THE CHEMICAL COMPOSITION OF THE MEAT TYPE DRAKES MUSCLES FROM BREEDING STRAINS

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Background

There are 5 strains of meat type ducks that have been produced in the Department of Poultry Breeding in Dworzyska and, that were recognised by Polish Ministry of Agriculture and Country Development as breeding strains. Two of them A44 and A55 have been the sire, and three of them P66, P77 and K11 have been the maternal strains. They, except K11 have been intended to broiler production – Astra K, K1 and K2. The A55 male and P66 female ducks have been the parental combination for broiler production.
The parental combinations of those strains for production of two strain crosses have been characterized by high: laying, fertilisation, and hatching as well as good vitality. However, the two strain crosses have been characterized by: very good musculature, small fatness and big feed efficiency per 1kg gain (Mazanowski 2002).
The ducks from A55 strain have been characterized by more favourable parameters such as: body weight, percentage of skin with subcutaneous fat and abdominal fat content, as well as water holding capacity than from A44 (Mazanowski and Ksiazkiewicz 2004) .
The characteristic of both P66 and P77 ducks has been alike. However, the body weight of K11 has been significantly lower than P66 and P77 (Mazanowski 2002). They are characterized by resistance to hard environment conditions, big ability to crossing and laying.
Such parameters as : body weight at 7 weeks of rearing, slaughter yield, content of breast and leg muscles, skin with fat, bones and fat in carcass, geometrical body measurements, reproductive trait, fall down of ducks during rearing were determined for all above mentioned strains (Mazanowski 2002). Additionally for sire strains chemical composition (protein, fat, moisture and ash), water holding capacity, pH 15 and pH 24 were determined (Mazanowski and Ksiazkiewicz 2004).
There are no adequate data on the chemical composition of maternal strains and composition of fatty acid, amino acid and cholesterol content in muscles of the all above mentioned breeding strains.

Objectives

The objective of the work was to evaluate and compare the chemical composition of the breast (BM) and leg (LM) ducks' muscles from A55 and P66 breeding strains.

Materials and methods

The material consisted of the breast and the leg muscles isolated from 10 male ducks 7 week old selected from population of 60 heads of each strain. The weights of birds being close to arithmetic mean of strains for male (A55-2869g and P66-2617g). Ducks were fed by standard mixture containing 19.6% crude protein and 11.96 MJ metabolizable energy (ME) to 3 weeks of rearing and 18.2% crude protein and 11.73% MJ ME from 4 to 7 weeks.

Each kind of muscle was separately ground and homogenized before analysis, 24 hours after slaughter. The analyses were made in 6 repetitions.
The analyses were carried out using the following methods:
Protein - multiplying nitrogen content with Kjeltec System 1026 by 6.25.
Fat – with Soxtec System HT2 using the petroleum benzine as the extraction solvent.
Moisture – by drying at 105^0 C.

Cholesterol – using enzymatic Human test in the extract prepared by Folch et al. (1957) procedure. The saponification was carried out by the Rhee et al. (1982) method.
Amino acid composition – by the procedure described by Skrabka-Blotnicka et al. (1997).
Fatty acids - with Agilant Techn. 6890N gas chromatograph. The methyl esters of fatty acids were separated on the CP-Sill 88 (Chrompack 100 x 0,25 mm) column, at the temperature from 165 to 200^{0}C. The temperature rose by 2^0 C /min. The helium was used as carrier gas.
The Duncan's multiple range test was used for establishing the differences between means.

Results and discussion

Comparing the chemical composition of breast and leg muscles in both investigated strains, only significant differences in cholesterol content were found. The A55 breast muscles comprised less cholesterol than P66, inversely A55 leg muscles comprised more cholesterol than P66 (table1).
The higher protein content and lower moisture and fat content in both kinds of A55 muscles was found than reported by Mazanowski and Ksiazkiewicz (2004).
The breast muscles from A55 birds comprised more : ILE, LEU, LYS, TRP, and less THR comparing to P66 (table2). However, the leg muscles from A55 comprised more PHE+ TYR, THR and less TRP than from P66.
The limited amino acid index was lower than 84% only for TRP (68-78%). The amino acids limiting the biological values of proteins established by Woloszyn (2002) for Mullard ducks were MET+CYS (22-45%) and TRP that was on the same level as in the muscles of investigated ducks.Taking into consideration the biological values of protein the A55 breast muscles appeared the most favourable, but the A55 leg muscles the least favourable.
The fatty acids from C4 to C22 were detected in all the investigated muscles.
The contents of C4 – C12 acids were lower than 0.1% of total fatty acids content. Among saturated fatty acids C16:0 was dominant (22.3% BM P66 , 19.9% LM P66 and LM A55, 21.9% BM A55), next C18:0 (from 9.1% LM P66 to 10.5% BM A55). The C18:1 fatty acids dominated among the monounsaturated (MUFA) fatty acids. It was in the lower percentage in lipids of A55 (BM 27.41% and LM 34.90%) comparing to P66 (29.41% and 36.32 % respectively). The presence of such fatty acids as C18 :2, C18:3, C20:4, C20:5, and C22:6 that belong to the essential polyunsaturated fatty acids (PUFA) has been very important. Lipids of A55 breast muscles comprised more C18:3 (1.30%), C20:5 (1.12%) and less C20:4 (7.11%) as compared to P66 (1.03%, 0.91% and 7.49% respectively).
The lipids of leg muscles from A55 comprised more C20:4 (6.63%), C20:5 (0.45%) and less C18:2 (13.4%) than P66 (6.10%, 0.38% and 14.06% respectively). The contribution of fatty acids C18:2 (14.2%) and C22:6 (3.4%) did not significantly differ in lipids of breast and leg C18:3 (1.13%), C22:6 (2.6-2.8%) muscles of both strains.
The ratios of n-6/n-3 fatty acids were very favourable (from 3.3 to 4.4) for all investigated muscles, from the human health point of view. They were close to recommended which amounted to 4 (Leskanich and Noble 1997).
Though, it was established the significant differences between contents of fatty acids in lipids influenced by the strains, they were not so large so that they were recognized as significant from the practical point of view. The contribution of saturated fatty acids and PUFA were higher and MUFA were lower in lipids of the breast than of the leg muscles regardless of strains (table3).

Conclusions

It is hard to say which investigated strain is more favourable, because the differences – though statistically significant – were small and some components were in more favourable quantities in the A55 muscles and the others in the P66 muscles.
It is evident that muscles from both examined strains have been characterized by the high nutritional value.

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Table 1. The chemical composition of ducks' muscles from A55 and P66 strains.

Component	Breast muscles					Leg muscles				
	A55		P66			A55		P66		
	x	SD	x	SD	D	x	SD	x	SD	D
Protein%	21.4	0.28	21.8	0.52	ns	20.8	0.40	20.8.	0.40	ns
Lipids%	1.3	0.09	1.3	0.16	ns	1.7	0.11	1.8	0.13	ns
Moisture%	75.9	0.53	76.1	0.54	ns	76.3	0.79	76.4	0.59	ns
Cholesterol mg/100g	71.2	0.80	82.2	2.16	*	66.8	0.31	65.2	0.79	*

Where : x – average value of 6 tests; SD – standard deviation; D- difference; ns – not significant;
*- significant difference, P< 0.05

Table 2. Essential amino acids' content in muscles of ducks'[% proteins]

Amino acid	Breast muscles					Leg muscles				
	A55		P66			A55		P66		
	x	SD	x	SD	D	x	SD	x	SD	D
PHE+TYR	8.08	0.12	7.83	0.32	ns	8.42	0.21	7.93	0.18	*
ILE	6.14	0.96	5.91	0.19	*	5.54	0.26	5.77	0.21	ns
LEU	8.45	0.19	8.13	0.11	*	8.40	0.23	8.66	0.22	ns
LYS	9.57	0.25	8.90	0.14	*	9.61	0.20	9.62	0.26	ns
MET+CYS	3.11	0.17	3.23	0.15	ns	3.42	0.18	3.30	0.18	ns
THR	4.13	0.15	5.22	0.06	*	5.66	0.26	5.29	0.09	*
TRP	0.78	0.03	0.70	0.04	*	0.68	0.02	0.74	0.03	*
VAL	7.01	0.11	6.93	0.11	ns	6.96	0.12	6.54	0.17	*

Description – as in table 1

Table 3. The contribution of different fatty acids in lipids from ducks' muscles [% lipids]

Fatty acid	Breast muscles		Leg muscles	
	A55	P66	A55	P66
Saturated	34.2	34.5	30.9	30.4
Mono unsaturated MUFA	30.0	32.0	38.8	39.2
Polyunsaturated PUFA	28.9	28.7	25.6	25.0
Trans isomers	4.4	3.6	1.0	1.2
Σ n-6	21.3	21.6	20.0	20.2
Σ n-3	6.6	6.0	2.1	2.1
n-6/n-3	3.3	3.6	4.4	4.3