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NUTRITIVE VALUE OF CORN MEAL IN NUTRITION OF FATTENING CHICKENS **

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Abstract: One of the by-products of corn processing which can succesfully be used in poultry nutrition is livestock meal. In this trial corn meal was investigated, meal in two form: non-extruded (T1 and T2) and extruded (T3 and T4) as a replacement of cracked corn (K) in the amount of 100% (T1 and T3) and 50% (T2 and T4). Investigation was carried out in 4 repetitions, 75 chickens of Arbor Acres x Ross 308 hybrid in each group. Trial lasted 42 days. Chickens were fed three standard mixtures (starter, grower and finisher).

Investigation demonstrated that group of chickens of treatment T3 realized the best final body masses (2254g), followed by chickens in treatment T4 (2173g), chickens of group T2 (2112g), K group (2106 g), and the worst results were established in chickens of group T1 (2103g). It was established that differences in final body mass of chickens from group T3 in relation to chickens from groups T1, T2, T4 and were statistically highly significant ($P<0,001$). Statistically significant differences ($P<0,05$) were established between body masses of chickens from group T4 in relation to T1, T2 and K group. Mortality of chickens was as followes: K-3,64%, T1-2,50%, and T2-5,00%, T3-6,39%, and T4-3,33%. Feed conversion in all investigated groups was almost identical (K-1,91; T2-,93; T3-1,93; T4-1,94) with the exception of T1 with 1,97. In regard to production index (PI), the best results were realized by group of chickens T3 (261), followed by chickens T4 (258), K (253), and the worst results were established in chickens of groups T1 (248) and T2 (248).

Key words: nutrition, corn meal, broiler chickens

Introduction

In food industry, corn is becoming important raw material for several products but also for production of ethanol. Many by-products of corn processing are used in poultry nutrition (gluten, germs, corn distillers solubles, dry, meal, etc.). New products appear on the market with declaration of changed chemical composition/content and changed nutritive value compared to existing corn products (*Waldroup, et al.* 1981*; NRC,* 1994*; Sauvant, et al.* 2002*; Spiehs, et al.* 2002*; Strugar et al.* 2006, *Milošević et al.* 2006). Corn meal represents by-product of food-mill industry in corn processing, it contains part of endosperm, subsequent to separation of fine fractions, seed coat and germ *(Filipović et al.* 2006). Considering the content of nutritive matters, corn meal has all the characteristics of energy feed. Since this is feed which has not yet been sufficiently studied, but is very similar to other feeds made of corn, it is to be expected that this is biologically very valuable feed, since it contains easy digestible carbon hydrates and considerable percentage of proteins (9-10%). It is especially useful in nutrition of fattening poultry because of the high energy and protein content necessary in their diets. Due to the presence of germ it is also rich in tocopherol (vitamin E), and therefore useful feed in nutrition of breeding poultry. By chemical analysis it was determined that corn meal contains 14,2% of mositure, 9,8% of crude protein, 3,26% of fibre, 49,6% of starch, 4,11% of sugar, 2,08% of fat, 0,12% of mineral matters, calcium 0,22% phosphorus and 1,28 mg/kg □caroten (*Milošević et al.* 2006). Contrary to some corn by-products in production of alcohol (ethanol) (*Saharan, et al.* 1999*; McNab and Boorman,* 2002*; Scheideler,* 2006) or corn gluten with bran (*Wilkinson and Barbee,* 1998*; Babidis, et al.* 2002; *Abdel-Raheem, et al.* 2005*; Brito et al.* 2005) this feed contains less protein, but more oils and starch and therefore in its nutritive value closer/more like corn shelled or oil corn (*Savić et al.* 1996). Content of metabolic energy was calculated according to *Jokiću et al.* (2004) in the amount of 14,28 MJ/kg. Objective of the investigation was to investigate nutritive values of non-extruded and extruded corn meal in nutrition of broiler chickens.

Material and Methods

Investigation of corn meal was based on replacement/substitution of corn

cracked (K) with non-extruded (T1 and T2) and extruded corn meal (T3 and T4) in ratio 50 (T2 and T4) and 100% (T1 and T3) in diet, while other components remained identical. Share of corn meal in finished mixtures is presented in table 1.

Table 1. Diet formulations

	Ingredients, %	Starter			Grower			Finisher		
		K	T1*/T3**	T2*/T4**	K	T1/T3	T2/T4	K	T1/T3	T2/T4
1	corn, grain	53,20	-	26,60	60,50	-	30,25	64,50	-	32,25
2	corn meal	-	53,20	26,60	-	60,50	30,25	-	64,50	32,25
3	soyabean meal	28,00	28,00	28,00	22,00	22,00	22,00	22,00	22,00	22,00
4	(42% SP) sunflower meal	6,00	6,00	6,00	6,00	6,00	6,00	5,00	5,00	5,00
5	fish meal	5,50	5,50	5,50	4,00	4,00	4,00	-	-	-
6	oil	4,00	4,00	4,00	4,00	4,00	4,00	4,50	4,50	4,50
7	DCF dicalcium phosphate	1,30	1,30	1,30	1,50	1,50	1,50	2,00	2,00	2,00
8	limestone	0,70	0,70	0,70	0,60	0,60	0,60	0,70	0,70	0,70
9	salt	0,20	0,20	0,20	0,20	0,20	0,20	0,30	0,30	0,30
10	DL-methionine	0,10	0,10	0,10	0,20	0,20	0,20	-	-	-
11	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 performed in experimental conditions with 4 repetitions in standard fattening in duration of 42 days. There were 300 chickens in each treatment (75 chickens x 4 repetitions). One day old chickens of Arbor Acres x Ross hybrid were used in this study. Chickens in trial were fed three different types of mixtures, and nutrition was ad libitum. Initial or starter mixture was used in first three weeks of age, the second or grower from 21to 35 days of age and finisher mixture from 35 to 42 days of age of chickens.

In formulation of mixtures the starting assumption was that corn meal in its nutritive value is slightly different to corn cracked of standard composition. Investigation was carried out in floor rearing system according to technological instructions provided by the producer of used hybrid. At the age of 42 days 10 average chickens were selected per treatment (5 male + 5 female) for investigation of slaughter parameters.

Results and Discussion

Data in table 2 show that final body masses of chickens from group K (K-2106 g) which used standard diet with cracked corn differed slightly from groups consuming non-extruded corn meal in mixtures (T1-2103g and T2-2112 g). Realized differences can be attributed to random variations since they weren't statistically significant. Final body masses of broiler chickens fed extruded corn meal (T3-2254 g and T4-2173 g) were considerably better compared to control (K), as well as chickens fed non-extruded corn meal (T1 and T2). Body masses of chickens in group T3 were statistically highly significantly greater ($P \leq 0,001$) compared to other groups of chickens in trial. Broiler chickens from group T4 had significantly ($P \leq 0,05$) higher average final body mass in relation to K, T1 and T2 groups.

Table 2. Parameters of chicken meat production (42. day old ages)

Treatment	Initial B.M.[1] g	Final B.M. g	Growth/day, g	Mortality,%	Conversion	P.I.[2]
K	40,10	2106^{bB}	50,13	3,64	1,91	253
T1	40,17	2103^{bB}	50,08	2,50	1,97	248
T2	40,13	2112^{bB}	50,29	5,00	1,93	248
T3	40,33	2254^{A}	53,66	6,39	1,94	261
T4	40,13	2173^{aB}	51,73	3,33	1,93	258

$^{a-b}$ Means within a column with different superscripts differ significantly ($P \leq 0,05$)
$^{A-B}$ Means within a column with different superscripts differ significantly ($P \leq 0,001$)
[1]B.M. Body weight of chicken
[2]P.I. Production number

Values of daily gains per treatment were adequate to final body masses of chickens. Average daily gains at the level of slightly above 50 grams were realized. Mortality of chickens per treatments was within technological norms bellow 5,00 %, except in group T3. In group T1 (2,50 %) it was very low which indicated high quality of chickens and satisfactory rearing conditions. Slightly higher mortality 6,39 % was recorded in group T3, but this can not be consequence of the effect of treatment but most probably some other factors, primarily environment. The differences in mortality between groups weren't considerably significant because of the high variability within the group.

The effect of corn meal on quality of carcasses wasn't observed, but there

was some effect on content of abdominal fat between carcasses of chickens from group T1 and other groups, and these differences were statistically significant. However, these differences in content of abdominal fat should be considered with a certain reservation since the investigation was carried out on small sample of processed carcasses (5 male + 5 female) so random variations are certain.

Table 3. Parameters of procesaing slaughter

Treatment	sex	Body weight, g	Processing percentage						Ab. fat	
			KO, g	KO, %	SZP, g	SZP, %	SZR, g	SZR,%	g	%
K	M	2088	1764	84,45	1618	77,45	1439	68,89	29^{a}	1,64
	Ž	1916	1618	84,45	1496	78,81	1334	69,63	26^{abc}	1,61
T1	M	1915	1534	80,04	1469	76,71	1265	64,99	15^{d}	0,98
	Ž	1868	1534	82,11	1419	75,98	1264	65,55	17^{d}	1,11
T2	M	2092	1731	82,73	1529	76,07	1421	67,85	19^{bcd}	1,10
	Ž	2028	1687	83,17	1570	77,39	1411	69,55	24^{ac}	1,42
T3	M	2160	1823	84,38	1683	77,89	1528	70,71	31^{a}	1,70
	Ž	2068	1732	83,77	1612	77,96	1458	70,51	30^{a}	1,72
T4	M	2116	1767	83,48	1633	77,15	1471	69,49	25^{ac}	1,42
	Ž	2064	1739	84,25	1618	78,38	1457	70,58	29^{a}	1,66

$^{a-d}$ Values within the column with different letters vary significantly ($P \leq 0,05$)
KO - Processing percentage - traditional
SZP - Processing percentage - ready roast
SZR - Processing percentage - ready to broil

Conclusion

In general, based on performed research, it can be concluded with certainty that corn meal used in both forms (non-extruded and extruded) is high quality feed which can be used withou limitations in nutrition of broiler chickens. It can be used as complete replacement of cracked corn, or in different substitution combinations. The single problem arising from use of meal form of feed is its storasge since it contains slightly more moisture and therefore stroage is limited.

NUTRITIVNA VREDNOST KUKURUZNOG STOČNOG BRAŠNA U ISHRANI PILIĆA U TOVU

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Rezime

U radu je dat efekat primene neekstrudiranog (T1 i T2) i ekstrudiranog (T3 i T4) kukuruznog stočnog brašna u ishrani brojlerskih pilića. U smešama kukuruz (K) je zamenjen kukuruznim stočnim brašnom u iznosu 50% (T2 i T4) i 100% (T1 i T3). Ogled je trajao 42 dana po sistemu 5 x 4 (5 tretmana x 4 ponavljanja). U svakom tretmanu je bilo po 300 pilića. Ishrana je bila ad libitum sa tri smeše: starter sa 23,30% SP i 12,78 MJ/kg ME, grover sa 20,30% SP i 13,10 MJ/kg ME, i finišer 17,70% SP i 13,25 MJ/kg ME.

Retultati ispitivanja su bili sledeći: telesne mase K-2106g, T1-2103g, T2-2112g, T3-2254g, i T4-2173g; dnevni ptirast K-50,13g, T1-50,08g, T2-50,29g, T3-53,66g, i T4-51,73g; mortalitet pilića K-3,64%, T1-2,50%, T2-5,00%, T3-6,39%, i T4-3,33%; Konverzija hrane K-1,91 kg/kg, T1-1,97 kg/kg, T2-1,93 kg/kg, T3-1,93 kg/kg, i T4-1,94 kg/kg. Pokazalo se da su razlike u završnoj telesnoj masi pilića iz T3, u odnosu na T1, T2, T4 i K grupe, bile statistički visoko značajne ($P<0,001$). Uzvrđene su statistički značajne razlike ($P<0,05$) između telesnih masa grupe pilića T4 u odnosu na T1, T2 i K grupe. Randmani su bili ujednačeni po grupama, a razlike u sadržaju abdominalne masti u trupovima su bile minimalne ali nešto niže kod petlića i kojica grupe T1 i petlića T2. Razlike su bile su statistički značajne.

Ključne reči*:* Ishrana, kukuruzno stočno brašno, brojlerski pilići

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