

CHEMICAL COMPOSITION AND EFFECTS THE DIETARY CORN BY-PRODUCTS ON BROILER PERFORMANCE

COMPOZIȚIA CHIMICĂ ȘI EFECTELE UTILIZĂRII UNOR SUBPRODUSE DIN PORUMB ASUPRA PERFORMANȚELOR PRODUCTIVE LA PUII BROILER

CIURESCU GEORGETA

National Research-Development Institute for Animal Biology and Nutrition, Balotești,
Romania, (ciurescugeorgeta@yahoo.com)

The paper presents a study conducted in INCDBNA –BALOTEȘTI on 840 Ross- 308 broilers from hatching to 42 days. The broilers were assigned to 3 groups (control – C, and two experimental – GLU and GERM), with 280 broilers per group (3 groups × 2 replicates × 140 broilers). Three compound feeds formulations were used, one control and two experimental. The control diet was based on corn, soybean meal, full fat soy and fish meal; in the experimental groups the fish meal was replaced by corn gluten (GLU); in the other experimental group the full fat soy was replaced by corn germs (GERM). All compound feeds formulations were isoprotein, isocaloric and contained equal levels of total and digestible sulphur amino acids, lysine, calcium and available phosphorus, in agreement with the feeding requirements recommended for the intensive rearing of these performing hybrids. The broilers were phased feed with diets according to their age: start (0 – 14 days), grower-developer (15 – 28 days) and finisher (29 – 42 days). The monitored productive parameters were: average daily feed intake (g); body weight evolution by growth stage (g); feed conversion ratio (g feed/g gain); stock liveability (%); slaughtering yield and proportion of carcass parts (%), economic efficiency (%).

Key words: corn gluten, corn germs, broilers, performance, slaughtering yield

Introduction

The poultry with improved genotypes used mainly in the modern zootechnical units are exploited for increasingly higher performance, which requires the formulation of diets adequate to the new breeds and hybrids, which require less feed for the same performance. It is known the trend to obtain as much as possible muscle, meat with a higher content of protein, which requires more dietary amino acids. To make proper use of the genetic potential of the poultry, the compound feed must fit the feeding requirements of these improved breeds and hybrids. Researchers have been concerned during the past years to find new feeding solutions for poultry which to yield high performance on low costs. Poultry

feeding uses two main types of raw ingredients: cereals and industrial by-products. The corn and soybean meal became indispensable to the detriment of the animal by-products currently contested by EU regulations.

Fishmeal supplies animal protein and it is very important for growing poultry diets. It is included in the diets according to availability and cost. Its biological value is very high ranging between 72.48% and 91.20% and 70% amino acids correlation. Fishmeal preservation depends on its content of water and fat. Its stabilisation with antioxidants immediately after manufacture decreased by 17% the loss of metabolisable energy and improved lysine and methionine digestibility. The ammonia content must not exceed 0.2%.

Corn gluten might be an alternative source of energy to fishmeal in poultry diets yielding similar performance. Corn by-product from the starch industry it has a high content of metabolisable energy and protein (60-62%), a concentrated source of xanthophylls which can complete the ingredients poor in pigments; it also is an excellent source of sulphur amino acids (methionine particularly) but lacks lysine and tryptophan. This fact and its cost are the main limiting factors for its utilisation. Another disadvantage is the susceptibility to get contaminated by aflatoxin due to improper storage. The gross chemical composition of the product „*corn gluten*” (supplied by SC Amylon SA- Sibiu), analysed by INCDBNA- Balotești was: dry matter – 86.78%, crude protein – 63.09%, digestible protein – 60.56%, ether extractives – 9.81%, gross fibre – 1.98%, ash – 2.86%, metabolisable energy – 3675 kcal/kg product.

Corn germs – another by-product of the starch and glucose industry is obtained from the full fat corn germs. They can be used as such in animal diets or they can be used to extract the oil and thereafter use the resulting meal. They have a medium nutritive value (10.36% PB), but the high fat content (47.07%), most of which is oleic acid, gives it a high-energy value. Due to the presence of carotenoids pigments and zeaxanthine the corn germs give a proper colour to the yolk and teguments. The gross chemical composition of the product „*corn germs*” (supplied by SC Amylon SA- Sibiu), analysed by INCDBNA- Balotești was: dry matter – 95.60%, crude protein – 10.36%, digestible protein – 9.63%, ether extractives – 47.07%, gross fibre – 8.36%, ash – 1.41%, metabolisable energy – 5050 kcal/kg product. Tables 1 and 2 show the content of amino acids and fatty acids of the average sample expressed in g/100g product, as well as the indices of fat degradation.

The purpose of the study was to determine the nutritive value and to quantify the productive and carcass quality effects of the compound feeds for broilers which incorporated corn processing by-products replacing fishmeal (corn gluten) or used as source of energy and protein (corn germs).

Table 1.**Amino acids content (g/100g)**

Specification	Corn gluten	Corn germs
Lysine	1.03	0.52
Methionine	1.49	0.22
Histidine	1.11	0.32
Arginine	1.79	0.74
Aspartic acid	4.09	0.87
Threonine	2.25	0.42
Serine	3.52	0.51
Glutamic acid	10.32	1.48
Proline	5.83	0.69
Glycine	3.08	0.58
Alanine	6.02	0.73
½ Cystine	0.62	0.11
Valine	3.14	0.56
Isoleucine	2.24	0.35
Leucine	9.08	0.93
Tyrosine	2.78	0.42
Phenylalanine	3.81	0.45

Table 2.**Fatty acids profile and fat degradability indices (g/100 g fat)**

Specification	Corn gluten	Corn germs
<i>Saturated fatty acids</i>		
Myristic acid	0.04	0.20
Palmitic acid	13.68	12.81
<i>Unsaturated fatty acids</i>		
Palmitoleic acid	-	0.31
Stearic acid	0.67	0.72
Oleic acid	31.61	31.20
Linoleic acid	52.69	53.56
Llinolenic acid	1.31	1.20
<i>fat degradability indices</i>		
Peroxide index (ml sodium thyosulphate 0.01 N / g fat)*	-	5.58
Fat acidity (mg KOH / g fat)**	-	3.05
Kreiss reaction	-	positive

* maximal limit 1.2 ml sodium thyosulphate 0.01 N / g fot for plant oils;

** maximal limit 50 mg KOH / g fat in feeds.

Materials and Methods

The trial was performed in the experimental farm of INCDBNA- Balotești on 840 Ross- 308 broilers over the age period 0 – 42 days. The broilers were assigned to 3 groups, a control group and two experimental groups (GLU and GERM), with 280 broilers each (3 groups x 2 replicates x 140 broilers).

Three compound feeds formulations were used, one control and two experimental. The control diet was based on corn, soybean meal, full fat soy and fish meal; in the experimental groups the fish meal was replaced by corn gluten (GLU); in the other experimental group the full fat soy was replaced by corn germs (GERM).

All compound feeds formulations were isoprotein, isocaloric and contained equal levels of total and digestible sulphur amino acids, lysine, calcium and available phosphorus, in agreement with the feeding requirements recommended for the intensive rearing of these performing hybrids.

The broilers were phased feed with diets according to their age: *start* (0 – 14 days), *grower-developer* (15 – 28 days) and *finisher* (29 – 42 days). The broilers had free access to the feed and water. The light regimen was continuous (24h) throughout the experimental period.

The broilers were housed in a house with microclimate conditions similar to those in a farm house with soil rearing, on permanent litter (wood shavings) and in separate pens for each group and replicate.

The broilers were vaccinated according to the sanitary-veterinary program specific to this category of poultry and treated with anticoccidiostatics in prevention dose

The monitored productive parameters were: average daily feed intake (g); body weight evolution by growth stage (g); feed conversion ratio (g feed/g gain); stock liveability (%); slaughtering yield and proportion of carcass parts (%), economic efficiency (%).

In the end of the experiment, 8 broilers per experimental variant were starved for 2 hours, then weighed and slaughtered; the carcasses (including the head+neck, feet, abdominal fat+organs) were weighed individually to calculate the slaughtering yield.

Statistical calculation: the data were processed statistically by the Fisher test; the Student – t test was used to detect the significant differences between the experimental groups; the differences between groups were considered statistical for $P < 0.05$.

Results and Discussions

Table 3 shows data regarding broiler performance during the experimental period. The body weight of GLU and GERM broilers were slightly lower but not significantly influenced ($P > 0.05$) by the inclusion level. Thus, broiler weight at 42 days was 1847.25 g in group M; 1815.22 g in group GLU and 1830.95 g in group GERM.

The cumulated gain over the experimental period was 1800.50 g in group M and 1769.86 g in group GLU, 1.70% lower than in group C. In group GERM the gain was 1785.47 g, with just 0.83% lower than in group C.

Feed conversion ratio was 2.21 g CF/ g gain in group C, 2.16 g CF/ g gain in group GLU and 2.17 g CF/ g gain in group GERM.

Stock liveability was not influenced by the level of corn gluten inclusion for *starter* and *grower-developer* and/ or of the corn germs for *starter*, *grower-developer* and *finisher* periods.

The economic efficiency was improved in the experimental groups: cost of XF/kg gain was 2.75% lower in GLU, and 2.40% in GERM, compared to C.

Table 4 shows the slaughtering yield and the proportion of carcass parts. The average values are close among groups which show that the diets did not influence the quality parameters of the broiler carcasses.

No other major effects due to the diets were noticed.

Table 3.

Effects of fishmeal replacement by corn gluten and/or full fat soy replacement by corn germs of broiler performance

VARIANT	Control	Experimental	
		GLU	GERM
Characteristic			
Initial weight (g)	46.75	45.36	45.48
Weight at 7 days (g)	161.87	155.53	145.37
Weight at 14 days (g)	394.27	364.80	374.40
Weight at 21 days (g)	700.73	688.47	706.20
Weight at 28 days (g)	1022.99	997.46	995.55
Weight at 35 days (g)	1412.38	1458.38	1408.25
Final weight at 42 days ¹⁾ (g)	1847.25	1815.22	1830.95
Total period (0-42 days)			
Cumulated gain (g)	1800.50	1769.86	1785.47
Average daily gain (g/day)	42.87	42.14	42.51
Differences, compared to C (%)	100	-1.70	-0.83
Cumulated feed intake (g)	3985.00	3830.00	3868.00
Average daily intake (g/day)	94.88	91.19	92.10
Feed conversion ratio (g feed/g gain)	2.21	2.16	2.17
Cost CF/kg gain (% compared to C)	100	97.25	97.60
Stock liveability (%)	96.00	96.00	96.67

1)- Not significant differences (P>0.05)

Table 4.
Slaughtering yield, percentage of carcass parts, organs and abdominal fat

CHARACTERISTIC	VARIANT	CONTROL	EXPERIMENTAL	
			GLU	GERM
Live weight (g)		1996.25	1962.50	1952.50
Eviscerated carcass (g)		1622.00	1604.50	1597.75
Eviscerated carcass (g) *		1477.00	1461.50	1447.50
Eviscerated carcass (g) **		1385.75	1371.0	1350.0
Eviscerated carcass (g) ***		1529.50	1514.0	1500.25
Head		3.33	3.51	3.47
Neck		4.86	4.87	5.07
Feet		5.61	5.69	5.93
Wings		9.79	9.92	9.87
Back		18.13	17.85	16.57
Breast		25.99	26.53	25.69
Legs		25.69	25.82	26.63
Abdominal fat		0.99	0.80	0.66
Organs:				
- liver		2.56	2.63	2.79
- heart		0.48	0.50	0.55
- gizzard		2.66	2.38	2.77
Slaughtering yield (%)		81.25	81.76	81.83

* - Eviscerated carcass, without head + feed

** - Eviscerated carcass, without head + feed + organs

*** - Eviscerated carcass, without organs

Conclusions

The results show that:

1. *Fishmeal* and/or *full fat soy* can be replaced by *corn gluten* in the *starter* and *grower finisher* compound feeds for broilers without affecting significantly broiler performance and carcass yield. The cost of feeds/kg gain decreased by 2.75% (gluten), and by 2.40 % (germs), compared to the control.

2. Because both products are rich in fat: 9.81% - *corn gluten* and 47.07% - *corn germs*, we consider that these products must be supplemented with antioxidants during their manufacture to preserve their quality. This would also increase further broiler performance.

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