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CORN MEAL IN BROILER CHICKEN NUTRITION

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This paper gives the effect of application of none extruded corn meal (T1, T2) and extruded corn meal (T3, T4) in broiler chicken nutrition. In meals the corn grain (C) was replaced by corn meal in the amount of 50% (T2, T4) and 100 % (T1, T3). The experiment lasted 42 days in system 5 × 4 (5 treatments × 4 repetitions). In every treatment 300 chickens were included. Feeding of chicken was ad libitum, with three types of meals: starter with 23.30 % CP and 12.78 MJ/kg ME; grower with 20.30 % CP and 13.10 MJ/kg ME, and finisher 17.70 % CP and 13.25 MJ/kg ME. The results of investigation were body weight of chicken C – 2161 g, T1 – 2168 g, T2 – 2164 g, T3 – 2261 g, and T4 – 2244 g; daily growth C – 51.45 g, T1 – 51.62 g, T2 – 51.52 g, T3 – 53.84 g, and T4 – 53.43 g; mortality of chicken C – 5.00 %, T1 – 5.71 %, T2 – 3.64 %, T3 – 3.81 %, and T4 – 6.36 %; feed conversion ratio C – 1.93 kg/kg, T1 – 1.84 kg/kg, T2 – 1.84 kg/kg, T3 – 1.86 kg/kg, and T4 – 1.84 kg/kg. Differences in production parameters were not statistically significant, except differences in body weights between the group T3 and T1, T2 and K groups which were statistically significant ($P < 0.001$) and between T4 and T1, T2 and C were statistically significant ($P < 0.001$). Processing percentages were unified among groups with minimal differences in contents of abdominal fat in carcass. There were only statistically significant ($P < 0.05$) differences in the abdominal fat between the groups of males and females T1 and T2 and all other groups.

Key words: nutrition; corn meal; broiler chicken

ПЧЕНКАРНО СТОЧНО БРАШНО ВО ИСХРАНАТА НА БРОЈЛЕРСКИ ПИЛИЊА

Во трудот е прикажан ефектот од примената на неекструдирано (Т1 и Т2) и екструдирано (Т3 и Т4) сточно брашно од пченка во исхраната на бројлерски пилиња. Во смеските за пилиња пченката (С) е заменета со сточно брашно од пченка во количина од 50% (Т2 и Т4) и 100% (Т1 и Т3). Опитот траеше 42 дена и се состоеше од 5 третмани со по 4 повторувања. Во секој третман имаше по 300 пилиња. Исхраната беше *ad libitum* и содржеше три смески: стартер со 23,30% CP и 12,78 MJ/kg ME, гровер со 20,30% CP и 13,10 MJ/kg ME и финишер со 17,70% CP и 13,25 MJ/kg ME. Резултатите од испитувањето на пилињата беа следните: телесна маса С – 2161 g, Т1 – 2168 g, Т2 – 2164 g, Т3 – 2261 g и Т4 – 2244 g; дневен прираст С – 51,45 g, Т1 – 51,62 g, Т2 – 51,52 g, Т3 – 53,84 g и Т4 – 53,43 g; смртност С – 5,00%, Т1-5,71%, Т2-3,64%, Т3 –3,81% и Т4 – 6,36%; конверзија на храна С – 1,93 kg/kg, Т1 – 1,84 kg/kg, Т2 – 1,84 kg/kg, Т3 – 1,86 kg/kg и Т4 – 1,84 kg/kg. Податоците покажаа дека разликите во завршната телесна маса на пилињата од групата Т3 во однос на групите Т1, Т2 и С беа статистички високо значајни ($P < 0,001$). Статистички значајни разлики ($P < 0,05$) беа утврдени и помеѓу телесните маси на групата Т4 во однос на групите Т1, Т2 и С. Рандманите беа уедначени по групите, а разликите во содржината на абдоминална маст во труповите беа минимални, но сепак имаше статистички значајни ($P < 0,05$) разлики меѓу машките и женските пилиња од групите Т1 и Т2 во однос на другите групи.

Клучни зборови: исхрана; сточно брашно од пченка; бројлерски пилиња

1. INTRODUCTION

Corn is not only important nutrition in the diet of domestic animals, but it is also important raw material for a number of products for various needs of the people. Today, corn is much used for the production of ethanol. The by-product of corn processing has its own use value, especially in the poultry diet (gluten, germs, animal meal, dry corn marc, etc.). The new or similar products so far occur with more or less changed content and changed nutrient values in relation to the existing in products of corn (Waldroup et al., 1981; NRC, 1994; Sauvant et al., 2002; Spiehs et al., 2002; Strugar et al. 2006; Milošević et al. 2006, Milošević et al. 2007). Corn meal is a by-product processing industry in the corn, which contains part of endosperm (after the separation of fine fractions), cover and germs (Filipović et al., 2004). It has all the characteristics of energetic nutrition. In addition to easily digestible carbohydrates, it contains a significant percentage of proteins. It is suitable for feeding fattening poultry that requires high energy and protein content in meals. Due to the presence of germs it is rich in tocopherol (vitamin E).

Numerous analyses revealed that the corn meal contains 13–14% moisture, 9–10% crude proteins, about 3.3% cellulose, 48–50% glucoses, 4.0% sugar, and fat 6–8%. It contains about 2.1% mineral matters, 0.12% calcium, 0.22% phosphorus and 1.28 mg/kg β-carotene, (Filipović et al., 2004; Milošević et al., 2006). Unlike some other by-products of corn in the production of alcohol (ethanol) (Saharan et al., 1999; McNab and Boorman, 2002; Scheideler, 2006; Wang et al., 2008) or corn gluten and corn gluten with bran (Wilkinson and Barbee, 1998; Babidis et al,. 2002; Abdel-Rachel et al,. 2005; Brita et al., 2005) this nutrition contains less proteins, but more oil and starch, and by nutrition values it is similar to oils of corn (Vodice et al., 1996).

Jokić et al. (2004) calculated content of metabolic energy, and it was 14.28 MJ/kg.

The aim of the research was to examine the nutritive value of none extruded and extruded corn meal in diet of broiler chickens.

2. MATERIAL AND METHODS

Testing of *t* corn meal was based on the replacement of corn grits (C) with none extruded (T1 and T2) and extruded corn meal (T3 and T4) in the aspect ratio 100% (T1 and T3) and 50% (T2 and T4) in the meal, while other components were in a similar relationship. The proportion of corn meal in the final mixture can be seen from Table 1.

Table 1

Diet formulations

Ingredient, %	Starter			Grower			Finisher		
	C	T1/T3	T2/T4	C	T1/T3	T2/T4	C	T1/T3	T2/T4
Corn, grain	53.20	–	26.60	59.00	–	29.50	64.00	–	32.00
Corn meal	–	53.20	26.60	–	59.00	29.50	–	64.00	32.00
Soyabean meal	28.00	28.50	29.00	23.00	23.30	22.60	23.00	22.00	22.00
Sunflower meal (42% SP)	6.00	7.00	6.00	6.00	7.00	7.00	4.00	5.00	5.00
Fish meal	5.50	4.00	4.50	4.00	2.60	3.30	–	–	–
Oil	4.10	4.00	4.00	4.50	4.40	4.50	5.30	5.00	5.20
Dicalcium phosphate	1.30	1.20	1.30	1.50	1.30	1.30	1.80	1.90	1.80
Limastone	0.60	0.80	0.70	0.60	1.00	0.90	0.70	0.90	0.80
Salt	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
DL-methionine	0.10	0.10	0.10	0.20	0.20	0.20	–	–	–
Premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

T1; T2 – Corn meal
T3; T4 – Extruded corn meal

Trials were made in the experimental conditions, with six repetitions in the standard fattening up to 42 days of age. 300 chickens (75 chickens × 4 repetitions) were in each treatment. For testing one-day chickens Hybro PN were used. Chickens were fed with three kinds of mixtures, and the food was *ad libitum*. Starter mixture is used in the first three weeks of age, grower was used from 21. to 35. and finisher mixture of 35. to 42. day old chickens. In composing mixtures was the hypothesis that the corn flour for its nutritive values slightly differ from the standard composition of corn grits. The study was performed in the floor of the rearing technology by the manufacturer instructions using hybrids. At the end of 42nd day of age 10 average broilers were selected by treatment (5 male + 5 female) for testing the slaughter parameters of carcasses.

By the computer program STATISTIC 7 (Stat Soft, 2007) the mean values and measures of variability were determined and checked the normal distribution in the examined characteristics. Also, the analysis of variance was performed by the ANOVA I method for the determination of properties that manifested statistically significant differences. Significant difference test was done by applying the LSD test on the 0.001% level of probability.

3. RESULTS AND DISCUSSION

From Table 2 we can see that the final body mass of chickens of C group (C – 2161 g), which used the standard meal with corn grits, was very little different from the groups which used none extruded corn meal in the mixture (T1 – 2168 g and T2 – 2164 g). Implemented differences can be attributed to random variations, because they were none statistically significant. Final body masses of broiler chickens were fed with extruded corn flour (T3 – 2261 g and T4 – 2244 g) were significantly better in comparison to the control (C), and the group chickens were fed with none extruded corn meal (T1 and T2). Body weights of group T3 chickens were statistically highly significant ($P \leq 0.001$) in relation to the group C, T1 and T2 chickens. Broiler chickens of the T4 group had significantly ($P \leq 0.05$) higher final average body mass in relation to the C, T1 and T2 groups. The difference between T3 and T4 groups of chickens was not statistically significant. Strugar et al. (2006) and Milošević et al. (2007) came to similar results in their research.

Table 2

Parameters of chicken meat production (42. day old ages)

Treatment	Start BW, g	Final BW, g	Growth/day, g	Mortality, %	FCR	P.I.[2]
C	41.20	2161^{bB}	51.45	5.00	1.930^{a}	253
T1	41.27	2168^{bB}	51.62	5.71	1.837^{b}	261
T2	41.33	2164^{bB}	51.52	3.64	1.838^{b}	262
T3	41.36	2261^{aA}	53.84	3.81	1.858^{b}	272
T4	41.28	2244^{a}	53.43	6.34	1.842^{b}	271

$^{a–b}$ Means within a column with different superscript letters differ significantly ($P \leq 0.05$)
$^{A–B}$ Means within a column with different superscript letters differ significantly ($P \leq 0.001$)
[1]BW – Body weight of chicken
[2]P.I. – Productivity index

The values of daily growth increase by treatments were ranged to adequate final body mass of chickens. Achieved average daily gains were at the level of more than 50 grams. Differences in daily gains of groups T3 and T4 chickens compared with other groups were highly statistically significant ($P \leq 0.001$).

The mortality of chickens by treatment was in the technological norms to 5.00%, except for T4 group which was slightly higher. In the T1 group mortality was very low (3.71%), which indicates the good quality of chickens and satisfactory conditions of rearing. Increased mortality of 6.34% from the chickens of group T4 could not be due to the influence of treatment, but other factors related to the ambient conditions and individual variations. It was shown that the differences in mortality between the groups were not significant because of large group internal variability.

Feed conversion within groups was standardized, and in expected technological frameworks for broiler chickens, which was allowed to do the intergroup testing. The average conversion by groups was in the limits of 1.837 to 1.930 kg / kg. The worst feed conversion had chickens of C group, and the difference compared to other experimental groups was statistically significant ($P \leq 0.05$). It was shown that the results regarding feed efficiency were in accordance with the earlier ones

that were explored and carried out with the same nutrition by Filipović et al. (2006), Strugar et al. (2006), Milošević et al. (2007), as well as with results that were obtained in their research with similar nutrition by Babidis et al. (2002), Abdel-Rachel et al. (2005), Brita et al. (2005). Production index as an important indicator of the effect of treatment indicates that the best results were achieved by chickens in the T3 group (272), and the control group of chickens (253) had the worst value of production. Since the variability in production number within the group was high, and the number of repetitions after all four, statistically significant differences between the groups were not found.

Major parameters of processing slaughter by treatments were done on chicken carcasses with average weight by sex. For both sexes collectively and abdominal fat content are given in Table 3.

Table 3

Parameters of processing slaughter

Treatment	Sex	Body weight, g	Processing percentage				Abdominal fat			
			KO, g	KO, %	SZP, g	SZP, %	SZR, g	SZR,%	g	%
C	M	2192	1870	85.30	1715	78.21	1525	69.56	30.7^{aA}	1.39
	F	2028	1715	84.58	1586	78.21	1414	69.74	27.6^{ab}	1.36
	M + F	2110	1792	84.94	1650	78.21	1470	69.65	29.1^{aA}	1.38
T1	M	2196	1835	83.55	1688	76.82	1506	68.52	20.1^{bc}	0.91
	F	2130	1788	83.94	1664	78.11	1496	70.19	25.4^{ab}	1.19
	M + F	2163	1812	83.74	1676	77.46	1501	69.36	22.8^{bAB}	1.05
T2	M	2012	1646	81.80	1483	73.70	1321	65.65	15.9^{cB}	0.79
	F	1964	1606	81.77	1504	76.58	1338	68.11	17.0^{cB}	0.87
	M + F	1988	1626	81.77	1494	75.11	1329	66.84	16.4^{cB}	0.83
T3	M	2222	1873	84.27	1731	77.88	1559	70.14	26.5^{ab}	1.19
	F	2170	1843	84.94	1715	79.03	1544	71.16	30.7^{aA}	1.41
	M + F	2196	1858	84.61	1723	78.45	1552	70.65	28.6^{aA}	1.30
T4	M	2270	1932	85.11	1784	78.57	1620	71.32	32.9^{aA}	1.45
	Ž	2170	1836	84.62	1709	78.75	1545	71.23	31.8^{aA}	1.47
	M + F	2220	1884	84.86	1746	78.66	1583	71.27	32.3^{aA}	1.46

$^{a–b}$ Means within a column with different superscript letters differ significantly ($P \leq 0.05$)
$^{A–B}$ Means within a column with different superscript letters differ significantly ($P \leq 0.001$)
KO – Processing percentage – traditional
SZP – Processing percentage – ready roast
SZR – Processing percentage – ready to broil

The influence of corn meal and its technological processed form (extrude) on dressing process of cooling carcasses is evident, because of the small number of repetitions per group, and high variability within the group, the differences between the groups were not statistically significant, which is in line with other researchers (Filipović et al. 2006; Strugar et al. 2006; Milošević et al. 2007). The effect of treatments on the content of abdominal fat has been evident for some groups. There were statistically high significant differences observed for sexes (M + F) between carcasses from C, T3 and T4 groups and T2 group of chickens. There were statistically significant differences for amount of abdominal fat for both sexes, between T1 and all other groups. However, these differences in abdominal fat content, especially a very low content of abdominal fat in chickens T2 group, should be taken with some caution because the testing was performed on a small sample of treated carcasses (5 male + 5 female) and random variations are quite possible. In the available literature similar differences in content of abdominal fat between the treatments are not found. This leads to

the extra care in making the conclusion of the influence of corn grits, in the relationship, on the content of abdominal fat.

4. CONCLUSION

In general, based on these investigations with full certainty it can be noted that the corn meal used in both forms (none extruded and extruded) of nutrition is of high quality that can be used without restrictions in diet of broiler chickens. It can be used in complete replacement of corn grits, and in other various combinations. When it is used as a meal form, the problem may occur only concerning the storage because it contains more moisture and it is time to be limited. In this study, the importance of extrusion of nutrition was showed. Chickens that were fed with extruded corn meal in both combinations of use had a better growing increase and the feed conversion was slightly lower in comparison to the groups which used none extrude corn meal.

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