THE EFFECT OF ENZYMATIC ADDITIVES ON THE PRODUCTIVITY OF LAYING HENS ISA BROWN

VPLYV ENZYMATICKÉHO ADITÍVA NA ÚŽITKOVOSŤ NOSNÍC ISA BROWN

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ABSTRACT

The aim of this work the influence of enzymatic additives on the productivity of laying hens ISA BROWN was to analyze. The experiment together with the Central Control and Testing Institute of Agriculture was realized. The experiment was conducted 11 months, in 3 phases: from the 22nd to the 28th week, from the 29th to the 46th week and from the 47th to the 68th week of production. Two groups with 1080 (540 in each group) animals were examined (control group A, experimental group B). In the experiment diets based on wheat, rye, barley, soybean, minerals and vitamins were used. In group B we administered a feed mixture with endo-1,4-ß-xylanase (activity 7820 $TXU.g^{-1}$) and endo-1,4-ß-glucanase (activity 2940 $TGU.g^{-1}$) fortification. After finishing of the last period (68th week of hens´ age) were registered parameters in both groups of animals. The body weight at the end of the experiment was positively affected in the second group (containing enzymes: B). This difference was significantly higher ($P<0.05$). In the B group was also confirmed significant better ($P<0.05$) feed intake (141.8 and 144.3 g respectively on the same level) and non significant ($P>0.05$) heavier eggs (64.54 and 64.02 g respectively) in A and B group. For hens in the control group (without enzymes), was registered significantly lower ($P<0.05$) body weight (2 239 and 2 307 g) of hens, a lower weight of eggs ($P>0.05$), and higher feed intake ($P<0.05$). The feeding without enzymes in the A group negatively influenced the quality of eggs. It was higher percentage of total non-standard eggs (7.10 and 6.56 %), cracked eggs (4.0 and 3.64 %) and broken eggs (0.52 and 0.39 %). The differences of these parameters are not significant ($P>0.05$). After the administration of the enzymes in the feed mixture fortification we determined a positive effect on laying hens´ productivity. The application of enzymes positively affected the average body weight of hens.

Keywords: nutrition, poultry, enzymes, productivity, eggs

DETAILED ABSTRACT

Cieľom práce bolo analyzovanie vplyvu enzymatického aditíva na produktivitu nosníc. V pokuse boli použité nosnice znáškového hybridu ISA BROWN od veku 140 dní. Nosnice boli ustajnené klietkovou technológiou. Experiment bol realizovaný v spolupráci s Ústredným kontrolným a skúšobným ústavom pre poľnohospodárstvo v šiestych opakovaniach. V práci sme sledovali celkový počet nosníc, ich živú hmotnosť, hmotnosť vajec, počet neštandardných vajec, počet prasknutých a rozbitých vajec a počet vajec s neštandardnou formou. Experiment trval celkom 11 mesiacov a bol rozdelený do 3 znáškových fáz: od 22. do 28. týždňa znášky, od 29. do 46. týždňa znášky a od 47. týždňa do 68. týždňa znášky. Sledované nosnice boli rozdelené do 2 skupín (kontrolná skupina A, pokusná skupina B), v každej po 540 ks. V experimente boli použité štandardné kŕmne zmesi na báze pšenice, raže, jačmeňa, sójového extrahovaného šrotu a kŕmnych aditív (minerálne látky a vitamíny). V skupine nosníc B bolo do kŕmnej zmesi zapracované enzymatické aditívum s účinnými zložkami endo-1,4-ß-xylanázy (aktivita 7820 TXU.g^{-1}) and endo-1,4-ß-glukanáza (aktivita 2940 TGU. g^{-1}). Po skončení poslednej znáškovej fázy (68. týždeň veku nosníc) sme zisťovali rovnaké parametre u oboch skupín. Mikroklimatické podmienky a svetelný režim boli automaticky regulované v zmysle technologických štandardov pre hybrid ISA BROWN. Variačno-štatistické ukazovatele boli analyzované t-testom (Microsoft Excel, Microsoft Office, 2007). Živá hmotnosť nosníc na konci experimentu bola pozitívne ovplyvnená v skupine B, kde sme skrmovali kŕmnu zmes obohatenú o enzymatické aditívum. Rozdiely boli štatisticky preukazné ($P<0,05$). V B skupine nosníc sme zistili preukazne ($P<0,05$) pozitívnejší príjem krmiva a nepreukazne ($P>0,05$) vyššiu priemernú hmotnosť vajec. Priemerná živá hmotnosť nosníc v skupine B bola preukazne vyššia (2 307 g). V tejto skupine sme zistili aj vyššiu hmotnosť vajec. V skupine nosníc bez enzymatického aditíva (skupina A) sme zaznamenali nižšiu živú hmotnosť zvierat (2 239 g), nižšiu hmotnosť vajec, vyššie zastúpenie neštandardných vajec (7,10 %), prasknutých (4,0 %) a rozbitých vajec (0,52 %). V práci sme zistili pozitívny vplyv skrmovania enzymatických aditív na úžitkovosť nosníc ISA BROWN. Enzymatická fortifikácia kŕmnych zmesí pozitívne zvýšila priemernú živú hmotnosť nosníc a pozitívne ovplyvnila kvantitatívne parametre znášky.

Kľúčové slová: výživa, hydina, enzýmy, produkcia, vajcia

INTRODUCTION

Feed additives affect physiological and nutritional parameters in poultry nutrition [4, 11]. Feed additives are claimed to exert antioxidative [5, 6] antimicrobial, immunomodulation and growth promoting effects [7] in livestock, actions which are partially associated with an enhanced feed consumption supposedly due to an improved palatability of the diet [17]. Exogenous enzymes fortification in poultry nutrition can positively influence nutrient utilization, product quality, health and welfare of birds [2]. In rye-based feed mixtures addition of enzymes, majorly xylanase and glucanase (β-glucanase), reduces the incidence of pasting vents and improves litter quality [16, 9]. Frigard et al. [8] and Langhout et al. [12] reported also positive effect of feed enzymes addition on performance of birds. Supplementation of enzymes in the diets for chickens can markedly affect weight gain, feed intake, and feed gain [13]. Positive effects on the productivity of hens reported Lazaro et al. [14], which reported that different enzyme concentrations in the feed mixture for hens increased laying hen productivity and nutrient digestibility. Egg weight of hens fed the diets supplemented with feed enzymes can by significantly greater [10, 15]. The target of this work the effect of enzymes feed mixtures fortification on the laying hens productivity was analyzed.

MATERIAL AND METHODS

Animals

The experiment with Central Control and Testing Institute of Agriculture cooperation, on the Biological testing station in Vígľaš was realised. The trial up with the comparison with six repetitions was made. In the test the productive parameters of laying hens of ISA BROWN type with up to 140 days of age were testing. The experimental hens before the beginning of the trial were weighted. During 11 months 3 periods of eggs laying (11-28 weeks, 29-46 weeks and 47-68 weeks of hens´ age) were compared. The hens were kept 5 birds in a cage (4.2 m^2, manufacturer Kovo Jesenná, Slovakia) and total number of hens in one group was 90. Each cage was a reperate statistical unit. Microclimate conditions and light regime were automatically regulated according to the technological standard for ISA BROWN hybrids.

Laboratory methods and feed mixtures

For analysing the organic and inorganic components of the nutrients the standard laboratory methods and steps were used [3]. From the organic nutrients we analysed the content of dry matter, crude proteins, amino acids (lysine, methionine, cystein, threonine), fat, crude fibre, nitrogen free extract, ash and linoleic acid. From the inorganic nutrients were analysed the content of calcium (Ca), available phosphorus ($P_{avail.}$) and sodium (Na).

The experimental group of laying hens by the feed

mixture, according to the requirements of maintenance and intensity of eggs production was fed. The control group of laying hens (group A) was fed only the basic feed mixture which was fortificated by multi-enzyme additives. The efficient part of the additive was enzyme of endo-1,4-ß-xylanase (activity 7820 TXU.g^{-1}) and endo-1,4-ß-glucanase (activity 2940 TGU.g^{-1}). The additive was supplied to the B group in 0.008 %. An ad libitum system of feeding and watering of laying hens was used. The composition of feed mixture is shown in table 1, and nutrient content in the diets in table 2.

Statistical analysis

To calculate basic statistic parameters, determine significance of differences and compare the results the analysis of variance, double-way ANOVA and t-test were performed at P level less than 0.05, the SAS statistical software was used (SAS Inc., New York City, U.S.A.).

RESULTS AND DISCUSSION

The composition of nutritive value of the used feed mixtures (table 1 and 2) were different only in concerning the enzymatic additive in group B. The nutritive value of feed mixtures was isoenergetical and isonitrogenous.

The total number of laying hens on the experiment 540 birds was in each group. More animals survived in the B group with enzyme additive (502 birds) as compared with the A group where 497 birds in laying stage after the end of the experiment were (table 3). Autopsy wasn´t used. The difference of 5 hens during 11 months of the testing period in benefit of the B group was due to the positive influence of the experimental conditions and reflected this

Table 1 Composition of the trial diets

Component	Participation in the Diet (%)	
	Group A	Group B
Wheat	26.30	26.30
Rye	15.00	15.00
Barley	20.00	20.00
Soybean meal (47% crude protein)	22.00	22.00
Soybean oil	2.50	2.50
Fat	2.00	2.00
Monocalcium phosphate	1.70	1.70
Calcium carbonate	9.14	9.14
Natrium chloride (38% Na)	0.30	0.30
Sodium bicarbonate (28% Na)	0.10	0.10
Methionin (99 % DL-Methionin)	0.16	0.16
Vitamin Premix	0.40	0.40
Mineral Premix	0.10	0.10
Choline chloride	0.20	0.20
Caroten premix	0.10	0.10
Multi-enzymatic premix	-	0.008

Table 2 Nutrient content in the trial diets

Nutrient		Content in mixture A	Content in mixture B
ME_N	(MJ.kg^{-1} of DM)	11.5	11.7
CP	(g.kg^{-1} of DM)	177	165
LYS	(g.kg^{-1} of DM)	8.81	7.90
MET	(g.kg^{-1} of DM)	4.17	4.03
M+C	(g.kg^{-1} of DM)	7.41	7.15
THR	(g.kg^{-1} of DM)	6.27	5.80
LA	(g.kg^{-1} of DM)	19.0	18.8
Ca	(g.kg^{-1} of DM)	39.1	32.4
$P_{avail.}$	(g.kg^{-1} of DM)	3.8	3.0
Na	(g.kg^{-1} of DM)	1.5	1.5

* ME_N: metabolisable energy for poultry, CP: crude protein, LYS: lysine, MET: methionine, M+C: methionine plus cysteine, THR: threonine, LA: linoleic acid, Ca: calcium, $P_{avail.}$: available phosphorus, Na: natrium.

Table 3 Mortality of hens during the experiment (without autopsy)

Total number of hens		Group A (without ES)	Group B (with ES)
[1]22nd	**Mean**	540	540
	S.D.	0	0
[2]68th	**Mean**	497	502
	S.D.	8.566	11.866

[1,2]The experiment start with 22 week old hens, finish was with 68 week old hens.
ES: enzymes supplementation, S.D.: standard deviation

Table 4 **Performance of hens (total productivity) fed with of without enzyme supplementation (ES)**

Productivity Parameters		Group A (without ES)	Group B (with ES)
Live weight			
[1]22nd		1 857 g	1 875 g
[2]68th		2 239 g[a]	2 307 g[a]
Feed intake (g/ egg)	**Mean**	144.3 g[b]	141.8 g[b]
	S.D.	3.563	6.333
Weight of eggs (g)	**Mean**	64.02 g	64.54 g
	S.D.	0.107	0.777
Non standard eggs / hen (pcs)	**Mean**	21.04	19.44
	S.D.	9.720	4.956
Cracked eggs (pcs)	**Mean**	11.84	10.80
	S.D	6.334	2.890
Broken eggs (pcs)	**Mean**	1.54	1.15
	S.D.	0.322	0.208
Non standard eggs form (pcs)	**Mean**	0.92	0.69
	S.D.	0.021	0.342
Non standard eggs in laying	**Mean**	7.10 %	6.56 %
	S.D.	1.088	0.559
Cracked eggs	**Mean**	4.00 %	3.64 %
	S.D.	0.447	0.293
Broken eggs	**Mean**	0.52 %	0.39 %
	S.D.	0.045	0.027
Non standard eggs form	**Mean**	0.30 %	0.23 %
	S.D.	0.003	0.003
Intensity of laying	**Mean**	90.01 %	90.14 %
	S.D.	0.118	2.244

[1,2]The experiment start with 22 week old hens, finish was with 68 week old hens.
ES: enzymes supplementation, S.D.: standard deviation
The values with superscript are significant in the row at P<0.05

performance of hens (total productivity) fed with and out enzyme supplementation is in table 4 (all experimental periods total results). Significantly lower (P<0.05) feed intake in group B we found. The higher egg weight in the group B compared to the A group (P>0.05) we confirmed. In this parameter of eggs production we found the opposite tendency than Kramarová and Chmelničná [11], who observed a decay of egg weight in the group with the feed additives. The multi enzyme additive in our experiment released the additional energy that is perhaps blocked by some of the antinutritional factors in the components (barley, rye) which are usually not used for the feeding of the poultry. A positive effect in the non-standard categories of eggs was also observed. For the hens fed by enzymatic trailed feed mixture the number of non-standard eggs was less (19.44 pieces), what is a share of 6.56 % in B and 7.10 % in the A group for the total laying period. Better results in every observed parameter of non-standard eggs by the enzymatic treating we obtained. The categories of cracked eggs (10.8 and 11.84), broken eggs (1.15 and 1.54) and non-standard eggs were observed to be (0.69 and 0.92) respectively. The ratio of these categories from non-standard eggs during the laying period was in percentage, cracked eggs

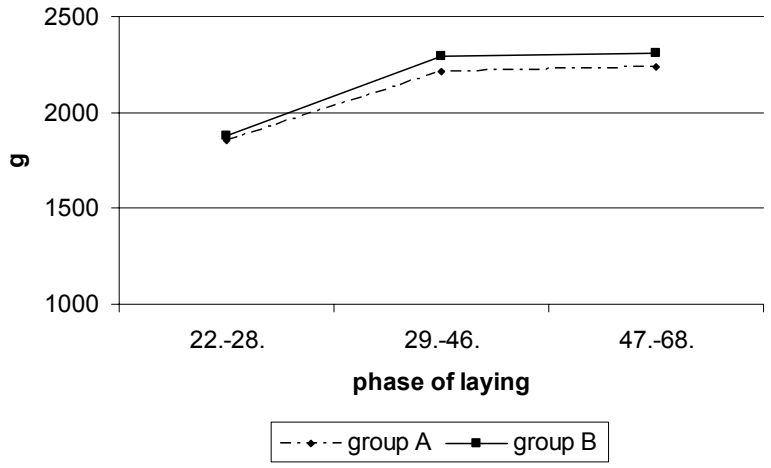

Figure 1 Changes of hens live weight in the trial

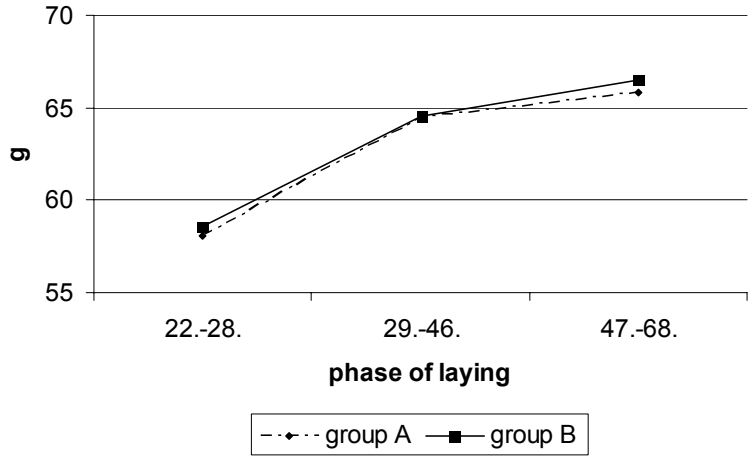

Figure 2 Changes of egg's weight in the trial

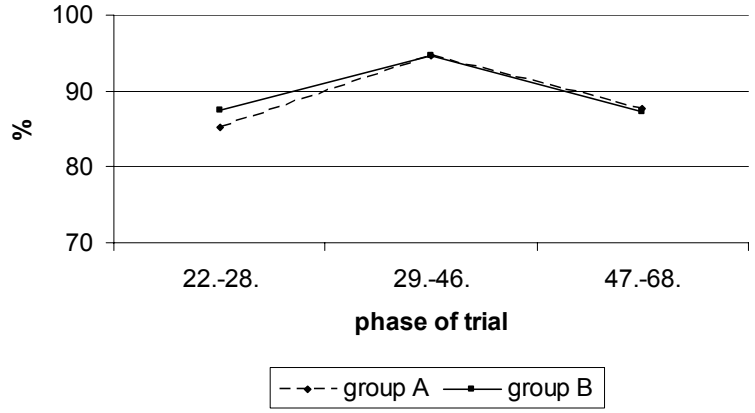

Figure 3 Changes in egg's production in the trial

4.0 %, 3.64 %, broken eggs 0.52 %, 0.39 %, non-standard eggs from 0.30 and 0.23 % in the A and B groups. These results are with Lazaro et al. [14] correspondence, for the qualitative parameters of eggs. A positive tendency on the intensity of laying eggs during the laying period was recognised also. In the B group it was 90.14 % against 90.01 % in the group A. The same effect after fortification of enzymes reported Lazaro et al. [13]. It is probably the higher energy content from the cereal, components in the feed mixtures. The utilisation of higher energy level influence also the final live weight of laying hens fed with enzymes additives ($P<0.05$). The opposite effect of the enzyme supplementation was discussed by Aderemi et al. [1], a found to have a significant reduction of live weight.

CONCLUSIONS

In the trial at the end of the experiment the live weight of hens in group B was significantly higher ($P<0.05$). The feed intake in grams per egg was significantly lower ($P<0.05$) in hens group fed feed mixture with multi-enzymatic additives fortification (group B).

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