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EFFECT OF BEE POLLEN EXTRACT AS A SUPPLEMENTAL COMPONENT OF DIET ON BROILER´S ROSS 308 BREAST AND THIGH MEAT MUSCLES FATTY ACIDS

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ABSTRACT

The present study was aimed to study the effect of the bee pollen extract on the broiler Ross 308 breast and thigh meat fatty acids. The experiment enrolled 90 chicks in one day old, which were divided into 3 groups (control, E1 and E2). The broiler has been bred in a cage condition for 42 days. To the experimental groups were added bee pollen extract in the amount (400, 800 mg.kg^{-1}). The chickens have been bred in a 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 the end temperature was 23 °C. At the end of the experiment the fatty acids have beenevaluatedby using Agilent 7890A Gas Chromatograph apparatus (USA). The findings have been shown that the myristoleic acid, linoleic acid, linoelaidic acid, arachidonic acid, and archaic acid were decreased after using the bee pollen into broiler feed mixture otherwise, the bee pollen has been increased the polemic acids and oleic acid and there were found no significant differences (P ≥0.05) among all the experimental groups.From the recent experiment, we conclude that bee pollen extract has decreasedthe fattyacids except palmitoleic acid acid and oleic acid, whichwere higher compared to control groupand there were no significant differences (P ≥0.05) between experimental groups.

Keywords: broiler Ross 308; bee pollen; feed mixture; fatty acid

INTRODUCTION

Fatty acid are important sources of body fuel because, when metabolized they yield large quantities of ATP and many cell types can use either glucose or fatty acid for this purpose in particular heart and skeletal muscle prefer fatty acid, despite longstanding assertions to the contrary, the brain can use fatty acid as a source of fuel in addition to glucose and ketone bodies **(Goodhart and Shils, 1980; Marin-Valencia et al., 2012)**. Fatty acids have been linked with the pathological processes of the various human diseases, particularly cardiovascular disease with the strongest evidence suggesting that saturated fatty acids (SFA) have negative consequences on human health whilst polyunsaturated fatty acids (PUFA) have beneficial effects **(Gibbs et al., 2013)**. One reason for the success of the broiler meat industry has been the consumer perception of a healthy product that contains less fat, most predominantly unsaturated fatty acids as comparable to beef or pork products **(Leeson, 1999; Bonoli, 2007)**. That dietary monounsaturated fatty acid enrichment has a positive effect on cardiovascular health, decreasing low-density lipoprotein cholesterol, but not high-density lipoprotein cholesterol in blood plasma, and decreasing the susceptibility of low-density lipoprotein to oxidation **(Grundy, 1986; Roche, 2001)**. The fatty acid profile of poultry meat is related to the composition of the bird's diet and, as such, dietary alterations can be used to modify the proportion of PUFA in chicken meat **(Rymer and Givens, 2005)**. The enrichment of poultry tissue with eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) has been proposed as a potential vehicle for increasing dietary intakes of long chain n-3 PUFA in the human diet **(Rymer and Givens, 2005; Gibbs et al., 2010)**. Bee pollen is rich of the a major fatty acid, presented as mean values were C18:3 (25.1%), C16:0 (19.6%), C18:1 (17.3%), C18:2 (8.78%), C22:0 (4.07%), and C18:0 (2.96%) acids. The proportions of C18:3 were generally higher than those of C18:2 and the ratio of total unsaturated fatty acid (TUS) to total saturated fatty acid (TS) was >1.0, except for *Nelumbo nucifera* Gaertn, pollen for the characteristic absence of C18:3 acids **(Yang et al., 2013)**.

The present experiment was objected to study the effect of the bee pollen extract on the broiler Ross 308 breast and thigh muscles essential fatty acids.

MATERIAL AND METHODOLOGY

The experiment has been done in the test poultry station of Slovak University of Agriculture in Nitra. The tested chickens were broiler Ross 308. The experiment included 90 chicks in one day-old, which were divided into 3 groups (n=30): control group, E1 and E2, for 42 days. The chickens were bred in a 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 23 °C. The lighting during the experiment 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 (Table 1). However, to experimental groups, they were added bee pollen extract in amount (400, 800 mg.kg^{-1}) into feed mixture. The complete feed mixture HYD-01 and HYD-02 has been produced without antibiotic preparations and coccidiostatics. The bee pollen extract was prepared from minced bee pollen (150 g) in the conditions of the 80% ethanol in the 500 cm^3 flasks **(Krell, 1996**). At the end of the fattening period (42 days) from each experimental group have 30 pieces of chickens for slaughter analysis (15 ♂ pieces and 15 pieces ♀), to evaluate the count of fatty acid in broiler muscles were selected. The experimental analyses were done in Animal Production Research Centre Nitra (APRC Nitra, Slovak republic) by using Agilent 7890A Gas Chromatograph (USA) apparatus.

Statistical analysis:

The results of the experiments were statistically analysed by the statistic program Statgraphics Plus version 5.1 (AV Trading Umex, Dresden, Germany). For the determination of significant differences (P ≤0.05) among the tested groups analysis of variance (arithmetic mean, standard deviation) was used.

RESULTS

The results of the effect of bee pollen extract on broiler Ross 308 breast muscles fatty acids (%) have been shown in the Table (2) where were found that the myristoleic acid in the control group (0.715 ± 0.110) was higher compared to E1 (0.554 ± 0.098) and E2 (0.632 ± 0.062) groups. Otherwise, the palmitoleic acid in E1 (6.485 ± 1.325) and (6.295 ± 0.606) were higher compared to the control group (5.577 ± 1.113). Moreover, were found that the oleic acid was higher in E1 (43.583 ± 1.507) and E2 (45.342 ± 0.877) groups than the control group (43.222 ± 4.284). Further, were found that the linoleic acid in the control group (12.348 ± 2.306) was higher compared to E1 (11.289 ± 0.882) and E2 (10.684 ± 0.676) groups. Moreover, the linoelaidic acid in the control group (0.728 ± 0.163) was higher compared to E1 (0.674 ± 0.179) and E2 (0.588 ± 0.123) groups. Also, arachidonic acid in the control group (1.346 ± 0.240) was higher compared to E1 (1.129 ± 0.480) and E2 (1.090 ± 0.376) similar result was found in archaicacid, which was higher in the control group (0.998 ± 0.362) compared to E1 (0.784 ± 0.258) and E2 (0.624 ± 0.121) groups. And there were no significant differences (P ≥0.05) among the groups.

Table 3 shows the data of the effect of bee pollen extract on broiler Ross 308 thigh muscles fatty acids (%) where were found the myristoleic acid in the control group (0.685 ± 0.078) was higher compared to E1 (0.638 ± 0.035) and E2 (0.623 ± 0.0505) groups. Similarly, the palmitoleic acid was higher in the control group

Table 1 Composition of the broiler feed mixture

Ingredients (%)	Starter (1 to 21 days of age)	Grower (22 to 42 days of age)
Wheat	35.00	35.00
Maize	35.00	40.00
Soybean meal (48% N)	21.30	18.70
Fish meal (71% N)	3.80	2.00
Dried blood	1.25	1.25
Ground limestone	1.00	1.05
Monocalcium phosphate	1.00	0.70
Fodder salt	0.10	0.15
Sodium bicarbonate	0.15	0.20
Sodium bicarbonate	0.15	0.20
Lysine	0.05	0.07
Methionine	0.15	0.22
Palm kernel oil Bergafat	0.70	0.16
[1]Premix Euromix BR 0.5%	0.50	0.50
Analysed composition (g.kg^{-1})		
Crude protein	210.76	190.42
Fibre	30.19	29.93
Ash	24.24	19.94
Ca	8.16	7.28
P	6.76	5.71
Mg	1.41	1.36
ME (MJ.kg^{-1})	12.02	12.03

[1] active substances per kilogram of premix: vitamin A 2 500 000 IU; vitamin E 50 000 mg; vitamin D3 800 000 IU; niacin 12 000 mg; d-pantothenic acid 3 000 mg; riboflavin 1 800 mg; pyridoxine 1200 mg; thiamine 600 mg; menadione 800 mg; ascorbic acid 50000 mg; folic acid 400 mg; biotin 40 mg; vitamin B12 10.0 mg; choline 100000 mg; betaine 50000 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.

(8.025 ± 0.636) compared to E1 (7.907 ± 0.925) and E2 (7.689 ± 0.708) groups. Comparably, were found that the oleic acid was higher in E1 (45.186 ± 1.471) and E2 (46.451 ± 1.156) groups than the control group (44.571 ± 2.205). Further, there were found that the linoleic acid was higher in the control group (11.549 ± 1.927) compared to E1 (11.544 ± 0.593) and E2 (11.315 ± 0.775) groups. Moreover, the linoelaidic acid was higher in the control group (0.737 ± 0.103) compared to E1 (0.699±0.0412) and E2 (0.665 ± 0.058) groups. Also, were found that the arachidonic acid was higher in the control group (0.638 ± 0.137) compared to E1 (0.627 ± 0.0649) and E2 (0.567 ± 0.021) groups. Analogous, were found that the arachidonic acid was higher control group (0.737 ± 0.103) compared to E1 (0.699 ± 0.0412) and E2 (0.665 ± 0.058) groups. However, no significant differences among the groups were found.

DISCUSSION

In the recent years there has been an increased interest to study the manipulate fatty acid composition in meat. This is because meat is seen to be a major source of fat in the diet and especially of saturated fatty acids, which have been implicated in diseases associated with modern life, especially in developed countries **(Wood et al., 2003)**. The fatty acid composition and total fatty acid content of broiler breast and thigh muscles retail was shown in Tables (2, 3) where we found that in our finding that following fatty acids such asmyristoleic acid, linoleic acid, linoelaidic acid, arachidonic acid, and archaic acid fatty acids were decreased after using the bee pollen extract into broiler Ross 308 feed mixture, although the bee pollen has content many types of fatty acids **(Yang et al., 2013)**, we suggest the reason which led to decrease the fatty acid, that return to use ethanol for made bee pollen extract and **(Horrobin, 1980; McCarty, 1999)** reported that the ethanol has damage fatty acid.

On the other hand, our results have increased the oleic acid and palmitoleic acid in breast muscles and thigh just oleic acid, which were higher in experimental groups than the control and this is a good result because oleic acid has a positive effect on human health **(Høstmark and Haug, 2013)** which led to an improved insulin sensitivity, and endothelium-dependent flow-mediated vasodilatation **(Ryan et al., 2000; Tholstrupet al., 2004)**, lowering of LDL cholesterol **(Gillingham et al., 2010; Damasceno et al., 2011)** and an increase in HDL cholesterol **(Estévez-González et al., 2010)** and oleic acid enriched LDL in lipids, which that led to particles will be less liable to be oxidized **(Cicero et al., 2008)**. **Bolsoni-Lopes et al. (2013)** found that palamtic acid (16:1n7) has increased fatty acid incorporation into TAG and glycerol 3-phosphate synthesis from glucose in both wild-type and PPARα- deficient, however, palmitoleic acid increases adipocyte lipolysis and lipases by a mechanism that requires a functional peroxisome proliferator-activated receptor alpha (PPARα.). **Paillarda et al. (2008)** said that the palmitoleic acid content a product of SCD activity and this enzyme (SCD) could represent a target for prevention and treatment of these metabolic disorders in particular in subjects at risk of developing a metabolic syndrome.

CONCLUSION

In the present study bee pollen extract treatment decreased the myristoleic acid, linoleic acid, linoelaidic acid, arachidonic acid, and archaic acid fatty acids, on the contrary palmitoleic acid palmitoleic acid and oleic acid were increased in broiler breast muscles also the oleic acid was increased in the thigh muscles.

Table 2 The effect of bee pollen extract broiler Ross 308 breast unsaturated fatty acids (%)

Indicators	Control	E1 Pollen 400mg.kg^{-1}	E2 Pollen 800mg.kg^{-1}
Myristoleic acid	0.715 ± 0.110	0.554 ± 0.098	0.632 ± 0.062
Palmitoleic acid	5.577 ± 1.113	6.485 ± 1.325	6.295 ± 0.606
Oleic acid	43.222 ± 4.284	43.583 ± 1.507	45.342 ± 0.877
Linoleic acid	12.348 ± 2.306	11.289 ± 0.882	10.684 ± 0.676
Linoelaidic acid	0.728 ± 0.163	0.674 ± 0.179	0.588 ± 0.123
Arachidonic acid	1.346 ± 0.240	1.129 ± 0.480	1.090 ± 0.376
Archaic acid	0.998 ± 0.362	0.784 ± 0.258	0.624 ± 0.121

E1, E2: experimental groups; ^{a,b}– means with different superscripts differ significantly; (P ≤0.05) significant.

Table 3 The effect of bee pollen extract broiler Ross 308 thigh unsaturated fatty acids (%)

Indicators	Control	E1 Pollen 400mg.kg^{-1}	E2 Pollen 800mg.kg^{-1}
Myristoleic acid	0.685 ± 0.078	0.638 ± 0.035	0.623 ± 0.0505
Palmitoleic acid	8.025 ± 0.636	7.907 ± 0.925	7.689 ± 0.708
Oleic acid	44.571 ± 2.205	45.186 ± 1.471	46.451 ± 1.156
Linoleic acid	11.549 ± 1.927	11.544 ± 0.593	11.315 ± 0.775
Linoelaidic acid	0.737 ± 0.103	0.699 ± 0.0412	0.665 ± 0.058
Arachidonic acid	0.638 ± 0.137	0.627 ± 0.0649	0.567 ± 0.021
Archaic acid	0.256 ± 0.324	0.122 ± 0.0323	0.129 ± 0.041

E1, E2: experimental groups; a,b– means with different superscripts differ significantly; (P ≤0.05) significant

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