Brazilian Journal of Poultry Science
Revista Brasileira de Ciência Avícola

ISSN 1516-635X Jul - Sep 2004 / v.6 / n.3 / 159 - 161

Use of Mannanoligosaccharides in Broiler Feeding

■ Author(s)

Flemming JS[1]
Freitas JRS[1]
Fontoura P[1]
Montanhini Neto R[2]
Arruda JS[2]

[1] Post-Graduation Program on Food Technology ST/UFPR.
[2] DVM – Cooperativa Agrícola Consolata Ltda (COPACOL).

■ Mail Address

José Sidney Flemming
Departamento de Zootecnia
Rua dos Funcionários, 1540
Bairro Cabral
80.035-050 - Curitiba, PR.

E-mail: flemmingjs@yahoo.com.br

■ Keywords

Broiler diets, alternative growth promoters, additives in broiler diets.

■ Acknowledgements

The authors thank Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) for financial support.

Arrived: april / 2004
Approved: august / 2004

ABSTRACT

A study with 2,400 broilers was carried out to compare the effect of the use of mannanoligosaccharides, *Saccharomyces cerevisiae* cell wall or growth promoter (Olaquindox) in the diet on broiler. Diets were based on corn and soybean meal. A completely randomized experimental design was used, and the obtained data were evaluated by analysis of variance and test of Tukey at a level of 5%. The following parameters were measured: feed intake, daily weight gain, feed conversion ratio, and mortality. It was concluded that the effect of the inclusion of mannanoligosaccharides in the diet on the studied parameters was significantly higher as compared to the inclusion of cell wall or to the control diet, but the effect was not different as compared to the inclusion of growth promoter.

INTRODUCTION

Prebiotics are products containing carbohydrates, which main component is mannose. These products are commonly use to reduce the colonization of the intestinal tract by enteropathogenic bacteria. Probiotics are mainly represented by mannanoligosaccharides (MOS) and fructo-oligosaccharides (FOS), present in the cell wall of yeasts, such as *Saccharomyces cerevisiae*. They exert their action by maintaining or reestablishing the conditions of eubiosis in the digestive tube, and thus, the normal microbial flora and the balance of the gastrointestinal tract (Santin *et al.,* 2001).

These oligosaccharides are usually represented by the mannanoligosaccharides, and have the ability to bind to the fimbria of pathogenic bacteria, favoring the competitive exclusion by probiotics, as well as the population of the intestinal mucosa by eutropic microorganisms. Mannanoligosaccharide prebiotics can be used as substrate by bacteria, and some authors attribute increase in mineral retention and better bone mineralization in broilers fed these products (Bradley & Savage, 1994). As eutropic bacteria and mannanoligosaccharides are added, balance conditions become permanent, preventing the establishment of *Salmonella, E. coli, Clostridium,* among others, and increasing the number of beneficial lactic-acid producing bacteria, thus maintaining eubiosis (Oyofo *et al*, 1999).

This study aimed at evaluating the live performance of broilers fed different diets containing different oligosaccharides and to compare them with growth promoters presently used in the poultry industry.

MATERIAL AND METHODS

The experiment was carried out in an experimental poultry house of Cooperativa Agricola Consolata Ltda (COPACOL), Brazil. A total number of 2,400 Ross commercial broilers, of both sexes, equally distributed

into 24 pens (100 birds per pen), with wood shavings litter and equipped with feeders and drinkers. Broilers were submitted to four treatments (six replicates): (T1) control feed, no growth promoter; (T2) feed containing the antibiotic growth promoter (Olaquindox; 50 gr/ton); (T3) feed containing mannanoligosaccharide (MOS, 500 g/ton); and (T4) feed containing *Saccharomyces cerevisiae* cell wall (SCCW; 500 g/ton) Birds and feed residues were weekly weighed to measure feed intake, daily weight gain, and feed conversion ratio. Mortality data were recorded daily. The experimental design used was randomized blocks. The experimental period was 1 to 42 days of age. The statistical analysis of data on weight, daily weight gain, feed intake, feed conversion ratio, and mortality was carried out using the software ESTAT 2.0 (1992); means were compared by the test of Tukey at a probability level of 5%.

RESULTS AND DISCUSSION

Feed intake, daily weight gain and feed conversion ratio results during the different rearing stages are presented in Table 1.

promoters, which also reduce pathogen colonization, thereby improving poultry performance (Miles *et al*, 1989).

Table 2 shows the data of the total experimental period. It is possible to observe that birds fed the SCCW diet presented lower feed intake as compared to those fed antibiotics. Daily weight gain was significantly higher in birds fed growth promoter (antibiotic) or MOS as compared to those fed the control diet and that containing SCCW. However, no significant differences were found in feed conversion ration or mortality among the treatments.

The best results presented by the birds fed MOS are probably due to an improvement of the integrity of the intestinal mucosa and reduction of the stress on the mucosa caused by the presence of mannanoligosaccharides, thereby increasing the absorption and utilization of the dietary nutrients (Crumplen *et al*, 1989; Bradley & Savage, 1994).

Birds fed growth promoter presented higher feed intake and daily weight gain. We speculate that these results may be due to the elimination of undesirable microorganisms from the gastrointestinal tract. These

Table 1 - Feed intake (FI), daily weight gain (ADG), and feed conversion ratio (FCR) means of broilers during different production stages.

	1 to 10 days			1 to 28 days			1 to 42 days		
	FI (g)	ADG (g)	FCR (g/g)	FI (g)	ADG (g)	FCR (g/g)	FI (g)	ADG (g)	FCR (g/g)
Control	593^{b}	30^{a}	1.37^{b}	2048^{a}	48^{a}	1.55	4079^{ab}	53.4^{a}	1.82
Growth promoter	603^{a}	30^{a}	1.38^{b}	2048^{a}	49^{a}	1.48	4128^{a}	56.1^{a}	1.75
MOS	597^{ab}	30^{a}	1.39^{b}	2033^{a}	48^{a}	1.50	4094^{ab}	55,0^{b}	1.77
SCCW	599^{ab}	26^{b}	1.55^{a}	1959^{b}	45^{b}	1.52	3980^{b}	53,7^{b}	1.77

*Values within a column not followed by a common letter are significantly different by the test of Tukey ($p<0.05$).

Birds fed with the diet containing MOS and the diet containing antibiotic showed higher feed intake during the different production stages. They also had higher daily weight gain during the stages 1-10 days of age and 1-28 days of age, which may be attributed to the higher feed intake. During the stage of 1-42 days of age, birds fed SCCW improved daily weight gain, reaching the same daily weight gain and feed conversion ratio as the birds fed MOS and antibiotics.

Gibson & Roberfroid (1995), evaluating the use of indigestible carbohydrates, such as plant and yeast cell wall – classified as MOS complexes (glucomannanproteins, and particularly mannanoligosaccharides) –, found that carbohydrates can bind to the fimbria of bacteria, thus inhibiting the colonization of the gastrointestinal tract by pathogenic microorganisms. These findings are similar to those found with the use of growth

Tabela 2 - Feed intake (FI), daily weight gain (DWG), and feed conversion ratio (FCR) and mortality (MORT) means of 1 to 42-days old broilers.

	FI (g)	ADG (g)	FCR (g/g)	MORT. (%)
Control	4079^{ab}	53.4^{a}	1.82	4.17
Growth promoter	4128^{a}	56.1^{a}	1.75	2.67
MOS	4094^{ab}	55.0^{b}	1.77	2.00
SCCW	3980^{b}	53.7^{b}	1.77	2.17

*Values within a column not followed by a common letter are significantly different by the test of Tukey ($p<0.05$).

microorganisms decrease nutrient absorption, increase the rate of passage of the digesta, and interfere with intestinal cell wall turnover rate and the thickness of the intestinal mucosa (Visek,1978; Miles *et al*, 1989).

Table 3 shows the evolution of average weights (in grams) of the birds in the different treatments during

the experimental period. No significant differences were found between the results from broilers fed MOS or antibiotic. When MOS-fed birds were compared to those SCCW-fed, it is observed that MOS produced better results. The control treatment, with no addition of any product, presented the worst results.

The conditions for the establishment of desirable microorganisms and their replication promoted by oligosaccharides are described by Gibson & Roberfroid (1995) in an extensive study with plant and yeast cell walls containing high concentrations of mannanoligosaccharides.

Table 3 - Evolution of mean weights (in grams), according to treatments, during the experimental period.

	Initial weight	Weight at 14 days	Weight at 28 days	Weight 1 to 42 dias
Control	43.0	432[a]	1351[a]	2288[b]
Growth promoter	43.2	436[a]	1377[a]	2398[ab]
MOS	43.0	428[a]	1349[a]	2353[a]
SCCW	42.6	386[b]	1286[b]	2297[b]

*Values within a column not followed by a common letter are significantly different by the test of Tukey ($p<0.05$).

Table 4 - Experimental diets using during the experiment (kg/ton).

Ingredients	Starter 1 at 14 days	Growning 15 at 28 days	Finisher 29 at 42 days
Yellow corn	595,0	647,0	684,5
Soybean meal (45% CP)	310,0	237,0	203,0
Meat meal (47% CP)	27,0	34,0	50,0
Poultry by product meal	20,0	40,0	25,0
Poultry,fat	25,0	25,0	25,0
Common salt	3,0	3,0	3,0
Limestone ground	7,0	5,0	2,5
Calcium phosphate	6,0	2,0	-
Vitamin,mineral, aminoacids,aditives premix[1]	7,0	7,0	7,0
Calculated analysis	**Starter 1 at 14 days**	**Growning 15 at 28 days**	**Finisher 29 at 42 days**
Crude protein %	21,8	20,7	19,0
Metabolizable Energy (cal/kg)	3020	3100	3150
Lisyne digest %	1,18	1,13	0,97
Methionine %	0,50	0,40	0,35
Calcium %	0,97	0,90	0,90
Phosphorus avall %	0,43	0,42	0,42

1 - premix levels: **vitamins**: vit.A 8.000 UI, vit D3 2.000 UI, vit.E 15UI, tiamin 2mg, riboflavin 5mg, niacin 30 mg, pantotenic acid 12 mg, piridoxin, biotin 50 mcg, fólic ácid 0,5mg, cianocobalamin 20 mcg, colin 500 mg. **minerals**: manganese70 mg, iron 80 mg, cupper 10 mg, zinc 70 mg, selenium 0,3 mg iodine 1 mg, cobalt 0,2 mg. **Adittives**: lisyne starter 0,20%, growning 0,15%, finisher 0.10%; methionine - starter 0,30%, growning 0,25%, finisher 018%.

CONCLUSIONS

Taking into consideration the conditions under which this experiment was carried out, it is possible to conclude that:

- The inclusion of growth promoter (antibiotic) produced the same results as the inclusion of mannanoligosaccharide in the diet.
- The use of mannanoligosaccharide produced significantly better results as compared to the use of yeast cell wall.
- The non-inclusion of growth promoters or of mannanoligosaccharides in broiler diets may cause production losses.

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