination of significant differences among the tested groups was used analysis of variance.

Table 1 Composition of the diets

Ingredients [%]	Starter (1st to 21st days of age)	Grower (22nd to 40th days of age)
Wheat	35.83	31.21
Maize	35.00	40.00
Soybean meal (48 % N)	20.00	21.00
Fish meal (71 % N)	4.00	-
Dried blood	1.60	2.10
Dried whey	-	2.20
Ground limestone	1.00	0.80
Monocalcium phosphate	1.00	0.90
Fodder salt	0.10	0.15
Sodium bicarbonate	0.20	0.20
Lysin	0.10	0.06
Methionin	0.17	0.23
Palm kernel oil Bergafat	0.50	0.65
Premix Euromix BR 0,5 %[1]	0.50	0.50
Nutrient composition [g.kg^{-1}]		
Crude protein	210.39	191.47
Fibre	29.78	29.89
Ash	24.56	17.77
Ca	8.24	7.13
P	6.76	6.11
Mg	1.39	1.37
Linoleic acid	12.77	13.41
ME_N (MJ.kg^{-1})	12.00	12.08

Legend: [1] active substances per kilogram of premix: vitamin A 2 500 000 IU; vitamin E 20 000 mg; vitamin D3 800 000 IU; niacin 12 000 mg; d-pantothenic acid 3 000 mg; riboflavin 1 800 mg; pyridoxine 1 200 mg; thiamine 600 mg; menadione 800 mg; ascorbic acid 20 000 mg; folic acid 400 mg; biotin 40 mg; kobalamin 8.0 mg; choline 100 000 mg; betaine 50 000 mg; Mn 20 000 mg; Zn 16 000 mg; Fe 14 000 mg; Cu 2 400 mg; Co 80 mg; I 200 mg; Se 50 mg

Table 2 pH of the thigh muscles after addition probiotic through drinking water (g), natural bee pollen (mg.kg^{-1}) and propolis extract (mg.kg^{-1})

Indicators	C	T1 (2 g probiotic)	T2 (4 g probiotic)	T3 (500 g bee pollen)	T4 (500 g propolis)	T5 (600 g propolis)
n	30	30	30	30	30	30
45 minutes	6.24±0.13^{a}	6.07±0.16^{b}	6.08±0.11^{b}	6.17±0.19^{a}	6.08±0.16^{b}	6.08±0.14^{b}
2 hours	5.94±0.14	5.86±0.10	5.83±0.11	5.89±0.14	5.89±0.16	5.89±0.12
24 hours	5.84±0.12^{a}	5.85±0.07^{a}	5.86±0.06^{a}	5.96±0.12^{b}	5.86±0.10^{ab}	5.91±0.04^{ab}

*C: control group, *T1, T2, T3, T4, T5 experimental groups; $^{a, b, c}$: values are expressed as means ± standard deviation (n = 30) (P≤ 0.05)

Table 3 pH of the thigh muscles after addition probiotic through drinking water (g), natural bee pollen (mg.kg^{-1}) and propolis extract (mg.kg^{-1})

Indicators	C	T1 (2 g probiotic)	T2 (4 g probiotic)	T3 (500 g bee pollen)	T4 (500 g propolis)	T5 (600 g propolis)
n	30	30	30	30	30	30
45 minutes	6.59±0.17^{ab}	6.48±0.14^{a}	6.50±0.13^{a}	6.65±0.13^{b}	6.53±0.15^{ab}	6.56±0.12^{ab}
2 hours	6.45±0.16^{ab}	6.54±0.18^{ab}	6.52±0.12^{ab}	6.63±0.14^{a}	6.42±0.16^{b}	6.47±0.15^{b}
24 hours	6.29±0.17^{ab}	6.36±0.19^{ab}	6.34±0.17^{ab}	6.37±0.12^{a}	6.28±0.14^{ab}	6.24±0.12^{b}

*C: control group, *T1, T2, T3, T4, T5 experimental groups; $^{a, b, c}$: values are expressed as means ± standard deviation (n = 30) (P≤ 0.05)

RESULTS AND DISCUSSION

The pH value of the broiler Ross 308 chickens breast and thigh muscles were shown in tables (*1*, 2) where they shows that the pH value after 45 minutes of the broiler breast and thigh muscles in control group (6.24±0.13, 6.59±0.17) was higher than experimental groups T1 (6.07±0.16, 6.48±0.14), T2 (6.08±0.11, 6.50±0.13), T3 (6.17±0.19, 6.65±0.13), T4 (6.08±0.16,6.53±0.15), T5 (6.08±0.14, 6.56±0.12) and there were found significant differences (P≤0.05) in breast muscles between control group and experimental groups (T1, T2, T3, T4 and T5). Otherwise, the pH value after 2 hours of the breast in the control group (5.94±0.14) was higher than T1 (5.86±0.10), T2 (5.83±0.11), T3 (5.89±0.14), T4 (5.89±0.16) and T5 (5.89±0.12) and they're not significant differences (P≥0.05) between the groups. On the other hand the pH value after 2 hours in the thigh was lower in the control group (6.45±0.16) compared to experimental groups T1 (6.54±0.18), T2 (6.52±0.12), T3 (6.63±0.14), T5 (6.47±0.15) except T4 (6.42±0.16) it was lower than the control group.

Moreover, the pH value after 24 hours in breast and thigh was lower in control group (5.84±0.12, 6.29±0.17) compared to experimental groups T1 (5.85±0.07, 6.36±0.19), T2 (5.86±0.06, 6.34±0.17), T3 (5.96±0.12, 6.37±0.12) T4 (5.86±0.10, 6.28±0.14) and T5 (5.91±0.04, 6.24±0.12) except in thigh there were found that the (T4, T5) groups was lower the control group, however they were found significant differences (P≤0.05) in breast between the control groups and T3.

The pH value results of the broiler breast and thigh are confirm **Haščík et al. (2013)** who was studied the effect of the bee pollen on broiler Ross (308) pH value. Similarly the present study is support **Šulcerova et al. (2011)** who added bee and propolis into broiler (Ross 308) feed mixture. Also, our results are in agreement with **Elimam et al. (2012)** who studied the impact of the bee pollen on broiler breast and the thigh muscles. Moreover, our findings confirm the study of **(Haščík et al., 2010**) who studies the effect of the probiotic on the broiler pH value. The reason why the bee pollen and propolis improves the meat pH value, because bee pollen and propolis decreases the meat oxidative stability, we knew that when meat oxidation is an autocatalytic process occurring in food and biological membranes, which leads to significant damage of the food quality they can be used as substrates for initiation of oxidative processes **(Haščík et al., 2011; Elimam, 2014**). Also the main catalysts of oxidation are highly reactive free radicals as superoxide anion (O-2), hydroxyl radical (OH°), proxyl radicals (ROO°), which contain one or more free electrons all this processing may

decrease the meat pH value, so when the bee pollen inhibit meat oxidation that the reason explains why bee pollen improves the meat pH value **(Marcinčák et al., 2005)**.

Moreover, bee pollen is antibacterial pathogens **(Basim et al., 2006; Kňazovická et al., 2009)** also bee pollen and propolis effect on the meat pH because the bee pollen gathered is considered as a valuable functional food with varied enhancing effects in health **(Bogdanov, 2004)**. According to this reason we conclude the bee pollen and propolis improve meat pH value.

CONCLUSION

The recent study has concluded the that the pH value after 24 hours was higher in the experimental groups compared to the control group and bee pollen in amount (500 $mg.kg^{-1}$) has been given the highest value of the pH compared to the probiotic and propolis, however, the propolis was given the lowest pH value.

Acknowledgments: The work was financially supported by project VEGA1/0129/13.

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