Effect of mannan oligosaccharides (Bio-Mos) supplementation on the small intestinum morphology of broiler chickens

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Abstract

The objective of this study was to examine the effects of dietary supplementation of mannan oligosaccharides (Bio-Mos, Alltech Inc. USA) on the gut morphology of broiler chicks. Significant differences between control and BM group were found in villi height at duodenum (2777.8 vs 2401.0 μm) and jejunum (1595.7 vs 2061.3 μm), in crypt depth in duodenum (524.1 vs 443.7 μm) and in vilus/crypt ratio at jejunum (4.94 vs 6.67). This results point out that Bio-Mos has significant influence on gut morphology and play important role in processes of digestion and absorption.

Introduction

The gastrointestinal tract has different possibilities to adapt or to react morphologically to changing conditions such as altered diet (Huisman et al., 1990; Van der Klis et al, 1993) or altered composition of the intestinal microflora (Koninkx et al., 1988). The intestine can change its surface by growing to length, and/or by increasing or decreasing the height of its villi. Shortening and fusion of villi will result in loss of surface for digestion and absorption of food (Van Dijk et al., 2002). The objective of this study was to examine the effects of dietary supplementation of mannan oligosaccharides (Bio-Mos, Alltech Inc. USA) on the gut morphology of broiler chicks.

Material and Methods

The trial was conducted at the Novi Sad University farm during October and November 2004. The trial involved Arbor Acres x Ross 308 (mixed sex) chicks assigned in two groups with 4 replicates per treatment. The birds were housed in deep littered battery pens housing 70 chicks per replicate, with population density of 16 chicks/m^2. All chicks were fed the same feed (corn/soybean meal based), formulated to meet nutrient requirements. Chickens were given starter (week 1-3), finisher I (week 4-5) and finisher II (week 6) until 42 days of age. Birds from the experimental group received dietary supplementation of Bio-Mos (BM) at 1, 0.75 and 0.5 kg/T for the starter, finisher I and finisher II periods, respectively.

At the end of the trial (42 days) 8 broilers from every group were slaughtered and small intestines were removed. After measuring the length of duodenum, jejunum and ileum, samples of small intestine parts were fixed in Bouin solution, and after histological procedure stained with hematoxylin and eosine. Crypt depth and villus height were determined using light microscope and software for image analysis. A minimum of 15 measurements were made for each parameter per chicken, which was then used for statistical analysis among treatment groups.

Results and Discussion

The results showed no significant difference in length of duodenum, jejunum and ileum between control and BM group. Significant differences between control and BM group were found in villi height at duodenum (2777.8 vs 2401.0 μm) and jejunum (1595.7 vs 2061.3 μm) (table 1, fig. 1). In crypt depth significant difference were found in duodenum (524.1 vs 443.7 μm) (table 1, fig. 2). Also, significant diference between control and BM group were found in vilus/crypt ratio at jejunum (4.94 vs 6.67) (table 1, fig. 3).

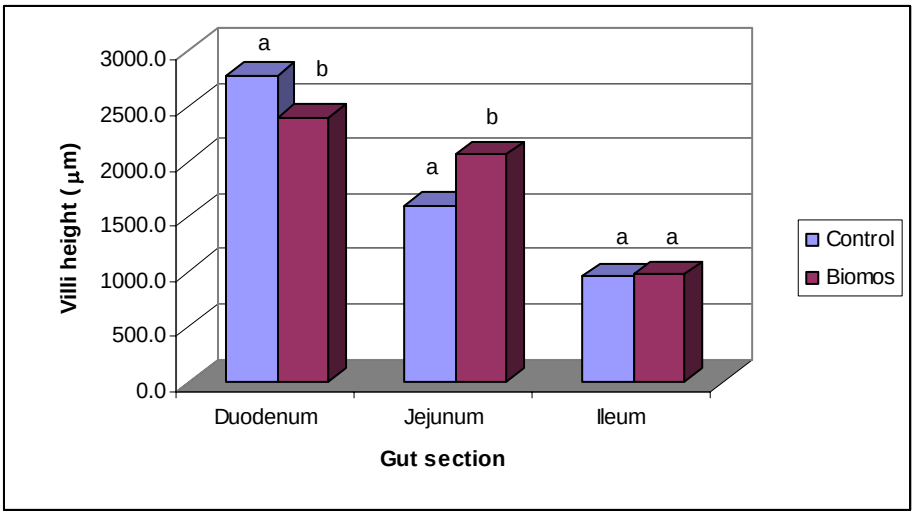

Figure 1: Effect on villi height (different letter in same gut section indicate significant difference (P< 0.05)

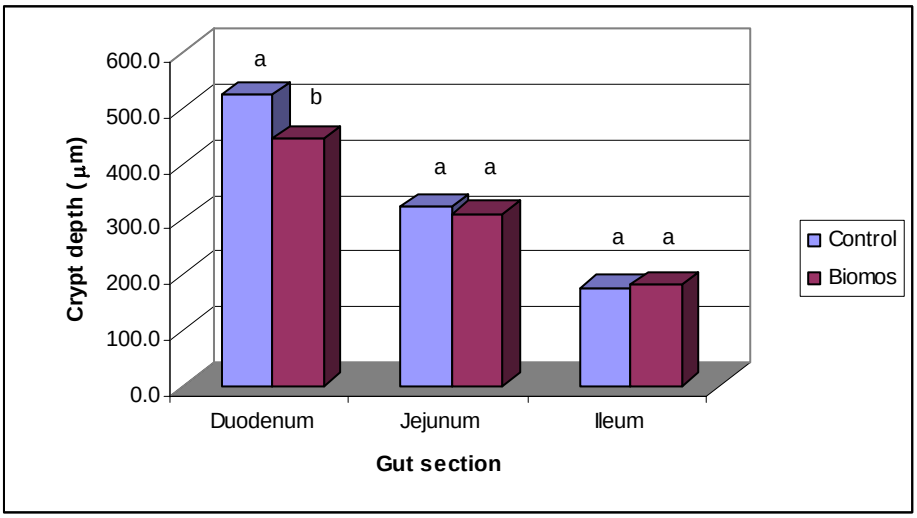

Figure 2: Effect on crypt depth (different letter in same gut section indicate significant difference (P< 0.01)

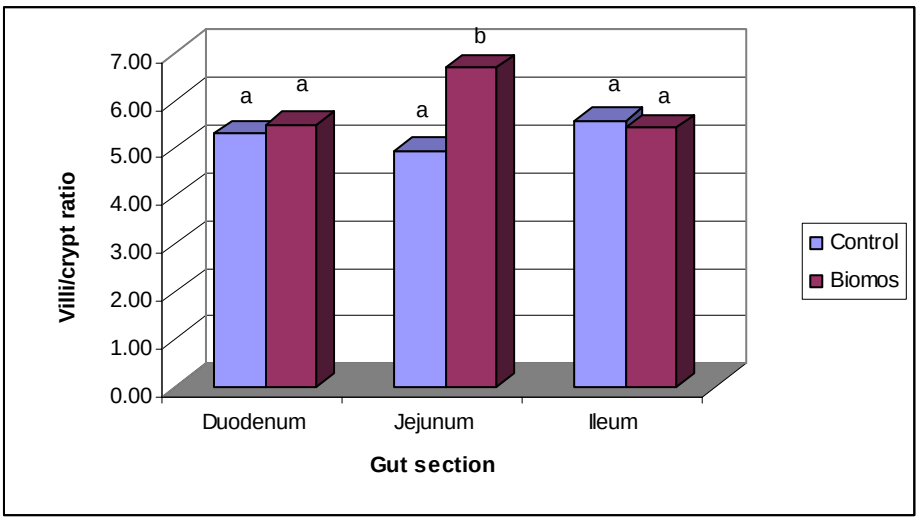

Figure 3: Effect on villi/crypt ration (different letter in same gut section indicate significant difference (P< 0.01)

Table 1. Villi height, crypt depth and villi:crypt ratio of small intestines in control and Bio-Mos groups

	Duodenum		Jejunum		Ileum	
	Control	Biomos	Control	Biomos	Control	Biomos
Villi height (µm)	2777.8	2401.0	1595.7	2061.3	957.2	976.4
Crypt depth (µm)	524.1	443.7	322.3	308.0	175.2	181.3
Villi:crypt ratio	5.29	5.47	4.94	6.67	5.57	5.42

In experiment with Bio-Mos, Iji et al (2001) pointed out that Bio-Mos in diet significantly increased jejunal villi height. In experiment with 14 days old pullets MOS showed significant effect on villi/crypt ratio in jejunum, which was higher compared to control group (Ferket et al., 2002). These changes were represented by elongated villi and a higher villi/crypt ratio, which indicate a lower rate of enterocyte-cell migration from the crypt to the villus. It was suggested that Bio-Mos would reduce both the damage of enterocytes and the need for cell renewal in the gut.

Conclusion

These results point out that Bio-Mos has significant influence on gut morphology and play important role in processes of digestion and absorption, leading to improved performance.

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