Influence of Bio-Mos on broilers performances and gut morphology

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Abstract
In a broiler trial, (3 x 3 setup) animals were fed a corn/soy feed with no additive, 2 kg/T Bio-Mos (Alltech Inc, USA) and AGP (15 ppm Flavomycin). At 42 days, the BW and daily growth of the animals fed Bio-Mos was significantly different from the BW of the control and the AGP group (1915 versus 1869 and 1816 g for Bio-Mos, AGP and control fed animals, $P< 0.05$). Daily Feed intake was also significantly reduced when Bio-Mos or AGP were administered to the feed leading to feed conversions which were significant lower for Bio-Mos versus AGP and control (1.84 vs 1.98 and 2.17 resp.) Gut sections taken at 21 days of age demonstrated that the supplementation of Bio-Mos increased the villus height and width, as well as decreased crypt depth in all parts of the small intestine ($P< 0.05$). In conclusion, Bio-Mos exhibited a nutritional, medical and economic advantages over antibiotic growth promoter.

Introduction
The objective of this trial was to investigate the effect of dietary supplementation of Bio-Mos (Alltech Inc, USA) and AGP (Flavomycin) on the performance and the intestinal morphology of broilers.

Material and Methods
The completely randomized experimental design comprehended 180 day-old male broiler chicks (Hybro) purchased from a commercial hatchery and fed a commercial corn-soybean diet (Table 1). There were three treatments and three replicates of 20 birds per pen. The treatments were control, 2 kg/T Bio-Mos (Alltech Inc, USA) and AGP (15 ppm Flavomycin). All birds had ad libitum access to feed.

	Diet		
Row material	**1**	**2**	**3**
Maize	56.73	63.30	67.75
Soybean meal	26.30	15.30	17.00
Fishmeal	4.00	4.00	-
Sunflower meal	-	5.00	6.00
Gluten meal, corn	6.00	6.00	4.00
Oil	3.00	3.00	2.00
Limestone	1.10	0.70	1.00
Dicalcium phosphate	1.30	1.30	1.00
Salt	0.20	0.25	0.25
Methionine	0.12	-	-
Lysine	0.25	0.15	-
Vitamin-mineral premix*	1.00	1.00	1.00
Chemical composition, %			
Protein	21,80	19,40	17,30
Ca	1,07	0,89	0,75
P	0,74	0,75	0,61
ME, MJ/kg	12,96	13,27	13,15
Lysine	1,38	1,05	0,76
Methionine + cystine	0,78	0,63	0,55

*including Flavomycin or 0.2% Bio-Mos

The following data were collected during the experimental period: body weight, weight gain, feed intake and feed conversion. At day 21, six birds per treatment were euthanized and from each animal sections of the beginning and the end of second third of small intestine, which correspond to the surpass of duodenum to jejunum and jejunum to ileum, were taken. Six sections of 5-8 mm thickness were cut from each sample fixed in 10% neutral formalin and absolute alcohol, embedded in paraffin and stained using the standard HE method (Scheuer and Chalk, 1986). Morphometric examination (villus height and width, as well as crypt depth) were done using an light microscopy using an ocular micrometer.

Results and Discussion

Table 2 gives information on the end weight, average growth, daily feed intake and feed conversion for the whole trial period. It can be seen that at 42 days, the BW of the animals fed Bio-Mos was significantly different from the BW of the control and the AGP group (1915 versus 1869 and 1816 g for Bio-Mos, AGP and control fed animals P< 0.05). This led to average daily gains that were significantly different from the control for the total period (P< 0.05). Feed consumption was also significantly reduced when Bio-Mos or AGP were administered to the feed considering the whole trial period (Table 3, P<0.05). As a result, feed conversion was significantly reduced compared to the control and the AGP fed birds (P< 0.05).

Table 3: Technical parameters at day 42

	Group					
Parameters	**Control**		**AGP**		**MOS**	
BW (kg)	1815.67	a	1869.40	a	1915.23	b
BWG (g/a/d)	41.96	a	43.50	b	44.58	b
ADFI (g/a/d)	91.19	a	86.16	b	81.64	b
FCR (kg)	2.17	a	1.98	b	1.84	b

*Values expressed as $\bar{X}$±Sd a, b, cp<0.05

During past years, a number of trials have been conducted contrasting MOS with conventional AGP. In the EU, only avilamycin and bambermycin are available as approved AGP. Supplementation of poultry diets with commercially available MOS enhances profitability by improving live bird performance parameters. Controlled trials that allow statistical analysis of data confirmed the benefit of MOS over AGP as feed additive in broiler nutrition.

Table 4: Effect of AGP and Bio-Mos on gut morphology, [µm]

	Group					
	Control		**AGP**		**MOS**	
			Duodenum			
Villus height	901.28±70.02	a	981.07±77.01	a	1013.03±81.98	b
Villus width	93.72±15.11	a	98.58±8.10	b	107.70±13.91	b
Crypt depth	140.35±27.20	a	137.52±18.23	a	123.72±32.10	b
	Ileum					
Villus height	452.77±181.13	a	478.32±124.35	a	640.53±115.95	b
Villus width	87.15±10.92	a	90.28±18.83	a	95.12±12.30	b
Crypt depth	111.93±14.06	a	103.98±34.03	a	86.52±10.90	b
	Caecum					
Villus height	160.22±29.77	a	163.08±48.67	a	171.25±44.06	b
Villus width	59.08±6.55	a	66.77±12.34	b	65.10±16.29	b
Crypt depth	42.23±11.77	a	40.83±8.67	a	31.75±7.82	b

*Values expressed as $\bar{X}$±Sd a, b, cp<0.05

The supplementation with Bio-Mos increased the villus height and width, as well as decreased crypt depth in all parts of the gut ($P< 0.05$, Table 4). Using MOS in broiler feed significantly increase villus lenght but not villus height (Spring, 1996). Besides mentioned, Bradly et al. (1994) noticed simultaneously decreasing crypth depth which is in an agreement with report of Savage et al. (1997).
There is substantial evidence that dietary MOS modifies the morphology and structure of the intestinal mucosa (Shane, 2001). Enterocytes undergo a continual cycle of proliferation in the intestinal crypt, maturation and migration up the villi with desquamation at the tip of the villus. The depth of the crypth is a function of the rate of cell replacement. Accelerated replacement of enterocytes requires diversion od energy and potein from growth and the development of tissues and organ systems. Thus, the changes in intestinal morphology are correlated to a significant increase in growth rate, suggesting an strongcorrelation between the parameters measured.

Conclusion

The improved intestinal morphology characteristics of birds receiving Bio-Mos may explain the improved performances (Loddi et al., 2004). Longer villi increase the surface area for nutrient resorption, while small crypt indicates lower tissue turnover and a lower demand for new tissue. Changes in intestinal morphology, as described above, can lead to better nutrient absorption, decreased secretion in the gut and better overall performance.
MOS is derived from the cell wall of Saccharomyces cerevisae and is commercially available as feed supplement included in diets as a GRAS (generally recognized as safe) compound. The benefits of MOS are based on different specific properties that, besides others, include reduction in turnover rate of the intestinal mucosa. These properties have the potential to enhance growth rate, feed conversion efficiency and livbility in commercial broilers nutrition. It could be concluded that Bio-Mos exhibited a nutritional, medical and economic advantages over antibiotic growth promoter.

References

BRADLY, G.L., SAVAGE, T.F., and TIMM, K.I. (1994): The effect of supplementing diets with Saccharomyces cerevisiae var. boulardii on male poult performance and ileal morphology. Poult. Sci. 73: 1766-1770.
LODDI, M.M. MORAES, V.M. B., NAKAGHI, L.S.O., TUCA, F.M., HANNAS, M.I., and ARIKI, J. (2004) Mannan oligosacharide and organic acids on performance and intestinal morphometric characteristic of broilers chickens. Abstract of Alltechs 20th Annual Symposium, Nicholasville Kentacky, 45.
SAVAGE, T.F., ZAKRZEWSKA , E.I., and ANDERSEN, J.R. (1997): The effects of feeding mannan oligosaccharide supplemented diets to poults on performance and morphology of the small intestine. Poult. Sci., 76 (Suppl. 1): 139.
SCHEURE, J.P. and CHALK, T.B. (1986) Clinical test: Histology. Wolfe Medical Publ. Ltd, Netherlands.
SHANE, M.S. (2001) Mannan oligosaccharides in poultry nutrition: mechanism and benefits. Science and technology in the feed industry, 65-77.
SPRING, P. (1996): Effects of mannanoligosaccharide on different cecal parameters and on cecal concentrations of enteric pathogens in poultry. PhD thesis, Swiss Federal Institute of Technology Zurich, Zurich.