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I ZAKŁAD BIOCHEMII I ANALIZY INSTRUMENTALNEJ INSTYTUTU PRZEMYSŁU PASZOWEGO

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Blood Picture of Broiler Chickens Fed a Different Diet. II. The Diet with Triticale and Fat

Obraz krwi kurcząt broilerów w zależności od diety. II. Dieta z dodatkiem pszenżyta i tłuszczu

Investigation on the utilization in the diet of broiler chickens of triticale indicate that good results may be obtained with a 30-40 % admixture of it in the food. A higher percentage of triticale may cause worse utilization of the fodder and lower body weight increments (2, 4, 5, 9). The worse results of feeding broilers with a high proportion of triticale in the fodder may be attributed to the specific properties of this cereal (10, 13), and partly to the lower energetic level and lower digestibility of such fodder (3, 5).

The present study was undertaken to test the influence of fodder mixtures including triticale as the only cereal, and energetically supplemented with feed fat, on some haematological indices of the chicken blood and compare them with those of birds fed standard mixtures with wheat.

MATERIAL AND METHODS

The experiments were performed with 96 one-day chicken of broiler type Astra B, bought in Tomaszów Mazowiecki. The birds were divided into four equal groups and fed according to the diagram in Table 1: I – the control group received a fodder mixture with ground wheat, II – were fed ground wheat with fodder fat added, III – received a mixture with triticale and IV chickens – triticale and fodder fat. The fodder variants were evaluated on 24 chickens (12 males and 12 females) each.

The chickens were kept in metabolic cages in thermostated and ventilated premises, the temperature being adjusted to their age. The fodder given *ad libitum* was DKA-starter for the first three weeks of life, the DKA-finisher to the end of the 8th week of fattening with continuous access to water. Food uptake and weight of the birds were checked weekly. The birds were weighed at the end of the experiment.

After the end of the 8th week of fattening from 12 birds (6 ♂ and 6 ♀) blood was taken from the brachial vein. The number of erythrocytes (RBC) and leucocytes (WBC) was determined by the chamber method in Natt-Herrick diluting fluid, haemoglobin level (Hb) by the cyanmethaemoglobin method and haematocrit value (Hct) by the micromethod. Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated in accordance with the models given by Wintrobe (14). The percentage composition of leucocytes was calculated in preparations stained by the Pappenheim method. The number of reticulocytes per 1000 erythrocytes was determined in preparations

Table 1. Composition of fodder mixtures
Skład mieszanek paszowych

Components (in %)	Groups							
	I		II		III		IV	
	S	F	S	F	S	F	S	F
Ground wheat	63.9	73.9–	55.7	65.7	–	–	–	–
Ground triticale	–	19.2	–	–	64.7	56.4	74.8	66.6
Ground soybean	26.1	3.0	28.3	21.3	25.3	18.2	27.6	20.4
Fish meat	3.0	–	3.0	3.0	3.0	3.0	3.0	3.0
Powdered milk	3.0	–	3.0	–	3.0	–	3.0	–
Fodder fat	–	1.4	6.0	6.0	–	–	6.0	6.0
Fodder phosphate	1.4	1.3	1.4	1.4	1.4	1.4	1.4	1.4
Fodder chalk	1.3	0.3	1.3	1.3	1.3	1.3	1.3	1.3
NaCl	0.3	–	0.3	0.3	0.3	0.3	0.3	0.3
Polfamix DKA-starter	1.0	1.0	1.0	–	1.0	–	1.0	–
Polfamix DKA-finisher	–		–	1.0	–	1.0	–	1.0

S – starter; F – finisher

stained *in vivo* with brilliant cresyl blue (8). The leucocyte index was computed according to the formula given by Stankiewicz (11).

The results were statistically analysed using Student's t test for independent data. As statistically significant $p < 0.05$ was assumed (7).

RESULTS AND DISCUSSION

After the end of the 8-week feeding the weight of the chickens fed the mixture including wheat and fat amounted to 1.963 kg and proved higher than of those receiving the mixture with wheat which weighed 1.831 kg, while those fed triticale and triticale with fat weighed 1.776 and 1.746 kg, respectively. In the groups receiving additionally fat, food utilization was better – in both these groups – 2.28 kg of feed per 1 kg of body weight increment as compared with control group 2.42 kg/kg increment and the group receiving triticale – 2.36 kg/kg increment (Table 2).

Table. 2. Body weight and food uptake
Masa ciała i pobierany pokarm

Parameters in kg	Groups			
	I	II	III	IV
Body weight after 8 weeks	1.831 ab	1.963 a	1.776 ab	1.746 b
Food uptake per 1 kg of body weight increment	2.42 a	2.28 b	2.36 ab	2.28 b

The same letters – statistically not significant differences between groups, the different letters – statistically significant differences between groups (Tables 2-4).

Te same litery – statystycznie nieistotne różnice pomiędzy grupami, różne litery – statystycznie istotne różnice pomiędzy grupami (dotyczy tab. 2-4).

It may be stated on the basis of the above mentioned results that triticale is a less favourable feed component than wheat, and energetic enrichment of this food by adding fat does not improve the rearing effects. Addition of fat to fodder mixtures prepared with wheat is fully justified.

Evaluation of the haematological data in all groups of chickens indicates that they lie within the limits of widely considered physiological norms (1, 6). The fact should be noted however, that the different food components modify to a certain degree the blood picture of the birds. Both in those fed fodder with fat addition and those receiving a mixture including triticale, the erythrocyte count was depressed without signicant differ-

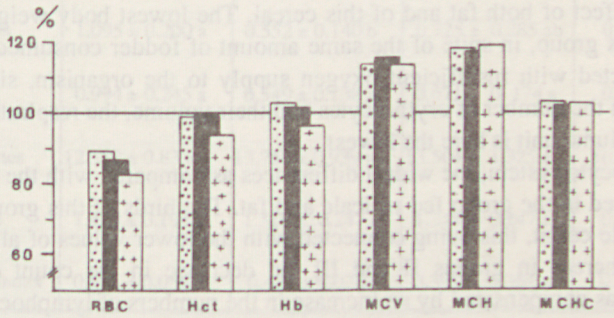

Fig. 1. The red blood cell system in chickens
Układ czerwonokrwinkowy u kurcząt

ences in the haematocrit value and haemoglobin level. In the latter groups the volume of the erythrocytes was markedly increased and so was the haemoglobin content in the blood cells, with normal saturation of the cell with this pigment, and a decreased reticulocyte count (Table 3, Fig. 1).

Table 3. Values of the red blood cell system in the chickens
Wartości układu czerwonokrwinkowego u kurcząt

Parameters	Groups			
	I $\bar{x} \pm SE$	II $\bar{x} \pm SE$	III $\bar{x} \pm SE$	IV $\bar{x} \pm SE$
Erythrocytes in mln/mm^3	2.581 ± 0.126 a	2.309 ± 0.167 ab	2.237 ± 0.108 b	2.126 ± 0.095 b
Haematocrit in %	32.05 ± 0.847 a	31.88 ± 0.655 a	31.98 ± 0.850 a	30.13 ± 0.746 a
Haemoglobin in g%	8.23 ± 0.186 a	8.49 ± 0.320 a	8.37 ± 0.222 a	7.94 ± 0.261 a
MCV in μ^3	126.76 ± 6.324 b	144.67± 9.492 ab	145.95 ± 6.570 a	143.89 ± 5.449 ab
MCH in pg	32.38 ± 1.121 b	38.32 ± 2.635 ab	38.10 ± 1.614 a	38.44 ± 2.802 ab
MCHC in %	25.79 ± 0.598 a	26.60 ± 0.737 a	26.27 ± 0.712 a	26.45 ± 0.879 a
Reticulocytes in ‰	205.58 ± 22.47 a	194.41 ± 24.55ab	188.75 ± 23.00 ab	181.00 ± 21.94 b

These data indicate that, in birds fed a less appropriate diet, the oxygen demand is satisfied by an increase in respiratory efficiency of the existing elements. The existence of such mechanism has been demonstrated in broilers receiving fodder with admixture of various fats (12).

The functioning of mechanism in birds fed a diet with high fat content is probably connected with the suppression of haemopoietic processes, owing to transformation of the active bone marrow cells to fat cells. It is, however, difficult to explain the mechanism of erythropoiesis insufficiency in the group consuming triticale. One can only suppose that this plant has some component which influences the processes of cell proliferation in the bone marrow. Thus, the lowest erythrocyte and reticulocyte counts noted in the group of chickens fed a high-fat diet including triticale in the mixture is probably the effect of both fat and of this cereal. The lowest body weight increment of the birds in this group, in spite of the same amount of fodder consumed as in group II, may be connected with insufficient oxygen supply to the organism, since, as may be concluded from the number of erythrocytes and their volume, the respiratory surface area of the blood volume unit is here the lowest.

In the leucocyte system, the widest differences as compared with the group receiving wheat were noted in the group fed triticale and fat. The birds of this group exhibited the lowest leucocyte count, this being connected with the lower values of all kinds of white blood cells, whereas in groups II and III the decrease in the count of all forms of granulocytes was compensated by an increase in the numbers of lymphocytes or lymphocytes and monocytes. Therefore, the total number of white blood cells remained at an almost unchanged level (Table 4, Fig. 2).

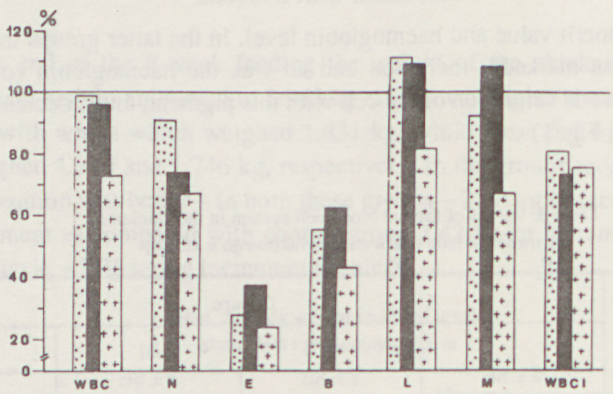

Fig. 2. The white blood cell system in chickens
Układ białokrwinkowy u kurcząt

As mentioned earlier, both fat and triticale have an unfavourable influence on the processes of erythropoiesis. The data concerning the leucocyte system indicate that granulopoiesis in the bone marrow is inhibited to a high degree by the considered factors. Addition of fat to the feed containing wheat as well as triticale itself do not impair the

Table 4. Values of the white blood cell system in the chickens
Wartości układu białokrwinkowego u kurcząt

Parameters		Groups			
		I $\bar{x}$ ± SE	II $\bar{x}$ ± SE	III $\bar{x}$ ± SE	IV $\bar{x}$ ± SE
in thouse/mm^3	Leucocytes	21.014 ± 0.997 a	20.868 ± 0.707 a	20.257 ± 1.095 a	15.405 ± 0.806 b
	Neutrophils	5.145 ± 0433 a	4.704 ± 0.604 ab	3.821 ± 0.666 ab	3.464 ± 0.404 b
	Eosinophils	1.095 ± 0.200 a	0.552 ± 0.140 b	0.725 ± 0.285 ab	0.474 ± 0.144 b
	Basophils	0.994 ± 0.245 a	0.549 ± 0.138 a	0.671 ± 0. 174 a	0.433 ± 0.139 a
	Lymphocytes	12.352 ± 0.83 a	13.750 ± 0.939 a	13.504 ± 1.325 a	10.091 ± 0.376 b
	Monocytes	1.429 ± 0.194 a	1.318 ± 0.247 a	1.318 ± 0.247 a	0.969 ± 0.212 a
White blood cell index		0.531 ± 0.056 a	0.427 ± 0.070 a	0.390 ± 0.084 a	0.398 ± 0.051 a

processes of lyphopoiesis or they even stimulate it. On the other hand, the joint influence of these two factors is manifested in an inhibition of this process as well.

To sum up, it may be affirmed that a high fat content in the fodder mixture including triticale is least favourable for birds because of its negative influence on the course of haemopoietic process, this being manifested in the poorest rearing effects recorded in this group of birds.

CONCLUSIONS

1. It may be stated on the basis of the above mentioned results that triticale is a less favourable feed component than wheat, and energetic enrichment of this food by adding fat does not improve the rearing effects. Addition of fat to fodder mixtures prepared with wheat is fully justified.

2. It was found that both fat and triticale have an unfavourable influence on the processes of erythropoiesis.

3. The data concerning the leucocyte system indicate that granulopoiesis in the bone marrow is inhibited to a high degree by the considered factors.

4. Addition of fat to the feed containing wheat as well as triticale itself do not impair the processes of lymphopoiesis or they even stimulate it. On the other hand, the joint influence of these two factors is manifested in an inhibition of this process as well.

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STRESZCZENIE

Badania przeprowadzono na 96 kurczętach typu brojler Astra B. Ptaki podzielono na 4 grupy żywieniowe. Grupa kontrolna I żywiona była mieszanką ze śrutą pszenną, II – mieszanką ze śrutą pszenną i z dodatkiem tłuszczu paszowego, III – mieszanką z pszenżytem i IV – mieszanką z pszenżytem i tłuszczem paszowym. Po zakończeniu 8-tygodniowego tuczu od 12 ptaków z każdej grupy (6 samców i 6 samic) pobrano z żyły skrzydłowej krew do badań morfologicznych. Oznaczenia hematologiczne wykonano według ogólnie przyjętych metod.

Na podstawie uzyskanych wyników można stwierdzić, że pszenżyto jest mniej korzystnym składnikiem paszowym aniżeli pszenica, a wzbogacenie energetyczne pokarmu przez dodanie tłuszczu nie poprawia efektów hodowlanych. W zakresie badań hematologicznych ustalono, że zarówno tłuszcz, jak i pszenżyto oddziałują niekorzystnie na procesy erytropoezy. Dane dotyczące układu białokrwinkowego wskazują, że również granulopoeza szpikowa zostaje w znacznym stopniu zahamowana pod wpływem tych składników pokarmowych. Dodatek tłuszczu do paszy z udziałem pszenicy, jak i samo pszenżyto nie upośledzają procesów limfopoezy, a nawet ją stymulują. Natomiast łączny wpływ obu tych czynników przejawia się upośledzeniem także i tego procesu.