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EFFECT OF APPLICATION OF ENZYMES TO BROILER DIETS CONTAINING RAPESEED CAKES ON PERFORMANCE AND POSTSLAUGHTER RESULTS

WPŁYW ZASTOSOWANIA ENZYMÓW W MIESZANKACH DLA KURCZĄT BROJLERÓW, ZAWIERAJĄCYCH MAKUCHY RZEPAKOWE, NA PRODUKCYJNOŚĆ I WYNIKI POUBOJOWE

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Streszczenie. Celem badań była ocena dodania ksylanazy lub ksylanazy i fitazy do diet zawierających makuchy rzepakowe z odmiany 'Kana' na wyniki odchowu, cechy rzeźne, jakość mięsa i kości kurcząt brojlerów oraz strawność mieszanek. Doświadczenie 1 (wzrostowe) zostało przeprowadzone na 90 kurczętach brojlerach Ross 308 przydzielonych do trzech grup. Kurczęta żywiono mieszankami starter (1–21 dni) i grower (22–42 dni), które zawierały odpowiednio 15% (starter) i 20% (grower) makuchów rzepakowych. Mieszanka kontrolna (RC) podawana w grupie pierwszej nie zawierała dodatku enzymów; w grupie drugiej RC(X) wprowadzono dodatek preparatu enzymatycznego zawierającego ksylanazę w ilości 0.3 g · kg^{-1} (min. 1000 FXU/g). Do diety w grupie trzeciej RC(X + PHY), oprócz ksylanazy, dodano preparat zawierający fitazę w ilości 0.35 g · kg^{-1} (min. 2500 FYT/g). Po 42 dniach doświadczenia wzrostowego w każdej grupie ubito po sześć kurcząt i poddano analizie rzeźnej. W doświadczeniu 2 (w teście strawnościowym) oceniano strawność mieszanek podawanych w doświadczeniu wzrostowym. Nie stwierdzono istotnych różnic w wynikach produkcyjnych po zastosowaniu enzymów w mieszankach pszenno-rzepakowych. Stwierdzono mniejszy udział skóry z tłuszczem podskórnym w tuszkach kurcząt otrzymujących w mieszance enzymy, istotny udział, przy łącznym wprowadzeniu ksylanazy i fitazy, oraz wzrost zawartości białka w mięśniach udowych. Łączne dodanie ksylanazy i fitazy nie poprawiło istotnie strawności fosforu ogólnego z mieszanek grower, natomiast zwiększyło zawartość popiołu surowego i fosforu całkowitego w kościach.

Key words: broiler chickens, nutrition, enzymes, performance, digestibility, meat and bone parameters.
Słowa kluczowe: kurczęta brojlery, żywienie, enzymy, produkcyjność, strawność, parametry mięsa i kości.

INTRODUCTION

Rapeseed cakes (RC) are produced by pressing rape seeds. The production technology of rapeseed cake is more cost-effective and environmentally friendly than that of rapeseed meal. The rapeseed cake was characterized by a high amount of protein (28–31%), fat (13–25% and more) and metabolizable energy (10.25–13.05 MJ) (Poultry Feeding Standards, 2005). The amino acid composition of protein is also beneficial: about 6 g Lys; 2 g Met; 4.6 g Thr

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and 1.2 g / 16 g N of tryptophan (Banaszkiewicz 2000). The protein digestibility of rapeseed cake for poultry amounted to 60–70% (Pastuszewska et al. 2001), whereas the fat digestibility amounted to 80% (Banaszkiewicz 1995). Consequently, rapeseed cake can be a valuable source of protein and metabolizable energy in poultry feeding. The utilization of rapeseed products are limited by the nutritionally unfavourable substances such as glucosinolates, sinapin, tannin and phytate (Ciska and Kozłowska 1998), as well as by a high contents of dietary fiber and non starch polysaccharide (NSP) (Kocher et al. 2000). These substances have negative effects on nutrient digestibility, mainly on the crude fat and amino acids (Knudsen 1997). The presence of NSP may adversely affect the performance of broiler chickens fed diets with high levels of rapeseed oil meal (Bedford 2000). In this connection, the NSP-degrading enzymes are application to the diets. The rape cakes content about 11 g of total phosphorus, in which a considerable part of crude phosphorus occurs in a phytate form, which is largely unavailable by monogastric animals (Bozkurt 2006). The nutritive value of the feed may be improved by enzyme addition (Kocher et al. 2001). Supplementation of diets with enzyme preparations can degrade dietary fiber and improve the digestibility of crude fat and protein (Mikulski et al. 2000). The nutritive value of broiler diets containing Chinese rapeseed meal was improved by an appropriate level of xylanase used as a basic enzyme (Fang et al. 2009). The addition of phytase to diets caused a significant increase in mineral bioavailability, improved the digestibility of protein and amino acids in feedstuffs (Ravindran et al. 1999) and bone physico-chemical parameters (Świątkiewicz et al. 2006; Banaszkiewicz 2012). In the majority of experiments, the enzyme addition into the poultry was estimated when control diets contain soybean meal. In case of phytase addition, the effect was estimated when the low- phosphorus and / or low-calcium diets were used. A little information about the effect of exogenous phytase in the presence of xylanase added to the wheat-rape diet in the literature was published.

The aim of the study was to evaluate the effect of xylanase or xylanase and phytase application together to broiler diet containing rapeseed cake on performance, carcass traits, nutrient digestibility and physico-chemical parameters of meat and bone.

MATERIAL AND METHODS

In this study two experiments were performed. Experiment 1(growth test) was carried out on 90 sexed broilers Ross 308 randomly divided into three groups, with 30 birds per group. Each group consisted of 6 replicates each of 5 birds (3 replicates of male and 3 of female). The birds were housed in metabolic cages. For the first 5 days, the temperature in the poultry house was 31°C and then it was gradually lowered according to the recommendations of the breed standard. In this experiment three diets were prepared for particular periods: starter (1–21 day) and grower (22–42 day of chicken age). The diets contained the rape cakes of Kana cultivar, which were introduced at the level of 15% (starter diets) and 20% (grower diets).The control diet (RC) for first group was without enzymes, diet for second group RC(X) contained enzyme preparation, with endo-1,4-β- xylanase(min. 1000 FXU/g), at the level of 0.3 g · kg^{-1}. The third diet- RC(X + PHY) contained enzyme preparation, with endo-1,4-β- -xylanase, introduced at the level of 0.3 g · kg^{-1} and enzyme preparation contained phytase (min. 2500 FYT/g), in the amount of 0.35 g · kg^{-1}. The rape cakes were obtained in the oil mill by pressing seeds of Kana cultivar to 400 kG/cm^2. Rape cakes of Kana cultivar in the experiment contained 891.7g of organic matter; 60.6 g of crude ash; 266.8 g of crude protein; 237.6 g of crude fat, 10.33 g of total phosphorus, 13 μmol/g of total glucosinolates, 0,015% of erucic acid in total acids which were analyzed. The diets were in a mash form and they were given *ad libitum* from the 1st day of age. The composition of experimental diets is shown in Table 1.

Table 1. Composition of experimental diets
Tabela 1 Skład eksperymentalnych diet [%]

Components Składniki	Starter			Grower		
	Group – Grupa					
	RC	RC(X)	RC(X + PHY)	RC	RC(X)	RC(X + PHY)
Wheat meal Śruta pszenna	57.82	57.82	57.885	60.07	60.07	60.135
Soybean meal Śruta poekstrakcyjna sojowa	24.00	24.00	24.00	16.85	16.85	16.85
Rape cake Kana cv. Makuch rzepakowy	15.00	15.00	15.00	20.00	20.00	20.00
L-lysine Lyzyna (99%)	0.08	0.08	0.08	–	–	–
DL-methionine Metionina (99%)	0.12	0.12	0.12	0.10	0.10	0.10
Limestone Kreda pastewna	0.60	0.60	0.60	0.60	0.60	0.60
Salt Sól pastewna	0.35	0.35	0.35	0.35	0.35	0.35
Calcium diphosphate Fosforan 2-Ca	1.50	1.50	1.40	1.50	0.50	1.40
Mineral-vitamin premix Premiks mineralno- -witaminowy (0.5%)[a]	0.50	0.50	0.50	0.50	0.50	0.50
Enzyme preparation Preparat enzymatyczny[b]	–	0.03	0.03	–	0.03	0.03
Enzyme preparation Preparat enzymatyczny[c]	–	–	0.035	–	–	0.035
Nutritive value of diets – Wartość pokarmowa mieszanek						
Metabolizable energy, MJ (calculated) Energia metaboliczna	11.46	11.46	11.47	11.92	11.80	11.92
Crude protein (analyzed) Białko ogólne [%]	21.06	21.37	21.62	19.35	19.55	19.48
Crude fibre (analyzed) Włókno surowe [%]	3.58	3.57	3.86	4.66	4.30	4.47
Crude fat (analyzed) Tłuszcz surowy [%]	5.21	5.66	5.27	6.41	7.03	6.71
Lysine (calculated) Lyzyna [%]	1.10	1.10	1.10	0.92	0.92	0.92
Methionine (calculated) Metionina [%]	0.45	0.45	0.45	0.42	0.42	0.42
P total (analyzed) Fosfor ogólny [$g \cdot kg^{-1}$]	8.27	8.14	7.67	7.48	7.90	7.15
Na (calculated) Sód [%]	0.16	0.16	0.16	0.17	0.17	0.17

RC control group – fed wheat-soybean-rape cake diet – grupa kontrolna – dieta pszenno-sojowo-rzepakowa.
RC(X) group – fed wheat-soybean-rape cake diet containing preparation of xylanase – dieta pszenno-sojowo--rzepakowa zawierająca dodatek ksylanazy.
RC(X + PHY) group – fed diet as in second group + preparation of phytase – dieta jak w grupie drugiej i dodatek fitazy.
[a]per kg – na 1 kg Vit. A (4 000 000 j.m.), D_3 (600 000 j.m., E (16 g), K_3 (0.6 g), B_1 (0.5 g), B_2 (1.75 g), B_6 (1.0 g), B_{12} (0.0048 g), Biotin (0.04 g), Nicotinic acid (10 g), Folic acid (0.3 g), Choline (100 g), Fe (16 g), Cu (1.8 g), Mn (16 g), Zn (14 g), Co (0.06 g), I (0.25 g), Se (0.055 g), Ca (192 g), Maxus Elanco (1.8 g), Salinomycin (12 g), BHT + Ethoxyquin (1,0 g).
[b]enzyme preparation containing xylanase – preparat enzymatyczny zawierający ksylanazę – 0.3 $g \cdot kg^{-1}$.
[c]enzyme preparation containing phytase – preparat enzymatyczny zawierający fitazę – 0.35 $g \cdot kg^{-1}$.

At the age of 1, 21 and 42 days the birds were weighed, their feed consumption and mortality was recorded. At the end of the experiment, 6 chickens (3 males and 3 females, one bird per cage) were randomly selected from each group, then they were slaughtered, wet plucked, eviscerated and chilled for 24 hours at 4°C. The slaughter analysis was performed by the method described by Ziołecki and Doruchowski (1989). The chemical composition and sensory evaluation of meat were determined. The sensory evaluation of thermally processed meat was conducted point method described by Baryłko-Pikielna and Matuszewska (2009). A 5-point scale was applied. Left femur and tibiotarsal bones with a fibular bone were cleaned and their physical traits were determined according to the methodology by Antoniewicz et al. (1992). The tibiotarsal bone and femur samples were dried to a constant weight at 105°C in an oven and then they were ashed. The dry matter, crude ash and total phosphorus in the bones were analyzed using the AOAC(1990) procedure.

The experiment 2 (digestibility test) was carried out on 60 chickens which were randomly divided into three groups, each with 4 replications of 5 birds. The diets used in the digestibility test were the same as in the growth experiment. The digestibility was evaluated using the total collection method at 3 weeks of age (starter diets) and at 5 week (grower diets). From the 18th to 20th day (starter diets) and from 33rd to 35th day (grower diets) the excreta were quantitatively collected, with particular attention paid to excluding the contaminants (downs, feathers and scales), as well as the feed consumption was recorded. The excreta were dried immediately at 60°C, weighed, ground and stored for chemical analyses. The diets, excreta, meat and bone samples were analyzed using the AOAC(1990) procedure. The uric acid nitrogen in the excreta was determined by the procedure with lead acetate (Hartfiel 1961). Lead acetate was used for separation of uric acid from excreta for the determination of faeces nitrogen content. The apparent digestibility of nutrients was calculated following the total collection method using the equation (Guevara et al. 2008).

The data obtained were analyzed statistically and significance of differences between means were tested by Duncan's multiple range test. The calculations were performed using the STATISTICA software package ver.8, StatSoft Inc.

RESULTS

The body weight of broiler chickens at 21 days of age ranged from 571 g to 611 g and at 42 days from 1959 to 2060 g, but differences obtained between groups were not significantly different (Table 2). The body weight of chickens at the age of 21 days and 42 days fed wheat-rapeseed diets containing enzymes did not differ significantly. The feed intake in the starter, grower and all feeding periods did not differ significantly too, but chickens fed diets containing enzymes intake less of feed. The feed conversion ratio (Table 2) in the first period ranged from 1.53 to 1.62 kg, in the second period fluctuated from 1.97 to 2.25 kg and in all rearing periods from 1.85 to 2.06 kg and did not differ significantly between groups.

The slaughter yield in broilers fed all diets was similar between groups (Table 3). The use of enzyme preparation of xylanase and the both enzymes did not statistically influence the content of liver, heart, gizzard and edible giblets in chicken carcass. The musculature of chicken carcass was similar between groups, whereas the content of skin with subcutaneous fat in the groups fed the diet contained enzymes was lower, significant ($P < 0.05$) in simultaneous introduced xylanase and phytase. There were no significant differences in the chemical composition and organoleptic characteristics of breast muscles (Table 4), whereas in thigh muscles the protein content was significantly different ($P < 0.05$). The least crude protein in thigh muscles of chickens fed the control diet was found.

Table 2. Results of broiler performance
Tabela 2. Wyniki produkcyjne kurcząt

Specification Wyszczególnienie	Group – Grupa			
	RC	RC(X)	RC(X + PHY)	SEM
Body weight of chickens – Masa ciała kurcząt [g]				
Initial – Początkowa	34	35	35	0.21
21 day – w 21 dniu	571	610	611	10.11
42 day – w 42 dniu	1963	2060	1959	48.77
Feed intake – Spożycie paszy [g]				
1–21 day – 1–21 dni	881	895	897	11.19
22–42 day – 22–42 dni	2925	2752	2716	80.39
1–42 day – 1–42 dni	3927	3754	3559	77.06
Feed conversion ratio – Zużycie paszy [kg/kg]				
1–21 day – 1–21 dni	1.62	1.53	1.53	0.02
22–42 day – 22–42 dni	2.25	1.99	1.97	0.08
1–42 day – 1–42 dni	2.06	1.85	1.87	0.05

SEM – pooled standard error of mean – błąd średniej.

Table 3. Results of slaughter analysis
Tabela 3. Wyniki analizy rzeźnej

Specification Wyszczególnienie	Group – Grupa			
	RC	RC(X)	RC(X + PHY)	SEM
Weight of cold carcass Masa tuszki schłodzonej [g]	1488.00	1544.00	1484.00	32.40
Slaughter yield Wydajność rzeźna [%]	73.28	73.78	73.95	0.37
Relative organ weight Względna masa podrobów [g · 100 g^{-1} b.w.]				
Heart – Serce	0.49	0.52	0.45	0.02
Liver – Wątroba	1.74	1.85	1.62	0.04
Gizzard – Żołądek	1.32	1.29	1.28	0.03
Edible giblets – Podroby jadalne	3.55	3.65	3.34	0.07
Content in cold carcass Udział w tuszce schłodzonej [%]				
Breast muscle – Mięsień piersiowy	25.52	24.49	24.00	0.50
Leg muscles – Mięśnie nóg	21.54	20.55	22.04	0.45
Muscles total – Mięśnie ogółem	47.05	45.03	46.00	0.69
Abdominal fat – Tłuszcz sadełkowy	1.09	1.02	1.07	0.12
Skin with subcutaneous fat – Skóra z tłuszczem podskórnym	9.70a	9.48ab	8.41b	0.24

a, b – values in rows with different letters differ significantly ($P \leq 0.05$) – wartości w rzędach oznaczone różnymi literami różnią się istotnie ($P \leq 0,05$).
SEM – pooled standard error of mean – błąd średniej.

Table 4. Physico-chemical characteristic and organoleptic evaluation of muscles
Tabela 4. Charakterystyka fizykochemiczna i organoleptyczna mięśni

Specification Wyszczególnienie	Group – Grupa			
	RC	RC(X)	RC(X + PHY)	SEM
Breast muscle – Mięsień piersiowy [%]				
Dry matter – Sucha masa	26.43	26.21	26.20	0.10
Crude ash – Popiół surowy	1.15	1.19	1.14	0.01
Crude protein – Białko ogólne	23.25	23.57	23.25	0.11
Crude fat – Tłuszcz surowy	1.57	1.31	1.37	0.09
Absorbability – Wodochłonność	17.80	12.13	15.36	2.63
Flavour – Zapach	4.20	4.40	4.60	0.15
Juiciness – Soczystość	4.14	3.86	3.57	0.22
Tenderness – Kruchość	4.00	3.86	4.00	0.18
Palatability – Smakowitość	4.20	4.00	4.20	0.16
Thigh muscles – Mięśnie ud [%]				
Dry matter – Sucha masa	24.70	25.17	25.01	0.200
Crude ash – Popiół surowy	1.02	1.05	1.02	0.009
Crude protein – Białko ogólne	18.36b	19.38a	19.31a	0.180
Crude fat – Tłuszcz surowy	5.15	4.50	4.48	0.240
Flavour – Zapach	4.00	4.00	4.25	0.08
Juiciness – Zapach	3.86	3.86	4.29	0.17
Tenderness – Kruchość	4.29	4.00	4.29	0.16
Palatability – Smakowitość	4.60	4.60	5.00	0.12

a, b – values in rows with different letters differ significantly ($P \leq 0.05$) – wartości w rzędach oznaczone różnymi literami różnią się istotnie ($P \leq 0,05$).
SEM – pooled standard error of mean – błąd średniej.

The obtained results showed that digestibility of nutrients in diets was similar (Table 5), but the total phosphorus digestibility in grower mixtures were numerically higher as a result of xylanase and phytase addition.

Table 5. Apparent digestibility of nutrients
Tabela 5. Pozorna strawność składników pokarmowych [%]

Specification Wyszczególnienie	Group – Grupa			
	RC	RC(X)	RC(X + PHY)	SEM
Starter diets – Mieszanki starter				
Dry matter – Sucha masa	70.3	72.0	69.4	0.66
Organic matter Substancja organiczna	71.9	73.2	70.9	0.96
Crude protein – Białko ogólne	86.6	86.9	85.5	0.53
Crude fat – Tłuszcz surowy	73.4	75.1	71.8	1.16
N-free extractives Bez-N-wyciągowe	78.5	79.9	77.4	2.80
Total phosphorus – Fosfor ogólny	54.5	58.9	54.6	1.48
Grower diets – Mieszanki grower				
Dry matter – Sucha masa	69.9	70.38	69.8	0.73
Organic matter – Substancja organiczna	72.5	73.00	72.5	0.62
Crude protein – Białko ogólne	85.8	86.50	85.1	0.39
Crude fat – Tłuszcz surowy	73.2	69.60	71.0	0.99
N-free-extractives – Bez-N-wyciągowe	81.8	82.00	82.1	0.50
Total phosphorus – Fosfor ogólny	36.9	36.10	39.0	1.35

SEM – pooled standard error of mean – błąd średniej.

The fact that the addition of simultaneous xylanase and phytase to the grower diet, but not to the starter improved the digestibility of phosphorus suggested some adaptation capacity of diets, which took time to become significant. Supplementation of xylanase and phytase into the grower diet numerically improved the digestibility of the component compared to the control diet.

The physical parameters of femur as well as tibiotarsal bones were similar in particular groups (Table 6), however, the longest femur as a result of simultaneous xylanase and phytase addition was observed. The largest relative weight and length of tibiotarsal bones characterized chickens in the group RC(X + PHY), whereas the smallest girth was found in this group. In case of the chemical composition of femur (Table 6) no significant differences, but obtained results of crude ash and total phosphorus content were numerically higher in the group fed the diet with the phytase application.

Table 6. Physico-chemical characteristic of leg bones
Tabela 6. Charakterystyka fizykochemiczna kości nóg

Specification Wyszczególnienie	Group – Grupa			
	RC	RC(X)	RC(X + PHY)	SEM
Femur – Kość udowa				
Relative weight [g · kg^{-1} of body weight] Relatywna masa [g · kg^{-1} masy ciała]	1.89	1.96	1.94	0.04
Length – Długość [mm]	76.10	76.51	77.81	0.58
Girth – Obwód [mm]	34.85	32.85	32.26	0.84
Tibiotarsal – Kość podudzia				
Relative weight [g · kg^{-1} of body weight] Relatywna masa [g · kg^{-1} masy ciała]	2.78	2.77	2.88	0.11
Length – Długość [mm]	106.75	108.43	110.01	2.78
Girth – Obwód [mm]	31.25	31.44	29.79	0.80
Chemical composition of femur – Skład chemiczny kości udowej				
Dry matter – Sucha masa [%]	95.18	95.15	94.98	0.08
Crude ash – Popiół ogólny [%]	44.28	44.44	45.03	0.50
Crude phosphorus – Fosfor ogólny [g · kg^{-1}]	80.39	81.03	82.27	1.04

SEM – pooled standard error of mean – błąd średniej.

DISCUSSION

In the present study, the wheat- rapeseed cake control diet with appropriate level of nutrients was used. Żyła et al. (1999) stated that the efficiency of phytase in wheat diets for broilers can be enhanced by adding xylanase. The results obtained in the study in relation to the body weight, feed intake and feed conversion ratio were not significantly different between groups at 1–21, 22–42 and 1–42 days of the experiment. Feed intake, body weight and FCR in particular periods were not affected by the dietary phytase, which was added to the diet with xylanase preparation. The addition of the microbial phytase to the diet and containing active glucanase and xylanase was as effective as xylanase in broiler chickens fed diets containing appropriate levels of phosphorus. Supplementing the basal wheat-soy diet containing adequate levels of phosphorus from phytase improved the weight gains and feed efficiency by 17.5 and 2.9%, respectively, and the addition of xylanase by 16.5 and 4.9%, respectively, whereas the combination of phytase and xylanase caused further improvements in broiler performance (Wu et al. 2004). Moshad et al. (2003) proved that the growth , feed conversion efficiency, survivability, meat yield and profitability increased by using mixed enzymes (phytase and carbohydrase), but the authors applied phytase preparation to the diet with lower phosphorus content. Smulikowska et al. (2006) reported that the feed intake and body weight gain of chickens fed wheat-maize-rape cake diets increased significantly after the phytase supplementation only at a lower level of dietary calcium and phosphorus. The performance of chickens fed wheat-rape cake diets with lowered Ca and P contents and supplemented with phytase was similar to the unsupplemented and containing adequate level of nutrients (Smulikowska et al. 2006). Results of the study conducted by Kocher et al. (2000) indicated that commercial enzyme products had some effects when they were applied in diets containing high concentration of canola meal. These effects could only be seen after detailed analyses and did not result in significant improvement of broiler growth performance.

In the present study the addition of simultaneous phytase and xylanase to the diet with the adequate content of nutrients did not significantly affect the carcass weight and carcass components, except for the skin with subcutaneous fat. The lower content of skin with subcutaneous fat in the group fed the diet with enzyme preparations was stated, whereas the lowest content of the trait was found in the group to which phytase and xylanase were added. It seems that basic nutrients and phosphorus were adequate with broiler requirements and the phytase addition did not affect the content of carcass components. These results are in agreement with those of Rezaei et al. (2007). The results obtained by Ghorbani et al. (2009) indicated that except for the breast weight and abdominal fat, other carcass components were not significantly affected by Grindazyme and phytase. Glucosinolate degradation products may adverse affect the physiological status of liver , thyroid and kidneys and the growth performance Smulikowska et al. (2006) stated the increase in thyroids in groups fed untoasted, phytase-supplemented rape cake, which indicates that the exogenous phytase increases hydrolysis of glucosinolates to goitrogenic compounds.

In the present study the protein content in thigh muscles was significantly differentiated ($P < 0.05$) between groups, but the addition of enzymes to diets did not influence the chemical composition and organoleptic estimation of the muscles. There were not significant differences between groups fed diets with 10% of wheat bran supplemented with a combination of xylanase and phytase in the percentage of carcass dressing, internal organs, commercial cuts and meat chemical composition as well as subjective meat quality parameters (Bin Baraik 2010). Pisarski and Lipiec (2000) stated that phytase supplementation (500 to 700 units) significantly increased dry matter and crude protein in breast and leg muscles. Obtained results in the present study showed that the digestibility of nutrients in groups was similar, but a tendency to improve the total phosphorus digestibility in grower mixtures as a result of phytase addition was observed. Obtained results in case of the phosphorus digestibility could be caused by the fact that endogenous phytase content is extremely low in young birds, but it increases with age (Sebastian et al. 1998). Rutherford et al. (2002) reported no statistically significant effect of added phytase on the total and phytate P digestibility, whereas Akyurek et al. (2005) stated that P and Ca availabilities were significantly affected by phytase supplementation. Bone mineralization is an important indicator of phosphorus availability. In the present study the chemical composition of bone was not significantly different between groups, whereas the crude ash and total phosphorus contents were quantitatively larger in bones of chickens fed the diet with xylanase and phytase supplementation. In the study conducted by Smulikowska et al. (2006) there were not significant interactions between the effect of rape cake and phytase supplementation on P retention. Rezaei et al. (2007) stated that with the addition of phytase the contents of toe ash, toe ash P and toe ash Ca increased. In the experiment conducted by Puzio et al. (2004) the addition of phytase to the diet for broilers did not have any effects on the quality of chicken bones. The tibia weight, tibia ash and tibia ultimate strength in chickens fed rape cake diets did not differ compared to the control group containing Avizyme 1300 (without rape cake) and in groups fed RC diets with lower Ca and P contents, and supplemented with phytase. The tibia ash content was reduced compared to unsupplemented groups, but tibia weight and its ultimate strength were not affected (Smulikowska et al. 2006). The ash content in the toes increased by phytase supplementation, whereas the effect was more noticed in birds consuming feeds that also contained xylanase, and mineralization of chicken bones was more observable in birds fed diets supplemented with both enzymes (phytase and xylanase) than added individually (Żyła et al.1999). Pisarski and Lipiec (2000) stated that phytase did not alter P, Ca, Mg, K and Na contents in the tibia significantly and Akyurek et al. (2005) that supplemental phytase did not have any effects on the toe ash content. The phytase application improved dry matter and ash contents of the tibia and toe in the study conducted by of Ahmad et al. (2000).

CONCLUSION

Introduction of xylanase or xylanase and phytase into the wheat mixtures contained rape cakes (starter – 15%, grower – 20%) did not have a significant effect on performance and musculature of chickens. Application of enzymes to the diets had profitable effect on fatness (less content of skin with subcutaneous fat in carcasses of broilers). Simultaneous introduced of xylanase and phytase numerically increased the digestibility of total phosphorus in grower mixtures and the crude ash and total phosphorus content in bones.

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Abstract. The aim of the study was to evaluate the effect of application of xylanase or xylanase and phytase to diets containing rapeseed cakes of 'Kana cv.' on performance, carcass traits, physico-chemical parameters of meat and bone and digestibility of diets. Experiment 1 (growth trial) was carried out on 90 one-day-old broilers Ross 308, which were divided into three groups. The chickens were fed diets that contained 15% (starter – 1–21 days) and 20% (grower – 22–42 days) of rapeseed cake. The control diet (RC) for first group was without enzymes, diet for second group RC(X) contained enzyme preparation with endo-1,4-β- xylanase at the level of 0.3 $g \cdot kg^{-1}$ (min. 1000 FXU/g). The third diet – RC(X + PHY) contained xylanase and enzyme preparation contained phytase in the amount of 0.35 $g \cdot kg^{-1}$ (min 2500 FYT/g). At the age of 42 days, six chickens from each group were slaughtered. In the experiment 2 (on 60 broilers) the digestibility of diets from the experiment 1 on broilers at 3 week of life (starter diets) and at 5 week (grower diets) was carried out. Obtained results showed the tendency to increase of body weight and decrease of feed conversion after application of enzymes to the wheat-rapeseed diets. Less content of skin with subcutaneous fat in carcasses of broilers fed diets with enzymes, significant in simultaneous introduced xylanase and phytase, and increase of protein content in leg muscles was stated. Simultaneous introduced of xylanase and phytase (non significant) increased the digestibility of total phosphorus in grower mixtures and the crude ash and total phosphorus contents in bones.