Bulgarian Journal of Agricultural Science, 25 (Suppl. 3) 2019
Agricultural Academy

Effects of compound poultry feed with different content of high-protein sunflower meal on growth performance of broiler chickens

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Abstract

Chobanova, S. (2019). Effects of compound poultry feed with different content of high-protein sunflower meal on growth performance of broiler chickens. *Bulg. J. Agric. Sci., 25* (Suppl. 3), 91–94

The aim of the present experiment was to evaluate the effect of feeding poultry compound feed with different level of high-protein sunflower meal on growth performance of broiler chickens. The experiment was performed with 3 groups of chickens (30 birds in group) – one control and two experimental ones. Feeding isocaloric and isoprotein diets, containing flour of sunflower meal – 10% for the second group and 15% for the third group during the three growth periods, had an adverse effect on growth performance: at the end of the finisher period the reduction of live weight was by 1.6% and 4.1% for the second and third groups respectively. Feed intake per 1 kg weight gain was increased by 2.7% and 4.2% in experimental groups. It could be assumed that worse production traits resulting from increased proportion of low-cellulose high-protein sunflower meal in diets was due to the lower feed intake associated to excessively fine meal particles – 150-300 μm. The optimum size of particles in corn or sorghum based poultry compound feed, preferred by broiler chickens, was from 600 and 900 μm.

Keywords: broiler chickens; high-protein; sunflower meal; live weight; feed conversion ratio

Introduction

Sunflower meal is the principal and least expensive dietary protein source for animals in Bulgaria. Its use is limited by the high husk content, which reduces its energy and protein nutritional value and by deficiency of amino acids lysine and threonine. In our country, a new technology for separation of sunflower meal into low- and high-cellulose fractions was developed and implemented. The low-cellulose fraction contains from 43 to 46% protein and was appropriate for fowl, replacement and fattening pigs and lactating sows. Additionally, feeds with high-protein low-cellulose sunflower meal should be supplemented with fats, synthetic amino acids (lysine, threonine etc.), enzymes (phytase, beta-glucanase, xylanase, proteases, etc.) as well as pelleted in order to profit completely from their nutritional potential.

An advantage of sunflower meal to other protein feeds is its relatively low cost, high content of sulfur-containing amino acids methionine and cysteine and the lack of antinutrients.

The investigations of different authors have shown that the addition of some essential amino acids and fat to diets containing high-protein sunflower meal could increase the dietary sunflower meal level to 200-350 g/kg, without effect on the performance of broilers (Gabriel Raj at al., 1978; Ibrahim & Zubeir, 1991; Musharaf, 1991; Reddy, 1993).

Alagawany et al. (2017) performed an experiment with one week-old broiler chickens (Hubbard), allotted into 4 groups with 60 birds in a fully randomized design including four dietary levels of high-protein sunflower meal (0, 25, 50 and 75% of soybean meal). The feed conversion, body weight and weight gain were significantly improved ($P < 0.01$) proportionally to increasing sunflower meal content to 50% of soybean meal. Higher dietary level of sunflower meal – substitution of 75% and 100% of soybean meal improved the utilization of nutrients, but had a negative impact on the growth and feed conversion by broilers.

Moghaddam et al. (2012) included up to 21% sunflower meal in broiler chickens rations and found no negative effect on performance, the body weight, feed intake and feed conversion ratio.

Waititu et al. (2018) conducted two experiments for evaluation of effect of replacing 25, 50, 75 and 100% of soybean meal with high-protein sunflower meal, with or without multienzyme mixtures on growth performance, nutrient utilisation, jejunal digesta viscosity and excreta moisture. Between the 1st and the 35th day, increasing the share of high-protein sunflower meal in feed resulted in linear reduction of live weight, feed consumption and feed conversion.

For rational utilisation of various new sunflower products, research should be carrier out to determine their nutritional quality, optimum combination with other protein feeds and for optimisation of compound feeds for different animal species and categories. Experiments for evaluation of the level of soybean meal substitution with novel sunflower products and its economic profit are necessary.

The aim of the present study was to evaluate the effect of feeding compound feeds with various dietary level of non-pelletised (bulk) high-protein sunflower meal on production traits of broiler chickens.

Material and Methods

The experiment with broiler chickens was planned and performed in the Experimental base of Animal Nutrition unit (Faculty of Agriculture, Trakia University, Stara Zagora) in order to evaluate the effects of different dietary sunflower meal levels on production traits. The experiment was conducted with 90 male one-day-old Ross 308 chickens reared in battery cages, divided in 3 groups with 30 chickens, each with 6 replications. The experiment's duration was 42 days. Chickens were housed under controlled microclimatic conditions. During the fattening period they received feed and water *ad libitum*. Lighting (24h) was kept constant throughout the trial. The ambient temperature was maintained at 33°C during the first 5 days and then gradually reduced in line with routine rearing practices – by 2°C per week until the temperature of 22°C was attained.

Table 1. Experimental design of the study

Groups*	Fattening periods		
	Starter**	Grower**	Finisher**
Group I (Control)	6%	8%	8%
Group II	10%	10%	10%
Group III	15%	15%	15%

* Number of birds per group (n = 30)
** High-protein sunflower meal (%)

The offered isocaloric and isoprotein compound feeds in control (I) and experimental groups (II and III) were in line with the Ross 308 hybrid requirements (Aviagen, 2009).

Live body weight (LBW) (individually) and feed consumption (by subgroups) were monitored on days 10, 28 and 42. On the basis of consumed feed and weight gain, feed consumption per unit weight gain was calculated by periods. The experimental design of the study is presented in Table 1.

The experimental protocol was approved by the Animal Experimental Committee of Trakia University, Stara Zagora, Bulgaria.

Results and Discussion

The experimental results for LBW and feed conversion ratio (FCR) of broiler chickens are presented in Tables 2 and 3.

The comparison of the data about LBW of broiler chickens from the different groups showed that the inclusion of 10 and 15% bulk high-protein sunflower meal in compound feeds of experimental groups II and III has reduced, yet at the highest extent during the starter period (up to 10 days of age) the LBW of chickens by 10.4% and 11.8%, respectively compared to the control (I). There was a pronounced relationship between the dietary

Table 2. Live body weight (LBW) of broiler chickens, g *

Parameters	Groups					
	Group I (Control)		Group II		Group III	
	$\bar{x} \pm S\bar{x}$	%	$\bar{x} \pm S\bar{x}$	%	$\bar{x} \pm S\bar{x}$	%
LBW at 10 days of age, g	222.97 ±3.62 a_1, a_2	100	199.43±2.96 a_1	89.6	196.7±3.05 a_2	88.2
LBW at 28 days of age, g	1410.63±19.57 c_1	100	1375.8±14.48	97.5	1352.73±11.03 c_1	95.9
LBW at 42 days of age, g	2618.5±40.67 c_1	100	2577.83±24.14	98.4	2511.93±28.88 c_1	95.9

*$p < 0.05$ at c_1-c_1; $p < 0.01$ at b_1-b_1; $p < 0.001$ at a_1-a_1; a_2-a_2

Table 3. Feed conversion ratio (FCR) per kg weight gain, g

Parameters	Groups					
	Group I (Control)		Group II (10% sunflower meal)		Group III (15% sunflower meal)	
	$\bar{x} \pm S\bar{x}$	%	$\bar{x} \pm S\bar{x}$	%	$\bar{x} \pm S\bar{x}$	%
FCR (g/kg) days 1-10	1349.33 ±25.56	100	1383.0 ± 53.06	102.5	1400.67 ± 85.62	103.85
FCR (g/kg) days 11-28	1607.33±16.4 a_1; c_1	100	1670.0±23.63 c_1	103.9	1697.5 ± 14.68 a_1	105.6
FCR (g/kg) days 29-42	1873.0 ±25.8	100	1907.0 ± 17.71	101.8	1928.33 ± 31.74	102.9
FCR (g/kg) days 1-42	1609.89 ± 19.46	100	1653.33 ±21.7	102.67	1678.5± 31.41	104.2

*$p < 0.05$ at c_1-c_1; $p < 0.01$ at b_1-b_1; $p < 0.001$ at a_1-a_1

percentage of high-protein sunflower meal and retarded growth of chickens. The retardation was the highest in birds fed a diet with 15% high-protein sunflower meal. Highly significant differences in live weight were established between controls and each of experimental groups II and III ($P < 0.001$).

At the end of fattening period (42 days of age), chickens from the control group had the highest LBW – 2618.5 g, whereas chickens from the second (II) and third (III) groups, respectively – 2577.83 g and 2511.93 g. Birds from group II compensated weight increase as compared to control group, being lighter by only 1.6%. At 42 days of age, the difference in LBW between controls and group III (fed the highest dietary level of high-protein sunflower meal: 15%) became statistically significant ($P < 0.05$) and birds from the latter group weighed by 4.1% less than controls.

Data for feed consumed per 1.0 kg weight gain followed the trend for weight gain. The supplementation of feed with 10% or 15% sunflower meal worsened FCR in experimental groups during the starter period by 2.5% and 3.85%, but only differences between controls and experimental group III were statistically significant ($P < 0.05$).

The effect of added bulk low-cellulose sunflower meal on this trait in supplemented groups showed a trend to relative increase during the grower and finisher periods, namely between days 11 and 28, chickens from groups II and III exhibited higher feed consumption per unit weight gain vs controls by 3.9% and 5.6% respectively ($P < 0.05$; $P < 0.001$).

During the finisher period, chickens from experimental groups' II and III showed poorer FCR by 1.8% and 2.9% vs controls. For the entire fattening period (days 1-42) the tendency for negative influence of low-cellulose sunflower meal on feed conversion was preserved for both dietary levels in compound feeds (10 and 15%) observing values by 2.7% and 4.2% higher than controls (respectively in groups II and III).

It could be assumed that poorer productive traits in experimental broilers fed 10% and 15% bulk high-protein sunflower meal were due to lower feed intake resulting from extremely fine meal particles – 150-300 μm. The optimum particle size in corn or sorghum based poultry feeds ranges from 600 to 900 μm. The taste and olfaction senses of birds are poorly developed (Lindmaier & Kare, 1959). This disadvantage is compensated by mechanoreceptors in the beak, through which birds distinguish the size of particles (Gentle, 1979; Berkhoudt, 1980, 1985). Data show clearly that the particle size was more critical in bulk feeds than in pelletised ones. Although finely ground ingredients increase the substrate available for enzyme degradation in the digestive tract, larger rough particles have a positive effect on the development of the gizzard. The more developed gizzard is associated with better digestion, hence to better degradation of nutrients (Amerah et al., 2007) and better productive performance.

Studies in this field show that moderately and coarsely ground feeds improved the productivity of broilers fed bulk compound feeds and that these beneficial effects were higher in feeds with better particle uniformity (Nir & Ptichi, 2001). According to Waldroup (1997) fine particles with diameter < 600 μm should be avoided for all ages.

Conclusions

Under present experimental conditions, the inclusion of 10% and 15% non-pelletized low-cellulose sunflower meal in compound feeds of broiler chickens fattened until 42 days of age had a negative impact on their growth performance. The compound feed with 15% low-cellulose sunflower meal resulted in statistically significant decrease in LBW by 4.1% compared to non-supplemented birds. Feeding compound feeds with 10 and 15% non-pelletized low-cellulose sunflower meal has increased the feed consumed per kg weight gain over the 42-day fattening period by 2.7% (1.653 kg/kg) and 4.2% (1.678 kg/kg) in experimental groups (II and III) compared to control group (I) of birds (1.61 kg/kg).

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