Bioproductive effect of a protein concentrate on the performance of broiler chicks

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Abstract

A total of 420 Arbor Acres broiler chicks were used from 11 to 42 days of age in an experiment testing three compound feed (CF) formulations, a control and two experimental formulations. The control formulation was based on corn, soybean meal and fish meal, while in the experimental diets soybean meal and fish meal were replaced by a protein concentrate in amount of 3 and 6% respectively of the formulation according to the growth period (starter and growth-development). The results have shown that the protein concentrate obtained from processed waste brewer's yeast may be used as protein source for broilers replacing up to 22.86% of the soybean meal and/or up to 25% of the fish meal (during the growth-development period).

Keywords: feedgrade yeast, *Saccharomyces cerevisiae*, broilers, gain, feed conversion ratio

Introduction

Yeasts are one of the biotechnological products produced in large amounts worldwide, while *Saccharmoyces cerevisiae* is the most widely used microorganism used by the current bioindustry. A large share of the yeasts is used in bakeries and for alcohol production.

Feedgrade yeasts can replace part of the plant and animal protein sources used in poultry feeding. Yeast content of essential amino acids is quite similar to that of the soybean meal; the lower biological value of the protein due to the lower level of sulfur amino acids and arginine, may be easily improved by the addition of synthetic amino acids (DL-methionine, L-arginine).

Feedgrade yeasts also are an important source of vitamins from B complex (particularly folic acid and biotin) and of vitamin D_2, of macro- and trace elements, of enzymes (Popa, 1986; Sefton, 1998).

The energy content of the yeasts is average due to the lack of lipids and digestible sugars, while the quite large amount of nucleic acids (DNA and RNA) may cause metabolic problems if ingested in excess (Larbier and Leclercq, 1992).

The studies conducted on broilers fed on compound feeds containing yeasts have shown that there were no adverse effects on the look, flavor and nutritive properties of the broiler meat (Pană, 2000).

The use of larger amounts of yeasts in compound feeds for poultry requires an analysis of the nutritional and economic aspects of feeding, namely the cost of yeasts compared to the cost of soybean meal and fish and/or meat meals.
The purpose of the bioproductive test was to quantify the technical and economic effects of using in broiler diets a protein concentrate obtained from processed waste brewer's yeast.
The chemical analyses conducted in our laboratories on an average sample (supplied by SC. SEMBODJA SRL) revealed the following:

Analysis	MU	Method	Result
Dry matter, 105^0 C	%	gravimetry	95.42
Crude protein	%	Kjeldhal - Tecator	47.85
Ether extractives	%	Soxhlet - Tecator	0.52
Crude fiber	%	Fiber - Tecator	below detection
Ash	%	gravimetry	6.58
Total chloride	%	volumetry	1.082
Vitamin B_1	mg %	fluorometry	1.46
Vitamin B_2	mg %	fluorometry	2.50
Iron	mg %	AES - ICP Beckman Spectraspan	38.27
Copper	mg %	AES - ICP Beckman Spectraspan	0.86
Manganese	mg %	AES - ICP Beckman Spectraspan	1.66
Zinc	mg %	AES - ICP Beckman Spectraspan	3.13

The amino acid content of the average sample expressed in g/100 g product was as follows:

Analysis	MU	Method	Result
Crude protein	%	Kjeldahl - Tecator	47.85
Lysine	g/100 g	Cromatography - Carlo Erba analyzer	2.864
Methionine	g/100 g	- //-	1.047
Histidine	g/100 g	- // -	1.525
Arginine	g/100 g	- //-	1.904
Aspartic acid	g/100 g	- // -	5.696
Threonine	g/100 g	- // -	2.919
Serine	g/100 g	- // -	3.831
Glycine	g/100 g	- // -	3.819
Alanine	g/100 g	- // -	4.961
Isoleucine	g/100 g	- // -	2.223
Leucine	g/100 g	- // -	3.088

Material and methods

The experiment was conducted on 420 Arbor Acres broiler chicks supplied by SC "AGRISOL INT.RO" SRL from 11 to 42 days of age. The broilers were assigned to three groups as follows: a control group (C) and two experimental groups (E1 and E2) with 140 broilers each. The birds were raised on the floor on permanent litter and in separate cages for each group.

The light regimen was 23 hours light and 1 hour darkness throughout the experimental period.

Broilers had free access to feed and water.

The broilers received compound feed formulations according to their age: starter (11-28 days) and growth-development (29-42 days). All chicks received a pre-starter CF formulation during the first 10 days of life,

The trial used three CF formulations, a control and two experimental ones. The control formulation was based on corn, soybean meal and fish meal, while in the experimental formulations the soybean meal and fish meal were replaced with a protein concentrate in amount of 3 and 6% respectively of the formulation. This amount replaced (according to the developmental stage) 6.64-13.28% of the dietary crude protein for E1 and 7.31-14.57% of the dietary protein for E2.

The three formulations were isocaloric, isoproteic and contained equal amounts of sulfur amino acids, lysine, calcium, and total phosphorus, according to the norms and nutritional requirements recommended for the intensive growth of this category of poultry (NRC, 1994).

Tables 1 and 2 show the compound feed formulations and the nutrient level.

Table 1 *Compound feed formulation, %*

Ingrediente	Stage I			Stage II		
	C	E1	E2	C	E1	E2
Corn	53.85	53.76	54.46	58.24	56.36	55.57
Soybean meal	31.50	28.00	24.30	29.00	29.00	27.20
Protein concentrate	-	3.00	6.00	-	3.00	6.00
Fish meal	6.00	6.00	6.00	4.00	2.00	1.00
Oil	5.60	5.80	5.80	5.20	5.80	6.20
Monocalcium phosphate	1.10	1.10	0.98	0.97	1.00	1.10
Feedgrade limestone	1.00	1.00	1.00	1.20	1.40	1.45
Salt	0.15	0.15	0.15	0.15	0.15	0.15
Vitamin-mineral premix A_1	1.00	1.00	1.00	-	-	-
Vitamin-mineral premix A_2	-	-	-	1.00	1.00	1.00
DL-methionine	0.15	0.19	0.19	0.24	0.26	0.25
L-lysine	-	-	-	-	0.03	0.08

Table 2 *Nutrient level in the experimental feed formulations*

Ingrediente	Stage I			Stage II		
	C	E1	E2	C	E1	E2
ME (MJ/Kg feed)	13.28	13.27	13.29	13.33	13.31	13.33
Crude protein	21.58	21.51	21.54	19.51	19.56	19.63
Methionine	0.52	0.54	0.55	0.53	0.53	0.53
Met.+cyst.	0.84	0.84	0.84	0.83	0.83	0.83
Lysine	1.25	1.25	1.23	1.08	1.08	1.08
Calcium	0.89	0.89	0.89	0.87	0.86	0.85
Phosphorus, total	0.74	0.75	0.74	0.62	0.62	0.65
Phosphorus, available	0.45	0.45	0.45	0.36	0.36	0.38

The broiler received vaccines according to the Sanitary-Veterinary program specific to this category of poultry and were treated with anticoccidiostatics (Sacox or Monensin) in prophylactic dose.

Monitored parameters

- daily feed intake (g);
- body weight evolution, by stage of growth, at 28 and 42 days (g);
- average daily gain by stage of growth (g);
- feed conversion ratio (kg CF/kg gain);
- health state of the stock;
- carcass weight and slaughter yield.

At the end of the experiment 8 broilers (4 male and 4 female) from each experimental variant were starved for 3 hours, then weighed and slaughtered; the carcasses were weighed individually to obtain data on the slaughter yield (including abdominal fat, heart, liver and gizzard).
The data were processed by variance analysis using ANOVA software; the differences between groups were considered statistical for $p<0.05$.

Results and discussion

Table 3 shows the data on broiler performance. The statistical processing of the data on broiler live weight at 28 and 42 days and of the daily feed intake by period did not reveal significant differences between groups, the average values being similar to the control group ($p>0.05$).
Table 4 shows data on carcass weight, slaughtering yield and mortality.
Carcass weight and slaughter yield were not influenced significantly ($p>0.05$) by the CF formulation. No other major effects due to CF formulations were observed.

Table 3 *Broiler performance*

		C	E1	E2
I period (11-28 days)				
Initial weight [1)]	g	210.71	228.21	223.57
Final weight [1)]	g	1146.40	1185.23	1145.32
Gain	g/day	52.00	53.20	51.20
Feed intake[1)]	g/day	87.18	86.55	86.13
Feed conversion ratio	g/g	1.68	1.63	1.68
II period (29-42 days)				
Initial weight [1)]	g	1146.40	1185.23	1145.32
Final weight [1)]	g	2090.58	2079.71	2055.19
Gain	g/day	67.40	63.90	65.00
Feed intake[1)]	g/day	163.04	163.56	168.44
Feed conversion ratio	g/g	2.42	2.56	2.59
Overall period (11-42 days)				
Initial weight [1)]	g	210.71	228.21	223.57
Final weight [1)]	g	2090.58	2079.71	2055.19
Gain	g/day	58.70	57.90	57.20
Feed intake[1)]	g/day	121.30	121.06	122.42
Feed conversion ratio	g/g	2.07	2.09	2.14

[1)] Not significant difference for$P > 0.05$

Table 4 *Carcass weight, slaughtering yield and mortality*

Experimental variant	Live weight, g	Carcass weight, g	Slaughter yield, %	Mortality, %
Control (female)	1962.50	1574.50	80.23	
Control (male)	2162.50	1752.00	81.02	4.13
E1 (female)	1912.50	1525.30	79.75	
E1 (male)	2012.50	1611.00	80.05	3.75
E2 (female)	1987.50	1571.00	79.04	
E2 (male)	2087.50	1667.50	79.88	5.00

Conclusions

Feeding the broilers with up to 6% protein concentrate of the CF formulation did not change significantly broiler performance (final body weight and feed conversion ratio) during both growth stages, the average values being similar to the control group.

The results show that the protein concentrate processed from waste brewer's yeast may be used as protein source for broilers replacing up to 22.86% of the soybean meal during the starter period. During the growth-development period (29-42 days) the product may replace 6.21% of the soybean meal and up to 25% of the fish meal, which could save money according to the price of the protein concentrate and to its dietary level.

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