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THE EFFECT OF DIETARY BIO-ALGINATE SUPPLEMENTATION OF THE GROWTH RATE AND BODY WEIGHTS OF COMMON PHEASANT (*PHASIANUS COLCHICUS*) CHICKS

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Key words: pheasant, Biopolym, alginates, growth rate, body weight.

Abstract

The aim of this study was to determine the influence of bio-alginates on the growth rate of pheasant chicks. Two experiments were performed in pheasant chicks were administered the Biopolym supplement from 1 to 29 days of age (experiment 1) or from 1 to 36 days of age (experiment 2). The Biopolym supplement had a significant effect on the growth rate of pheasant chicks, the highest relative increase in the body weights of birds was observed between 1 and 8 days of age, and it reached 62.9% in birds fed Biopolym-supplemented diets vs. 37.5% in the control group ($P \leq 0.05$) in experiment 1, and 60.2% vs. 48.0%, respectively ($P \leq 0.05$) in experiment 2. The body weights of pheasants fed Biopolym-supplemented diets increased 6.6-fold vs. 5.7-fold in the control group in experiment 1, and the respective values noted in experiment 2 were 9.1-fold vs. 8.4-fold ($P \leq 0.05$).

WPŁYW DODATKU BIOALGINIANU NA TEMPO WZROSTU I MASĘ CIAŁA KURCZĄT BAŻANTA ZWYCZAJNEGO (*PHASIANUS COLCHICUS*)

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Słowa kluczowe: bażant, Biopolym, alginiany, tempo wzrostu, masa ciała.

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Streszczenie

Celem badań było określenie wpływu suplementacji dodatkiem bioalginianu na tempo wzrostu kurcząt bażanta. Przeprowadzono dwa doświadczenia w warunkach produkcyjnych, w których podawano pisklętom preparat Biopolym od 1. dnia życia do wieku 29 dni (doświadczenie 1.) lub do 36 dnia (doświadczenie 2.). Stwierdzono istotny wpływ dodatku preparatu na tempo wzrostu masy ciała piskląt. Względne tempo wzrostu masy ciała piskląt było największe w okresie od 1–8. dnia życia u ptaków żywionych z dodatkiem preparatu Biopolym w doświadczeniu 1. wynosiło 62,9% i 37.5% w grupie kontrolnej ($P \leq 0.05$), a w doświadczeniu 2. odpowiednio – 60.2 i 48.0% ($P \leq 0.05$). Masa ciała ptaków, którym podawano Biopolym w doświadczeniu 1., wzrosła 6,6-krotnie (z 19,7 g do 133,3 g), a w grupie kontrolnej 5,7-krotnie (z 19,8 g do 112,3 g), natomiast doświadczeniu 2. odpowiednio 9,1- (z 20,5 g do 171,1 g) i 8,4-krotnie (z 20,3 g do 180,5 g; $P \leq 0,05$).

Introduction

Common pheasants (*Phasianus colchicus*) are raised commercially for meat or for release in hunting preserves. Pheasant hunting is very popular in the Czech Republic, where it is deeply rooted in local tradition. As a result, the number of birds introduced to hunting areas has to be continuously increased (HOLÁ et al. 2015). The profitability of commercial pheasant farming is determined by numerous factors, including the number of chicks reared. The success of pheasant farming depends on environmental factors, including adequate nutrition and housing conditions, particularly in the early life stages of birds (NOWACZEWSKI and KONTECKA 2005).

An EU-wide ban on the use of antibiotics as growth promoters in animal feed entered into effect in 2006, which prompted the search for new, safe feed additives and dietary supplements that could replace antibiotics and help maintain production efficiency. Probiotics, prebiotics, enzymes, oligosaccharides, organic acids and selected herbal extracts are considered to be a viable alternative to growth-promoting antibiotics. Positive effects of probiotic compounds have been observed, among others, in chickens (PATTERSON and BURKHODER 2003, ECKERT el al. 2010). Lactobacillus-based probiotics and prebiotic preparations are involved in beneficial modulation of gut microbiota in poultry, thus enhancing the birds' resistance to intestinal infections (FULTON et al. 2002). Probiotics and prebiotics can be used to prevent infections in poultry (LUTFUL KABIR 2009), but their therapeutic benefits are limited (EHRMANN et al. 2002).

Algae are also regarded as effective and safe feed additives, posing no risk to animal or human health. Microalgae, macroalgae and their products – alginates are used in plant production (HANZAL et al. 2015) and animal nutrition. Alginates are polysaccharides derived from marine algae, mainly brown algae (*Phaeophyceae*). They can also be synthesized extracellularly by bacteria such as *Azotobacter vinelandii*, *Pseudomonas aeruginosa* and *Pseudomonas fluor-*

escens (HOLTE et al. 2003, PEREIRA et al. 2003). One of the most common species of brown algae is *Ascophyllum nodosum,* harvested commercially on the coasts of Canada, Island and Northern Scotland. Algal preparations are widely used as feed supplements for livestock. In Canada, a commercial A. nodosum animal feed supplement is distributed under the brand name Tasco. The product has been found to improve feed efficiency and boost the immune system of animals. Results study BACH et al. (2008), indicate that 2% Tasco-14 supplementation in feedlot cattle diets reduces *Escherichia coli* (EHEC O157 and EHEC O157:H7) prevalence on hide swabs and in fecal samples and may suppress increases in *Salmonella spp*. Tasco© has been studied to determine effects on ability to increase reproductive traits in cattle and goats (YATES et al. 2010) and horses (WILLIAMS et al. 2015). Another algal preparation used as a feed additive is Biopolym. Biopolym, a hydrolysate of the brown alga A. nodosum, can be administered with solid feed or in liquid form (brand name: Biopolym FZT). Research has shown that Biopolym exerts a beneficial influence on gut microbiota, it improves digestion and accelerates nutrient absorption into the bloodstream, which increases feed conversion efficiency and body weight gains (GJUROV et al. 2007). Biopolym contains vitamins, amino acids, alginic acid in the form of sodium alginate E401, iodine and other trace elements. Due to its rich chemical composition, Biopolym contributes to cell regeneration, improves the health status and overall body condition of animals and helps reduce the mortality rates of young animals (HANZAL 2006, VOSTOUPAL et al. 2005).

Pheasant breeders also have to find effective alternatives to antibiotic growth promoters. The performance of farmed pheasants should be improved, particularly in early growth stages. The positive effects of dietary supplementation with bio-alginates, noted in other animal species, have prompted us to conduct the present study which investigated the influence of the Biopolym supplement on the growth rate of pheasant chicks.

Materials and Methods

The experimental materials comprised common pheasant (*Phasianus colchicus*) chicks. Two preliminary experiments were performed in the pheasantry located in Luhy near Chlumce in Eastern Bohemia (Czech Republic). In experiment 1, pheasant chicks were administered the Biopolym supplement (hydrolyzate) from 1 to 29 days of age, in experiment 2, from 1 to 36 days of age (control and experimental group of 120 birds each; 4 replicates of 30 birds), both groups were fed *ad libitum* commercial diets: 1–21 d; 29% total protein and 11.3 MJ (2700 kcal kg^{-1}) ME and 22 -36 d; 23% total protein and 11.7 MJ (2800 kcal kg^{-1}) ME.

The Biopolym supplement was mixed with drinking water (1ml/day/30 birds). All chicks were weighed individually on the first day of age and next at seven-day intervals.

In both experiments, pheasants were kept in the same hall with ventilation through windows and passive chimney fans. Lighting and thermal conditions were identical. An infrared heater was used during the first days of chicks' life. The birds were placed in the breeder house immediately after hatching.

Symbols:

– experiment 1: 1*C* – control group, no dietary Biopolym supplementation, 1*B* – experimental group, diets supplemented with Biopolym;

– experiment 2: 2*C* – control group, no dietary Biopolym supplementation, 2*B* – experimental group, diets supplemented with Biopolym.

The growth rate of pheasant chicks was calculated from the following formula:

$$\mathrm{gr} = \frac{w_2 - w_1}{0.5x(w_1 + w_2) \cdot 100}$$

where:

gr – growth rate [%]

w_1 – BW at the beginning of the rearing period

w_2 – BW at the end of the rearing period.

The experiment was approved by the Local Ethics Committee at the University of South Bohemia in Ceske Budejovice.

The statistical analysis included the characteristics of the analysed traits – arithmetic means ($\bar{x}$) and standard deviations (SD) and the determination of the significance of differences in mean values between age groups, by Duncan's D test. The data were analysed by two-way ANOVA. The results were processed in the Statistica 2011 application (StatSoft Inc. 2011), at a significance level of 0.05.

Results

The Biopolym supplement had a significant effect on the growth rate of pheasant chicks (Figure 1). The highest relative increase in the body weights of birds fed Biopolym-supplemented diets (group 1*B*) was observed between 1 and 8 days of age, and it reached 62.9% vs. 37.5% in control group 1*C* ($P \leq 0.05$, Figure 1). At the next stage of the study (days 8–15), an interaction was noted: the growth rate of control group (1*C*) birds increased significantly to 64.7%, as compared with 52.4% in experimental group 1*B* ($P \leq 0.05$).

Between days 15–22 and 22–29, the growth rate of birds decreased gradually in both groups, but the noted decrease was smaller in experimental group 1*B* than in control group 1*C* (days 15–22: 1*B* – 41.9%, 1*C* – 35.7%, days 22–29: 1*B* – 32.7%, 1*C* – 29.1%, a statistically not significant difference). The age of birds and dietary supplementation with Biopolym had a significant influence on the body weights of pheasant chicks. The body weights of one-day-old birds from the control group (1*C*) and the experimental group (1*B*) were similar at 19.7 g and 19.8 g, respectively (Figure 2). At 29 days of age, the average body weight of

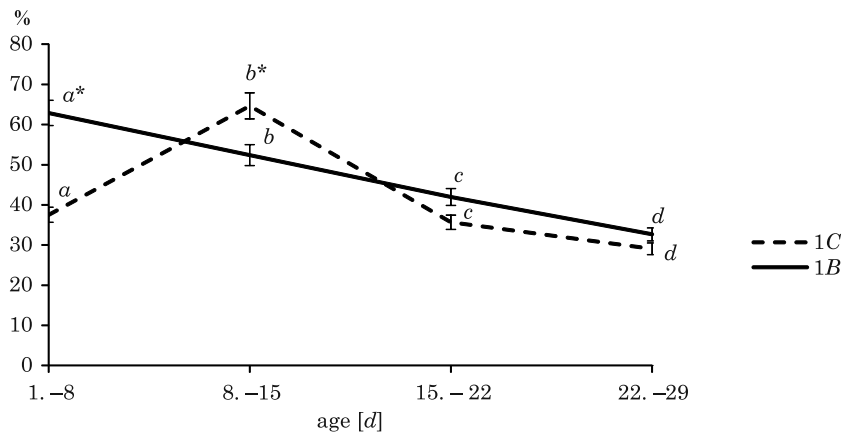

Fig. 1. Experiment 1. The growth rate of common pheasant chicks from 1 to 29 days of age [%; $\bar{x} \pm$ SD]. Values followed by different letters (age) or * (1*C* – control group, 1*B* – "Biopolym" group) differ significantly (α = 0.05)

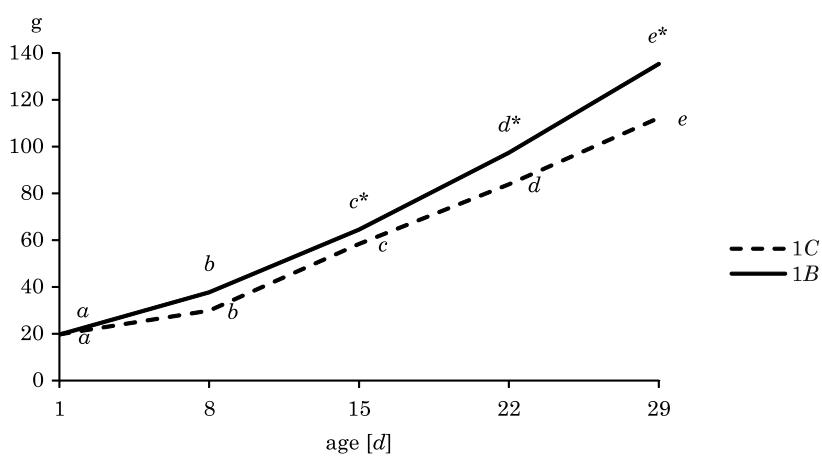

Fig. 2. Experiment 1. Average body weights of common pheasant chicks from 1 to 29 days of age [g; $\bar{x} \pm$ SD]. Values followed by different letters (age) or * (1*C* – control group, 1*B* – "Biopolym" group) differ significantly (α = 0.05)

experimental group birds (1*B*; 133.3 g) was significantly higher than the average body weight of control group birds (1C: 112.3 g; $P \leq 0.05$, Figure 2). A significant effect of Biopolym on the body weights of pheasants was noted day 8 – 37.7 g in experimental group 1*B* vs. 28.9 g in control group 1*C* ($P \leq 0.05$). The beneficial influence of the analyzed supplement was observed until the end of the experiment, and the age x feeding interaction was noted in week 2. In this age group, no differences in body weight were found between control (1*C*) and experimental (1*B*) birds (Figure 2).

In experiment 2, Biopolym was administered to pheasant chicks aged 1 to 36 days. The differences in the growth rate of birds from experimental group 2*B* and control group 2*C* were similar to those noted in experiment 1. In both groups, the growth rate of birds decreased gradually with age ($P \leq 0.05$, Figure 3). Between 1 and 8 days of age, the growth rate of pheasant chicks that received the analyzed supplement (group 2*B*) reached 60.2%, and it was significantly higher than the growth rate of control group birds (2*C*; 48.0%; $P \leq 0.05$, Figure 3). In successive stages of the study, no differences in growth rate values were found between experimental (2*B*) and control (2*C*) birds. The Biopolym supplement had a significant effect on the body weights of pheasant chicks. The body weights of one-day-old birds from the control group (2*C*) and the experimental group (2*B*) were similar at 20.5 g and 20.3 g, respectively. At 36 days of age, the body weights of birds reached 185.0 g in the experimental group fed Biopolym-supplemented diets and 171.0 g in the control group ($P \leq 0.05$, Figure 4). The differences in the body weights of control and experimental birds were observed at 8 days of age, and were maintained until the end of the experiment.

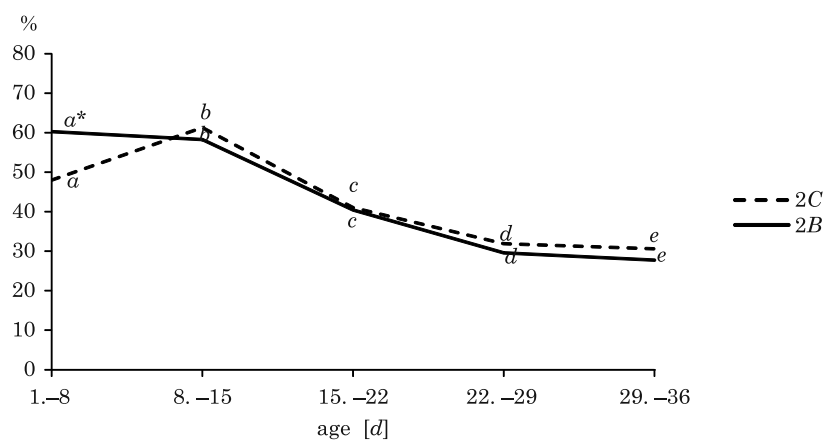

Fig. 3. Experiment 2. The growth rate of common pheasant chicks from 1 to 36 days of age [%; $\bar{x} \pm$ SD]. Values followed by different letters (age) or * (2*C* – control group, 2*B* – "Biopolym" group) differ significantly ($\alpha = 0.05$)

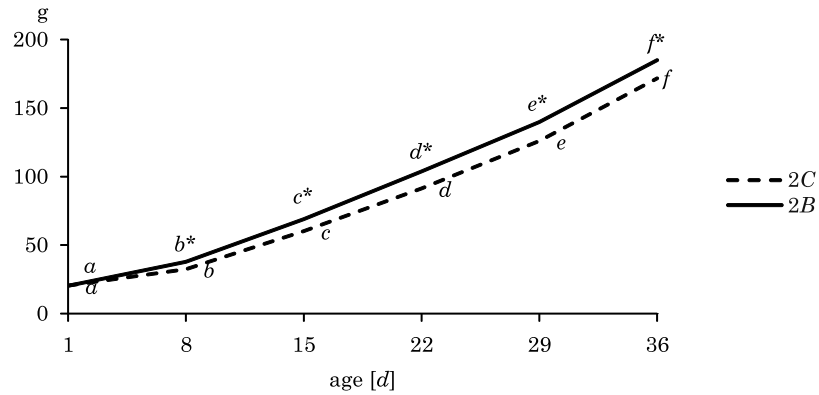

Fig. 4. Experiment 2. Average body weights of common pheasant chicks from 1 to 36 days of age [g; $\bar{x} \pm$ SD]. Values followed by different letters (age) or * (2*C* – control group, 2*B* – "Biopolym" group) differ significantly ($\alpha = 0.05$)

Discussion

Full expression of the genetic potential of farm-raised birds is largely dependent on the optimization of environmental conditions, including dietary modifications (HAVENSTEIN 2006). The effect of the dietary inclusion of Biopolym on performance and health status has been investigated in various livestock species. In contrast to the results of BACH et al. (2008), Biopolym did not produce the expected positive results in cattle (PETRÁŠKOVÁ et al. 2012), whereas it exerted a beneficial influence on the performance of pigs and broiler chickens (CERMAK et al. 2010). CERMAK et al. (2010) demonstrated that Biopolym increased body weight gains and improved feed efficiency in pigs, and reduced the mortality rates of broiler chickens. In a study by ZHANG et al. (2014), alginate-whey protein dry powder improved intestinal absorption in chickens and, in consequence, improved their performance.

An increase in body weight may vary in response to changing environmental conditions. In the present study, the Biopolym supplement had a significant effect on the growth rate of pheasant chicks in early life stages. Both in experiment 1 (dietary supplementation with Biopolym for 29 days) and experiment 2 (dietary supplementation with Biopolym for 36 days), birds fed Biopolym-supplemented diets were characterized by a considerably higher growth rate between days 1 and 8. The differences between control and experimental groups reached 22.1% in experiment 1 and 12.3% in experiment 2 (Figure 1 and Figure 3, respectively). It should be stressed that in both experiments, the growth rate of experimental group birds remained high also in the following week. The Biopolym supplement had no significant influence on the growth rate of pheasants older than 15 days of age. The high growth

rate of birds observed in early life stages led to increased body weights in successive weeks. The higher growth rate of pheasant chicks fed Biopolym-supplemented diets, noted in our study, resulted most probably from a positive effect of the analyzed feed additive on the gut microbiota of birds (VOSTOUPAL et al. 2005, SCHULZE and HERMSEN 2002, ZÁBRANSKÝ et al. 2014). The body weights of pheasants receiving Biopolym increased 6.6-fold vs. 5.7-fold in the control group in experiment 1, and the respective values noted in experiment 2 were 9.1-fold vs. 8.4-fold (Figure 2 and Figure 4, respectively).

The results of this preliminary study indicate that diets fed to farmed pheasants can be supplemented with Biopolym to improve bird performance and productivity. The dietary inclusion of Biopolym contributed to a faster growth rate of pheasant chicks in early life stages, followed by an increase in their body weights, which is a good indicator of bird condition.

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