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MODIFICATION OF QUAIL MEAT QUALITY WITH OLIGOSACCHARIDE FEED SUPPLEMENTATION

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ABSTRACT

The studies were carried out on 40 female Pharaoh quails. In the fifth week of age, the quails were weighed and randomly assigned to 5 feeding groups. In the group I, control, the females were fed on standard feed formed for adult quail feeding. The experimental groups II and III received the standard mixture with oligosaccharides added, which had been extracted from pea seed, in the quantities and duration, respectively: 0.4 g · kg^{-1} of mixture for 3 weeks, 0.4 g · kg^{-1} for the entire period of the experiment, i.e. 4 months. In the groups IV and V, the addition of oligosaccharides was 3 g per kg of feed, with the group IV fed this way for 3 weeks and the group V for 4 months.

The quails were slaughtered on the completion of the experiment. Breast muscles were collected from the carcass and stored at approx. 6°C for 24 hours. Thereafter, pH, colour — visually and with SPECOL 11 at wave length of 560 nm — as well as the quantity of thermal drip were evaluated, and sensory analysis was done of the boiled muscles and the broth obtained through boiling.

Basing on the results of the studies, was observed that the degree of breast muscle acidification in 24 hours post mortem was different between the particular experimental groups. Moreover, an improvement of sensory characteristics of boiled meat was found if oligosaccharides had been applied in the quantity of 3 g for 3 weeks, while a deterioration was observed when 0.4 g was applied for 3 weeks and 3g of oligosaccharides were applied throughout the period of raising. Application of

oligosaccharides, irrespective of the experiment variant, improved the water-holding capacity of meat (lower meat juices drip loss). Application of higher doses of oligosaccharides in quail feeding may lead to raw breast muscle meat colour brightening.

Key words: quail, meat, quality, oligosaccharides

INTRODUCTION

The interest in oligosaccharides grew over the last decade of the past century [4, 5, 7], also in poultry feeding where the compounds are considered as alternative supplements that improve feed intake and product quality [9, 11]. The experiments that have been carried out so far demonstrate that some types of oligosaccharides (mannan- and glucooligosaccharides) have a stimulating effect on poultry immune system and enhance their resistance to pathogenic factors [11]. Other benefits of an addition of oligosaccharides to feed mixtures may include increased concentration of lactic acid in the large intestine contents, which reduces pathogenic bacteria growth [1]. In quails, oligosaccharides reduced concentration of cholesterol in yolk, increased the concentration and activity of lysozyme in quail egg-white, and enhanced the colour intensity of yolk [9]. Also, as a result of oligosaccharide application, breast muscle colour in quails was found to grow brighter [2] and acidity of breast muscles decreased directly after slaughter [3].

The few reports published so far that deal with oligosaccharides applied in poultry feeding point to their beneficial effects, however the knowledge on the influence of various types of oligosaccharides on digestive tract, metabolism, and, in consequence, on the quality of poultry products has still been too small. Therefore, the studies were undertaken that aimed at determination of the dependence between the quantity of pea-seed oligosaccharides in the ration, feeding duration, and selected quality characters of quail meat.

MATERIALS AND METHODS

The studies were carried out on 40 female Pharaoh quails. The birds had been raised from own chicks in standard conditions being fed according to the needs of the growing quails. In the fifth week of age, the young quails were weighed and randomly assigned to 5 feeding groups. In the control group (group I), the females were fed on standard feed for adult quails (Table 1). The experimental groups II and III received the standard mixture with oligosaccharides added, which had been extracted from pea seed, in the quantities and duration, respectively: 0.4 g · kg^{-1} of mixture for 3 weeks, 0.4 g · kg^{-1} for the entire period of the experiment, i.e. 4 months. In the groups IV and V, the addition of oligosaccharides was 3 g per kg of feed, with the group IV fed this way for 3 weeks and the group V for 4 months. On the completion of the experiment, the quails were slaughtered after 12-hour fasting. The slaughter was carried out through decapitation with a sharp knife after prior stunning. After bleeding, plucking, and gutting, breast muscles were collected from the carcass and stored at about 6°C for 24 hours. Thereafter, meat pH was measured directly inside a sample using a pX-processor PM-600 pH-meter with a combined glass electrode ESAgP-307; meat colour was assessed visually and instrumentally. In the visual evaluation, a 5-grade scale was applied, where score 1 meant very bright colour, 5 – a very dark meat, and score 3 – colour normal for quail meat. The instrumental evaluation was carried out using a "Spekol" spectrocolorimeter with R 45/0 remission attachment at a wavelength 560 nm. Also, thermal drip was determined, and sensory analysis was done of cooked muscles and the broth obtained from cooking.

The results were statistically analysed using Statistica software package.

Table 1. Composition of feed mixture for adult quails (%)

Ingredients of feed mixtures	Percentage
Ground wheat	30.00
Ground triticale	20.00
Ground barley	11.67
Extracted soybean meal 46%	19.20
Extracted rapeseed meal 35.5%	5.00
Meat-bone meal 55%	5.00
Animal fat (poultry)	2.00
Rapeseed oil	1.60
Salt	0.20
Fodder lime	3.20
Dicalcium phosphate	0.70
Premix (EWOS)	1.20
Lysine	0.20
Methionine	0.03

RESULTS AND DISCUSSION

The results of physicochemical assays are presented in Table 2. The pH of quail breast muscles found in this study in most cases did not differ from those reported by other authors [2, 3]. The pH muscle measuring carried out 24 hours after slaughter demonstrated that in groups II (5.87) and V (5.88) the values were similar to those recorded in the control group (5.85). In group V, pH was lower (5.80), while in group III it was higher (5.95) than in the control.

Table 2. Results of physicochemical analyses (x±SD)

Trait	I	II	III	IV	V
PH	5.85 ±0.09	5.87 ±0.12	5.95^{a} ±0.12	5.80^{b} ±0.12	5.88 ±0.12
Colour, pts*	2.75 ±1.16	2.75 ±1.16	3.00^{a} ±0.92	2.00^{b} ±1.85	1.50^{b} ±1.06
Colour,(%), 560nm	13.6^{b} ±2.60	14.4 ±4.27	13.1^{b} ±3.09	16.2^{a} ±3.46	16.4^{a} ±3.46
Thermal drip, (%)	31.8^{a} ±1.46	31.1 ±1.39	29.2^{b} ±1.49	30.2 ±1.65	29.5^{b} ±3.06

*Grade score from 1 to 5, with 1 point – very bright meat, 5 pts – very dark meat.

Table 3. Results of sensory analysis* (x±SD)

Trait		I	II	III	IV	V
Odour	meat	4.44 ±0.32	4.00^{B} ±0.00	4.19^{b} ±0.53	4.69^{Aa} ±0.37	3.87^{B} ±0.44
Brittleness		4.12 ±0.74	3.43^{B} ±0.62	4.06 ±0.78	4.62^{A} ±0.52	3.37^{B} ±0.95
Juiciness		4.12 ±0.74	3.44^{B} ±0.62	4.06 ±0.78	4.62^{A} ±0.52	3.37^{B} ±0.95
Palatability		4.25 ±0.53	3.62^{B} ±0.52	4.25 ±0.46	4.69^{A} ±0.37	3.75^{B} ±0.65
Colour	broth	4.37 ±0.44	4.12 ±0.99	4.06 ±0.78	4.25 ±0.65	4.06 ±0.73
Odour		4.19^{b} ±0.37	3.87^{b} ±0.35	4.19^{b} ±0.26	4.50^{a} ±0.38	4.06^{b} ±0.32
Taste		4.50 ±0.76	4.37 ±0.92	4.06^{b} ±0.42	4.69^{a} ±0.26	4.50 ±0.38

* The following grade score was applied in sensory analysis: 1 point – insufficient, 2 pts – sufficient, 3 pts – good, 4 pts – very good, 5 pts – excellent.

The evaluated feed supplements were demonstrated to be regulating factors of quail breast muscle acidity. This has been proved by the results achieved in groups III (5.95) and IV (5.80). The pH increased in group III, so acidity dropped in relation to the control, while pH decreased, i.e. acidity was higher, in the group IV.

The highest pH level found in group III (5.95) was reflected by the colour of the muscles. In this group, breast muscles were darker (3.00 pts) in relation to the remaining muscles (from 1.50 to 2.75 pts).

The analysis of colour transmission with SPECOL at the wave length of 560 nm provided a confirmation for the results of visual colour evaluation. Higher values, i.e. brighter colour of the meat, was found in groups IV (16.2%) and V (16.4%). The lowest results were found in group III (13.1%), which demonstrated the darkest colour of the muscles. In groups IV and V, where the quails received the highest doses of oligosaccharides, a distinct brightening of breast muscle colour was found, both under visual (2.00 ans 1.50 pts) and instrumental analysis (16.2 and 16.48%). Hence, an application of oligosaccharides in a quantity of 3 $g \cdot kg^{-1}$ of feed contributes to distinct colour brightening. Raw meat colour brightening of the quails that had received oligosaccharides was also observed in a previous experiment [3].

Thermal drip recorded in our experiment during meat cooking remained at a level typical for quail meat. The studies by Gardzielewska et al. [3] also carried out on quails represent a confirmation of this. The highest cooking loss of meat juices was found in the control group I (31.8%). Similar values were recorded in group II (31.1%) and, slightly lower, in group IV (30.2%). On the other hand, statistically significant decrease in thermal drip loss in comparison with the control was found in groups III (29.2%) and V (29.5%), in which oligosaccharides were supplemented throughout the studied period. Nevertheless, the studied oligosaccharides, added to feed mixture, resulted in a reduced thermal drip of meat juices in all the experimental groups, although it was not always statistically significant. This may demonstrate an improved water-holding capacity of meat as a result of the feed supplementation. In a previous experiment, the results on thermal drip were different [3]. Those, however, referred to different quantities of oligosaccharides added to feed (6 $g \cdot kg^{-1}$). Then, the results achieved in the experimental groups were worse than in the control.

The values obtained in sensory analysis of cooked meat ranged between 3.37 and 4.69 points. Group IV was best in all the quality factors of sensory analysis, i.e. odour, brittleness, juiciness, and palatability, while groups II and V achieved the worst results, which was statistically confirmed ($p \leq 0.01$). In group III, the values were found to be intermediate, and – apart from odour – were similar to those achieved by the control group.

The sensory analysis of broth revealed that its colour was of poorer quality in all the experimental groups. On the other hand, in odour evaluation as it was in the case of meat evaluation, the best results were reached by group IV (4.50), while the worst by groups II (3.87) and V (4.06). Broth taste was evaluated as best in group IV (4.69).

CONCLUSIONS

1. As a result of supplementation with oligosaccharides obtained from pea seeds, a different degree of breast muscle acidity after 24 hours from slaughter was obtained.
2. In order to achieve better sensory characteristics of boiled breast muscle meat, an addition of 3 g of oligosaccharides per kg of feed should be applied for 3 weeks only.
3. Application of oligosaccharides, irrespective of the experiment variant, improved water-holding capacity of meat (lower drip loss of meat juices).
4. Application of higher doses of oligosaccharides in quail feeding may lead to raw breast muscle meat colour brightening

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