

THE NUTRITIVE VALUE OF EXTRUDED CORN IN NUTRITION OF BROILER CHICKENS

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Abstract: In poultry farming is increasing effort to increasing profitability and decreasing of feed cost. Behind the components that are part of the mixture, the most of cost makes processing of nutrients. Extrusion is process which is increasingly used in order to enhance the quality of different feed for poultry. The aim of this research was comparative testing of nutritional value of extruded and nonextruded corn in nutrition of broiler chicken. The experiment was conducted under experimental growing conditions, in duration of 42 days. The following parameters were measured: growth, feed intake and vitality of broilers. The experiment was divided into two groups of chickens hybrid Ross-308, which were grown separately by sex with 8 replication. The first group was fed standard pelleted mixtures for growing chickens, in which the entire amount of corn in the mixture was extruded, and the second, control group was fed the same food in which corn was not extruded. In the second week of rearing the body weight was 437 g in both groups. In 4th week of age the average body weight was 1439g in group I, and 1419 in group II. For the first group conversion was 1,69 and for the second it was 1,71. The final body weight amounted 2595g for the first group and 2609 for the control group. In the first group conversion was 1,91, mortality 4,39% and the production index had a value of 309, and in the second 1,92; 4,56% and 306. In this study excellent production effects were achieved, so it was not expected that extrusion could achieve better production effects. These results showed that extrusion process does not always give the expected effects.

Key words: extrusion, corn, nutrition value, broiler chickens

Introduction

Food is the most significant cost in raising chickens. Definitely, feed ingredients make up the largest portion of the cost of food. However, the cost of processing food are an important part of the cost of feeding broilers and processing, in addition to food ingredients, provides the best opportunity to influence the performance of broilers (*Milošević et al., 2006; Wu and Ravindran, 2004; Gracia*

et al., 2009; *Beuković et al.* 2010a). Almost every food processing has a positive or negative effect on animal performance and can certainly affect the profitability of production (*Buchanan et al.*, 2010). Improving the nutritional value of maize is important, since corn is the dominant energy source in poultry nutrition (*Milošević et al.*, 2006). Its high starch content, high content of oil and a bit of cellulose, makes the corn highly energetic feed which organic matter have digestibility of 90%. The amount of individual components varies depending on the type of hybrids and growing condition (*Jeličić et al.*, 2009). In recent years the extrusion increasingly used in food for animals, because this technology has numerous advantages, including the possibility of wide application, high productivity, energy efficiency and high quality of the resulting product (*Brenes et al.*, 2008). Extrusion of corn may increase digestability of starch, since starch is becoming more accessible to digestive enzymes, resulting in greater mass of chicks (*El-Khalek and Jamssens*, 2010). Extrusion leads to the formation of complex fats and carbohydrates and enhances stability; prevents oxidation process over inactivate lipolytic enzymes (*Strugar et al.*, 2006). Besides the positive effects of extrusion of maize, in previous research researcher were also found some negative consequences. In the work of *Moritz et al.* (2005), process of extrusion of maize reduced the nutritive value of maize in the diet of broilers aged from 0 to 3 week. *Amornthewaphat et al.* (2005) have observed that extruded crushed corn has a negative effect on performance of broilers. The aim of this study was comparative testing of nutritional value of extruded and nonextruded corn in the diet of broiler chickens.

Materials and Methods

Day-old chicks hybrid Ross-308 were separated by sex with method based on the length of cover and primary wing feathers. The experiment was set up as two treatments with eight replications. The first group was fed standard diets for fattening of broiler chickens (starter, grower and finisher), in which the entire amount of corn in the mixture was extruded. The second group (control group) was fed the same mixture in which corn was not extruded. All mixtures were pelleted. Composition of the mixture and its chemical composition are shown in Tables 1 and 2. Food and water were provided *ad libitum* during the fattening. Control measurement of chicken and food was carried out every week of experiment and a measurement of all broilers and feed was done at 2nd, 4th and at the 6th week of age. Health status was monitored daily, and mortality and dead birds were regularly put away from the object. All obtained results were processed using standard statistical-variation methods (descriptive statistics, variance analysis, t-test) in the program STATISTIKA 10 (*StatSoft*, 2010).

Table 1. Ingredients of mixture

Ingredients	Starter (0-10 day)	Grower (11-28 day)	Finisher (29-42 day)
Corn	47,36	51,93	58,14
Wheat meal	9,00	6,00	5,90
MethioninDL 99%	0,10	0,00	0,00
Soybean meal 44%	22,48	16,12	10,77
Soybean croup	16,75	22,35	21,72
Lysine L (78%)	0,19	0,00	0,00
Monocalcium phosphate	1,15	1,01	0,92
Threonine L (98%)	0,09	0,00	0,00
Salt (NaCl), iodized	0,33	0,33	0,33
Limestone	1,56	1,26	1,22
Premix+enzyme supp.	1,00	1,00	1,00

Table 2. Chemical composition of mixture

Chemical composition	Starter (0-10 day)	Grower (11-28 day)	Finisher (29-42 day)
Dry matter %	89,54	89,52	89,50
Crude protein %	22,00	21,03	19,00
Crude fat %	5,44	6,43	6,50
Crude ashes %	6,25	5,62	5,20
Crude cellulose %	4,36	4,08	3,82
ME (ME _n) MJ/kg	12,65	13,20	13,40
Lysine %	1,43	1,24	1,10
Methionine %	0,72	0,61	0,59
Methionine + Cystine %	1,07	0,95	0,90
Threonine %	0,94	0,84	0,75
Tryptophan %	0,30	0,28	0,24
Ca %	1,05	0,90	0,85
P (total) %	0,81	0,76	0,76
P (useable) %	0,50	0,45	0,42
Na %	0,16	0,24	0,16
Cl %	0,27	0,24	0,25
C18:2 (linoleic) %	2,78	3,28	3,30
Xantophyll mg/kg	8,01	8,78	9,83

Results and Discussion

The average body weight of broiler chickens at 2nd, 4th and 6th week of age are shown in Table 3.

Table 3. Average body weight, g

Age, weeks	Group	
	Extruded	Control
2	437	437
4	1439	1419
6	2595	2609

From the results, we can see that the extrusion of corn had no effect on body weight of chickens. The slightly higher weight of chickens was observed in 4th week old, but the difference was not statistically significant. At the end of fattening weight of broilers was higher in the control group, but the difference was not statistically significant. In both groups achieved excellent production results when it comes to body weight. Health and vitality of broilers were also at a high level in both groups. The results of feed conversion at the 4th and 6th week of age, mortality and value of European Production Efficiency Factor (EPEF) are shown in Table 4. Slightly higher conversion was observed in the control group and the fourth and the sixth week of experiment. Mortality, expressed as a percentage was slightly higher in the control group, while the value of EPEF was higher in the group that was fed extruded corn. The observed differences were not statistically significant.

Table 4. Feed conversion at 4 and 6 week, mortality and European Production Efficiency Factor

Feed conversion and EPEF	Group	
	Extruded	Control
Feed conversion at 4 week	1,69	1,71
Feed conversion at 6 week	1,91	1,92
Mortality, %	4,39	4,56
European Production Efficiency Factor (EPEF)	309	306

The results indicate that the extrusion of corn had no effect on the performance of broilers. Previous research on the effects of extrusion on the performance of poultry have been inconsistent results (*Plavnik and Sklad, 1995; Amornthewaphat et al., 2005; Beuković et al., 2010b*). *Moritz et al. (2005)* were obtained that extrusion process of corn has led to an increase in body weight of broiler chickens, aged 0 to 3 weeks. In the work of *Amornthewaphat et al. (2005)*, extruded crushed corn has a negative effect on performance of broilers. Their

results indicated that this addition to weight gain and feed conversion in poultry can be improved if the extruded corn would be pelleted. According to *Milošević et al. (2007)* extrusion of corn meal has significantly affected the improvement of production performance of broiler chickens. During the extrusion process occur nutritional changes which may be significant for the quality of extruded feed. *Moritz et al. (2005)* attributed the different effects of extrusion to different conditions during extrusion process, variations in the different effects of extrusion to different conditions during extrusion process, variations in the extrusion process that can lead to the improvement of the nutritive value of feeds, but also to its reduction. Undesirable effects of extrusion cooking involve losses of heat-labile vitamins (A, E, thiamine), oxidation of lipids (*Lin et al., 1997*), destruction and reduction in the availability of amino acids, in particular, of lysine which is related to the Maillard reaction (*Moughan and Rutherford, 1996*). As a result of the Maillard reaction, which occurs during the extrusion process, lysine is damaged and protein digestability decreases (*Hurrell and Carpenter., 1981*). Starch is a dominant nutrient in maize. Starch plays a key role during extrusion, and undergoes several significant structural changes, which include starch gelatinisation, melting and fragmentation. Starch in grains is also an important binding agent in steam-pelleted and extruded feeds (*Jovanović et al., 2009*). Extrusion process can reduce the availability of non starch ingredients in corn. Moisture content of diets may also influence feed intake (*Moritz et al., 2001, 2002*). However, moisture percentages among groups were relatively similar. One explanation for the variation in results is that these differences are due to different types of extruders (wet or dry, with one or two extractors) and different condition during the extrusion process, such as temperature, humidity, pressure, etc. (*Hongtrakul et al., 1998*).

Conclusion

As a whole, based on the examinations and the results obtained, it can be concluded that this type of research is justified because they show that the extrusion process does not always have positive effects. Considering that each processing increases the cost of food, it is not always justifiably subjected to thermal treatment of food. This does not mean that the extrusion process should be abandoned as a useless process, but should seek the causes of bad effects. In the research we have achieved excellent production effects in both groups, and there was no expectation that the extrusion process will lead to major positive effects.

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Nutritivna vrednost ekstrudiranog kukuruza u ishrani brojlerskih pilića

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Rezime

U živinarskoj proizvodnji se sve veća pažnja posvećuje rentabilnosti proizvodnje i smanjivanju troškova ishrane. Posle komponenti koje su sastavni deo smeše, najveći deo troškova otpada na proces obrade hraniva. Ekstrudiranje je proces koji se sve više primenjuje u cilju da se poboljša kvalitet različitih hraniva za živinu. Cilj rada je bilo uporedno ispitivanje nutritivne vrednosti ekstrudiranog i neekstrudiranog kukuruza u ishrani brojlerskih pilića. Ogled je izveden u eksperimentalnim uslovima gajenja, u trajanju od 42 dana. Praćeni su sledeći parametri: prirast, utrošak hrane i vitalnost brojlera. U ogledu su bile dve grupe pilića hibrida Ross-308, koji su gajeni odvojeno po polu sa 8 ponavljanja. Prva grupa je hranjena sa standardnim peletiranim smešama za tov pilića, u kojima je celokupna količina kukuruzne prekrupe u smeši bila ekstrudirana, a druga, kontrolna grupa istom hranom u kojoj kukuruzna prekrupa nije bila ekstrudirana. U drugoj nedelji telesna masa je iznosila 437 g u obe ispitivane grupe. Sa 4 nedelje starosti, telesna masa je bila 1439 g u I grupi i 1419 g u II grupi. Konverzija je u četvrtoj nedelji starost bila 1,69 (I), odnosno 1,71 (II). Završna telesna masa je iznosila 2595 g u I grupi i u II 2609 g. U prvoj grupi konverzija je iznosila 1,91, mortalitet 4,39% i proizvodni indeks je imao vrednost 309, a u drugoj 1,92; 4,56% i 306. U slučaju ovog istraživanja postignuti su vrhunski proizvodni efekti, pa nije bilo ni za očekivanje da će se procesom ekstrudiranja postići bolji proizvodni efekti. Dobijeni rezultati ukazuju da proces ekstrudiranja ne daje uvek pozitivne efekte.

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