MODIFICATION OF QUAIL MEAT QUALITY WITH OLIGOSACCHARIDE FEED SUPPLEMENTATION

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Summary. 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 of mixture for 3 weeks, 0.4 g/kg for the entire period of the experiment, that is 4 months. In the groups IV and V, the addition of oligosaccharides was 3 g/kg of feed; with the group IV fed this way for 3 weeks and the group V – for 4 months.

The quail 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 the thermal drip were evaluated; sensory analysis of the boiled muscles was done and the broth obtained through boiling.

Basing on the results of the studies it 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, whereas a deterioration was observed when 0.4 g was applied for 3 weeks, and 3 g 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.

Keywords: quail, feed supplementation, oligosaccharide, quail meat.

PUTPELIŲ MĖSOS KOKYBĖS MODIFIKACIJA LESINANT OLIGOSACHARIDŲ PAŠARO PAPILDAIS

Santrauka. Tyrimai buvo atlikti su 40 *Pharaoh* veislės putpelių patelėmis. Penktąją amžiaus savaitę putpelės buvo pasvertos ir analogų principu padalintos į 5 lesinimo grupes. I – kontrolinės grupės, patelės buvo lesinamos standartiniu pašaru suaugusioms putpelėms. Eksperimentinės II ir III grupės gavo standartinius mišinius, papildytus oligosacharidais, kurie buvo ekstrahuoti iš žirnių sėklų nurodytais kiekiais ir laikotarpiu: 3 savaites 0,4 g/kg mišinio, visą eksperimento laikotarpį t. y. 4 mėnesius – 0,4 g/kg,. IV ir V grupėms oligosacharidų papildo įdėta 3 g/kg lesalo. IV grupė lesinanta 3 savaites, o V – 4 mėnesius.

Baigus bandymą putpelės buvo papjautos. Tyrimams mėginiai paimti iš krūtinės raumens ir laikomi maždaug 6ºC temperatūroje 24 valandas. Tada įvertinta mėsos pH, spalva – vizualiai ir su SPECOL 11 esant 560 nm bangos ilgiui. Buvo įvertintas ir terminio nuvarvėjimo kiekis, atlikta virtų raumenų ir sultinio sensorinė analizė.

Remiantis tyrimų rezultatais nustatyta, kad krūtinės raumenų rūgštėjimo laipsnis praėjus 24 valandoms nuo paskerdimo buvo skirtingas konkrečiose eksperimento grupėse. Reresnė virtos mėsos sensorinė charakteristika nustatyta, kai oligosacharidai buvo po 3 g vartoti 3 savaites. Blogesnė, kai oligosacharidai po 0,4 g buvo vartojami 3 savaites, o 3 g oligosacharidų duodami viso auginimo laikotarpiu. Oligosacharidai, nepriklausomai nuo eksperimento varianto, pagerino mėsos vandens rišlumą. Didesnės oligosacharidų dozės putpelėms gali paryškinti žalios krūtinės raumenų mėsos spalvą.

Raktažodžiai: putpelės, pašaro papildai, oligosacharidai, mėsos kokybė.

Introduction. The interest in oligosaccharides grew over the last decade of the past century (Kozłowska, 1995; Rastall, 2001; Śliżewska, Libudzisz, 2002), also in those belonging to the compounds widely distributed in the world of large-grain leguminous plants and oilseed crops. Oligosaccharides are often considered as alternative feed supplements that improve feed intake and product quality (Tarasewicz, 2000; Zduńczyk, 2001). Besides, experiments that have been carried out so far, demonstrate that some types of oligosaccharides (manna- and glucooligosaccharides) have a stimulative effect on poultry immune system and enhance their resistance to pathogenic factors (Skórko-Sajko, and Sajko, 1996). Choi et al. (1994) demonstrated that an addition of oligosaccharides to feed mixtures resulted in increased concentration of lactic acid in large intestine contents, which reduced pathogenic bacteria growth. It was also found for quails that 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 (Tarasewicz, 2000). Also for quails, it was observed as a result of oligosaccharide application that breast muscle colour went brighter and acidity of muscles decreased after slaughter (Gardzielewska, 1999b).

The few reports published so far that deal with oligosaccharides applied in poultry feeding demonstrate 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 oligosaccharides in the ration, feeding duration, and some quality characteristics 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 with feeding in accordance with the growing quails' needs. In the fifth week of age, the young quails were weighed and randomly assigned into 5 feeding groups. The control (group I) birds 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 of mixture for 3 weeks, 0.4 g/kg for the entire period of the experiment, that is 4 months. In the groups IV and V, the addition of oligosaccharides was 3 g per kg of feed; with group IV fed this way for 3 weeks and 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, pH, colour – visually and with Specol 11 at wave-length of 560 nm, as well as the quantity of thermal drip, were evaluated; sensory analysis of the boiled muscles was done, and the broth obtained through boiling. The results were statistically analyzed using Statistical software package.

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

Ingredients of feed mixture	Participation
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 (Gardzielewska et al., 1999a, 1999b). The pH muscle measuring carried out 24 hours after slaughter demonstrated that in the groups II (5.87) and V (5.88) the values were similar to those recorded in the control group (5.85). In group V, the pH was lower (5.80), whereas in group III it was higher (5.95) than in the control. However, only the difference for groups III and IV was statistically significant.

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, %, 560 nm	13.6^{b}±2.60	14.4±4.27	13.1^{b}±3.09	16.2^{a}±3.46	16.38^{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.

The tested feed supplements appeared regulators of quail breast muscle acidity. This is proved by the results achieved in groups III (5.95) and IV (5.80). The pH increased in group III, that is acidity dropped in relation to the control, while pH decreased, that is acidity was higher in group IV.

The highest pH level found in group III was reflected by the colour of the muscles. In this group, breast muscles were darker comparing to the remaining muscles. An analysis of the obtained results demonstrated that in groups IV (1.60) and V (1.50) the muscle colour was brighter compared with group III (3.00 points). The colour in the control group (I) and group II was at a similar level as the colour in group III (2.75 points).

In groups IV and V, a distinct brightening of breast muscle colour was found, both under visual and instrumental analysis. Hence, an application of oligosaccharides in a quantity of 3 g/kg of feed contributes to distinct colour brightening. Raw meat colour brightening of the quails that received oligosaccharides extracted from

lupine had also been observed in a previous experiment (Gardzielewska et al., 1999b).

The analysis of colour transmission with SPECOL at the wavelength of 560 nm provided a confirmation of the results of visual colour evaluation. Higher values, that is 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 %), where the meat was of the darkest colour of all.

The thermal drip recorded in this study during meat boiling remained at a level typical for quail meat. The studies by Gardzielewska et al (1999b) also carried out on quails represent a confirmation of this. The lowest loss of meat juices as a result of boiling was found in 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 %).

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

Trait		I	II	III	IV	V
Flavor	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
Flavor		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 studied oligosaccharides, added to feed mixture, resulted in a decreased thermal drip of meat juices in all the experimental groups, although it was not always statistically significant. This may demonstrate improved water-holding capacity of meat as a result of the feed supplements application. In a previous experiment, the results on thermal drip were different (Gardzielewska et al., 1999b). Those, however, referred to different quantities of oligosaccharides added to feed (6 g/kg). Then, the results achieved by the experimental groups were worse than in the control group.

The values obtained in sensory analysis of boiled meat ranged between 3.37 pts and 4.69 pts. In all the quality factors of sensory analysis, that is flavor, brittleness, juiciness, and palatability, group IV was the best, whereas groups II and V achieved the worst results. It was statistically confirmed at $P \leq 0.01$. In group III, the values were found to be intermediate, and – apart from flavour – were similar to those achieved by the control group.

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

Conclusions. Different degree of breast muscles acidification in 24 hours post mortem in particular experimental groups demonstrates a different process of meat maturation, depending primarily on life muscle tissue composition, and consequently, reveals that the applied oligosaccharides had an effect.

The application of 3 g oligosaccharides for 3 weeks was found to have a favourable effect on sensory properties of boiled quail meat, whereas no effect was found when a quantity of 0.4 g was fed to quails over the entire experimental period. A quality deteriorating effect was recorded when the 0.4 g of compounds were added for 3 weeks and 3 g over the entire period of raising. Therefore, in order to achieve better sensory characteristics of boiled breast muscle meat, an addition of 3 g oligosaccharides per kg of feed should be applied for 3 weeks only.

Application of oligosaccharides, irrespectively 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, because their addition of 3 g/kg of feed distinctly brightened the muscle colour irrespectively of the duration of their application.

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