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EFFECT OF PROBIOTIC SUPPLEMENTATION ON THE SMALL INTESTINUM

MORPHOLOGY OF BROILER CHICKENS

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ABSTRACT

The aim of this study was to establish the effects of dietary supplementation of probiotic additive Biolac (Biofeed Ras. USA) on the gut morphology of broiler chicks. Significant differences between control and Biolac group were found in length of some intestine parts (jejunum and ileum), villi height at duodenum, jejunum and ileum, in crypt depth in duodenum and jejunum, as well as in vilus/crypt ratio at duodenum, jejunum and ileum. This results pointed out that addition of probiotic Biolac in feed had significant influence on gut morphology and plays an important role in processes of digestion and absorption.

Key words: probiotics, broilers, intestine, morphology

1. INTRODUCTION

Probiotics can be defined as cultures of live micro-organisms which affect beneficially in the host by improving the properties of the indigenous microflora (Fuller, 1992). The different bacterial species which are present in normal microflora of birds, have a specific multifactorial “barrier” impact, such as: induction of anatomical and physiological changes in the intestinal cell wall structure, immunological modifications in the gut, enhancement of the bird resistance to enter pathogenic bacteria, etc. It is obvious that probiotics should have a similar bio-efficacy related to colonization, in-situ proliferation, and production of specific metabolites, bacterial interaction (competitive exclusion, colonization resistance), aggregation and stimulation of the “none”-specific immune system (Gedek, 1999; Mead, 2000).

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), altered composition of the intestinal microflora (Koninkx et al., 1988) or addition of probiotics. 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 probiotics (Biolac) on the gut morphology of broiler chicks.

2. MATERIAL AND METHODS

The trial was conducted at the experimental farm in Itebej, SCG. The trial involved Ross 308 (mixed sex) chicks assigned in two groups with 4 replicates per treatment. The birds were housed in deep littered battery pens housing 75 chicks per replicate, with population density of 16 chicks/m². All chicks were fed the same feed (corn/soybean meal based), formulated to meet nutrient requirements. Chickens were given starter (week 1-3), grower (week 4-5) and finisher (week 6) until 42 days of age.

Birds from the experimental group received dietary supplementation of Biolac (Biofeed Ras. USA) at 1 kg/t for the starter, grower and finisher periods.

At the end of the trial (42 days) 8 broilers from every group were slaughtered and small intestines were removed. After the 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 bird, which was then used for statistical analysis among treatment groups.

3. RESULTS AND DISCUSSION

The results showed significant difference in length of jejunum and ileum between control and experimental group.

Table 1. Length of small intestine parts (cm)

	Biolac	Control	
Duodenum	30.8	31.2	
Jejunum	73.6	82.4*	p<0.05
Ileum	72	84.4*	p<0.05
Cecum	39.2	40.4	

It is known that length and weight of the small intestine increase when birds consume diets with lower digestibility (Smits, 1996). Considering that, the results of this trial indicate that addition of Biolac in feed increased the digestibility, because the length of all parts of small intestine were lower in relation to control group.

Significant differences between control and Biolac group were found in villi height at duodenum (μm), jejunum (μm) and ileum (table 2, fig. 1).

Table 2. Villi height, crypt depth and villi: crypt ratio of small intestines

	Duodenum		Jejunum		Ileum	
	Control	Biolac	Control	Biolac	Control	Biolac
Villi height (μm)	2124.8	2505.1*	1230.9	1535.3**	917.5	1190.7*
Crypt depth (μm)	424.1	315.8*	338.4	244.8*	241.1	219.5
Villi: crypt ratio	5.77	8.00*	3.76	6.38**	3.94	5.53**

* Statistically significant difference (p<0.05)

**Statistically significant difference (p<0.01)

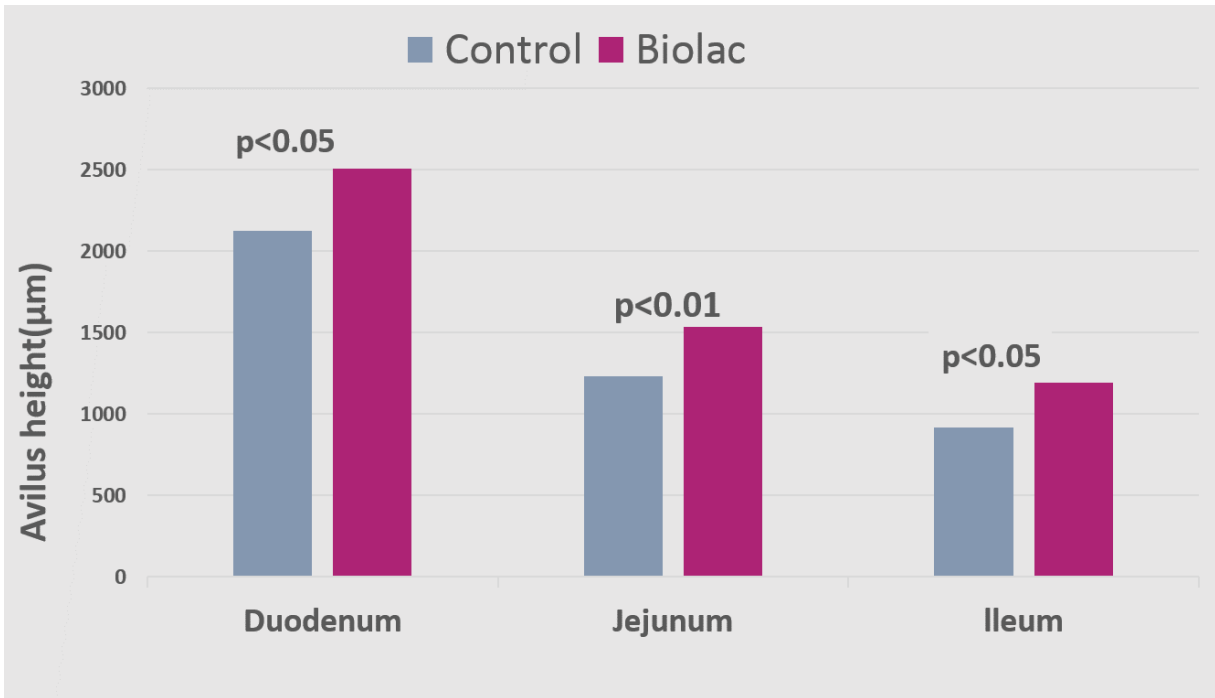


Figure 1. Effect on villi height

In crypt depth, significant differences were found in duodenum and jejunum, but the difference between crypt depths in ileum was not statistically significant (table 1, fig. 2).

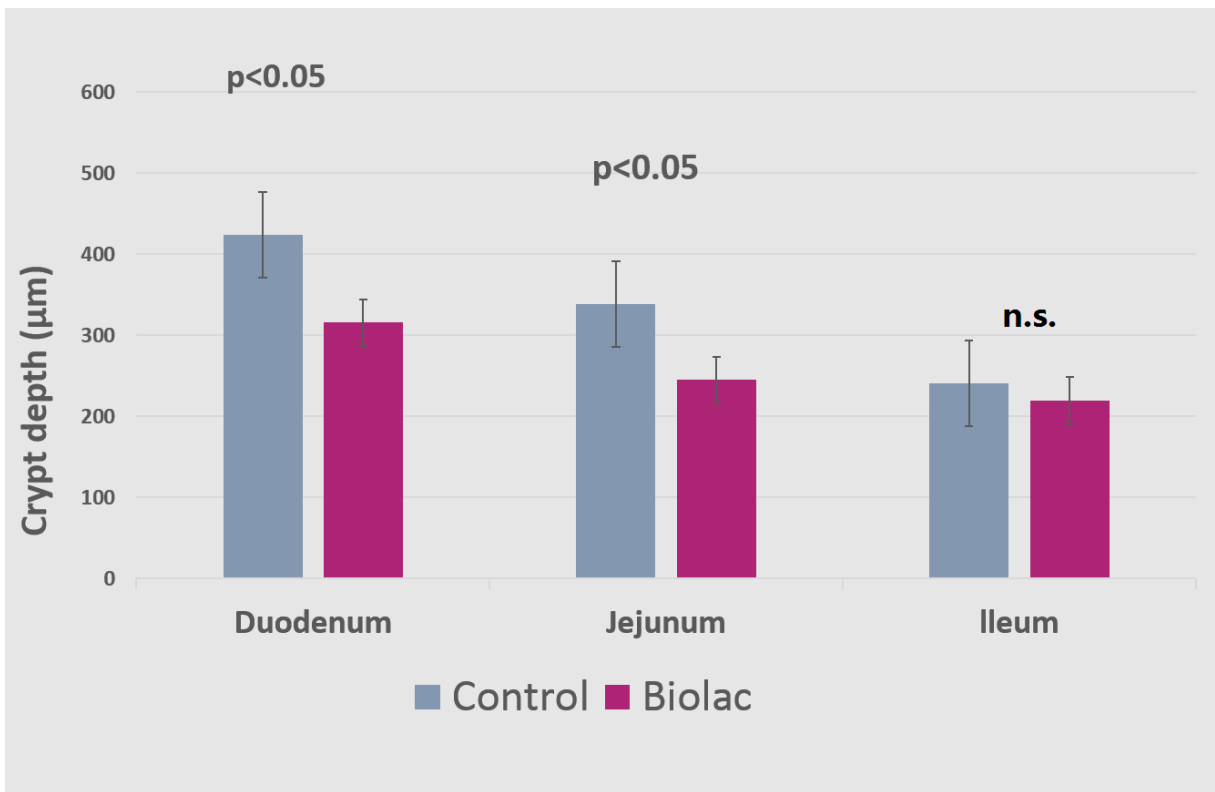


Figure 2: Effect on crypt depth

Also, significant differences between control and Biolac group were found in vilus/crypt ratio at duodenum, jejunum and ileum (table 1, fig. 3).

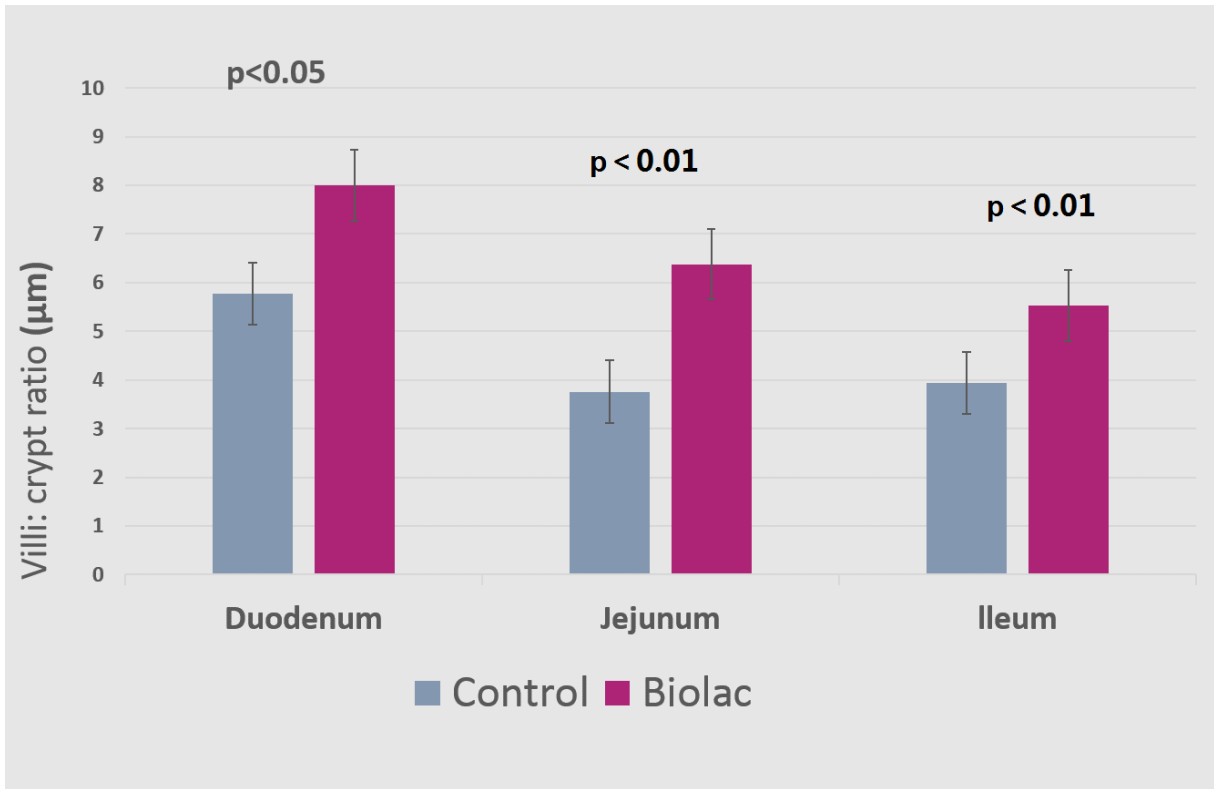


Figure 3: Effect on villi/crypt ratio

In all parts of small gut villus/crypt ratio were increased in broiler with Biolac in feed. That result show better development of villus, longer life of enterocytes which resulting in better digestion of feed.

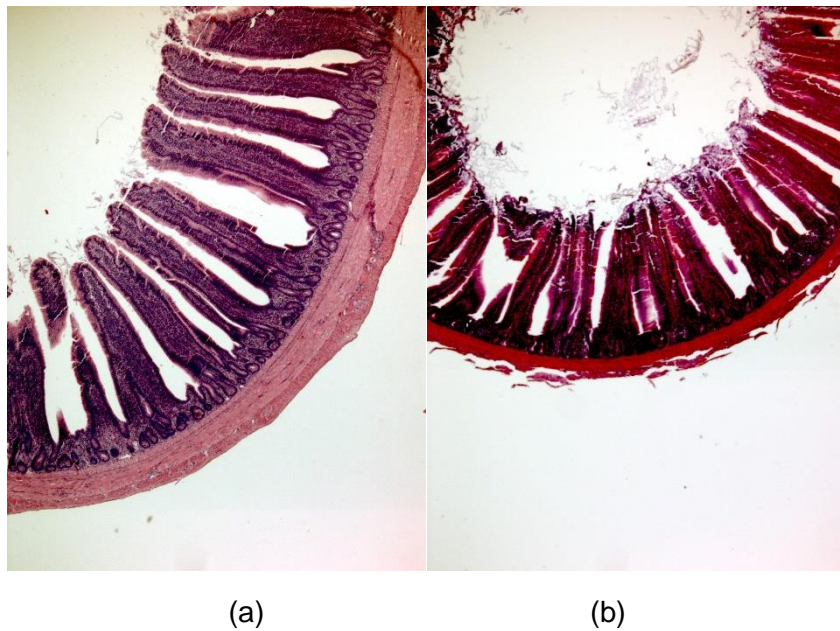


Figure 1. Microphotographys of ileum in broiler with Biolac in feed (a) and broiler of control group (b) (HE, objective 5x)

Obtained results confirmed the fact exposed by many researchers (Huisman et al., 1990; Van der Klis et al., 1993, Van Beers-Schreurs et al., 1998) that gastrointestinal tract can adapt and react morphologically to some factors related to changing the diets or addition of probiotics. The intestine can change its surface by growing to length, and/or by increasing or decreasing the height of its villi. In this trial, the increased villi height and decreased crypt depth indicate that addition of probiotic can have a beneficial effect on digestibility. It is suggested that Biolac could reduce both the damage of enterocytes and the need for cell renewal in the gut.

In experiment with prebiotics, Iji et al (2001) pointed out that prebiotics and other additives in diets can significantly increase jejunal villi height. In experiment with 14 days old pullets prebiotics 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.

4. CONCLUSIONS

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

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