

Sodium butyrate improved performance while modulating the cecal microbiome and regulating the expression of intestinal immune-related genes of broiler chickens

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Introduction

- Intestinal bacteria are the main responsible for the production of short chain fatty acids;
- Butyrate is naturally produced by cecal fermentation, but its production in the small intestine is negligible, suggesting that dietary butyrate could bring benefits to the birds;
- Butyrate can be used as an energetic source by intestinal cells, could also positively affect their proliferation, and maturation, and may regulate the intestinal immune system and microbiota (Guilloteau et al., 2010).

Objective

- Effect of a sodium butyrate (SB) on:
 - performance: 1 – 28 days;
 - cecal microbiome profile;
 - expression of immune-related genes in cecal tonsils.

Material and Methods

- 2,208-d-old Ross 708 broiler chickens were randomly distributed into floor pens (46 birds/pen and 8 replicates/treatment);
- A total of 6 dietary treatments (Trt) were used, in a 3×2 factorial arrangement of 3 diets (control diet, diet with a reduction of 2.3% of amino acids and 60 kcal/kg, and diet with a reduction of 4.6% of amino acids and 120 kcal/kg) with or without the inclusion of SB;
- Feed intake (FI), body weight gain (BW gain) and feed conversion ratio (FCR) were recorded. At 28 d of age, cecal tonsils and cecal content were collected for gene expression and microbiota analysis.

Results

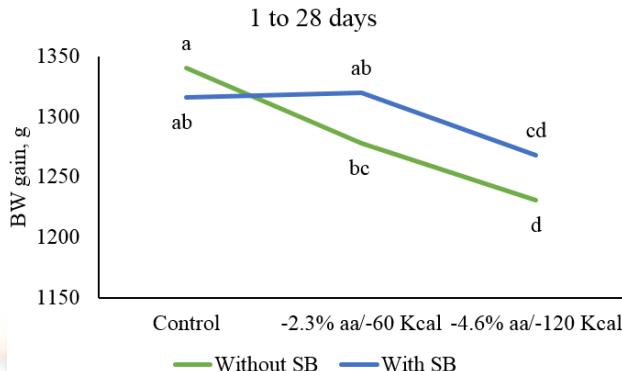


Figure 1: Performance of broiler chickens from 1 to 28 d fed nutritionally reduced diets and supplemented or not with SB.

Results

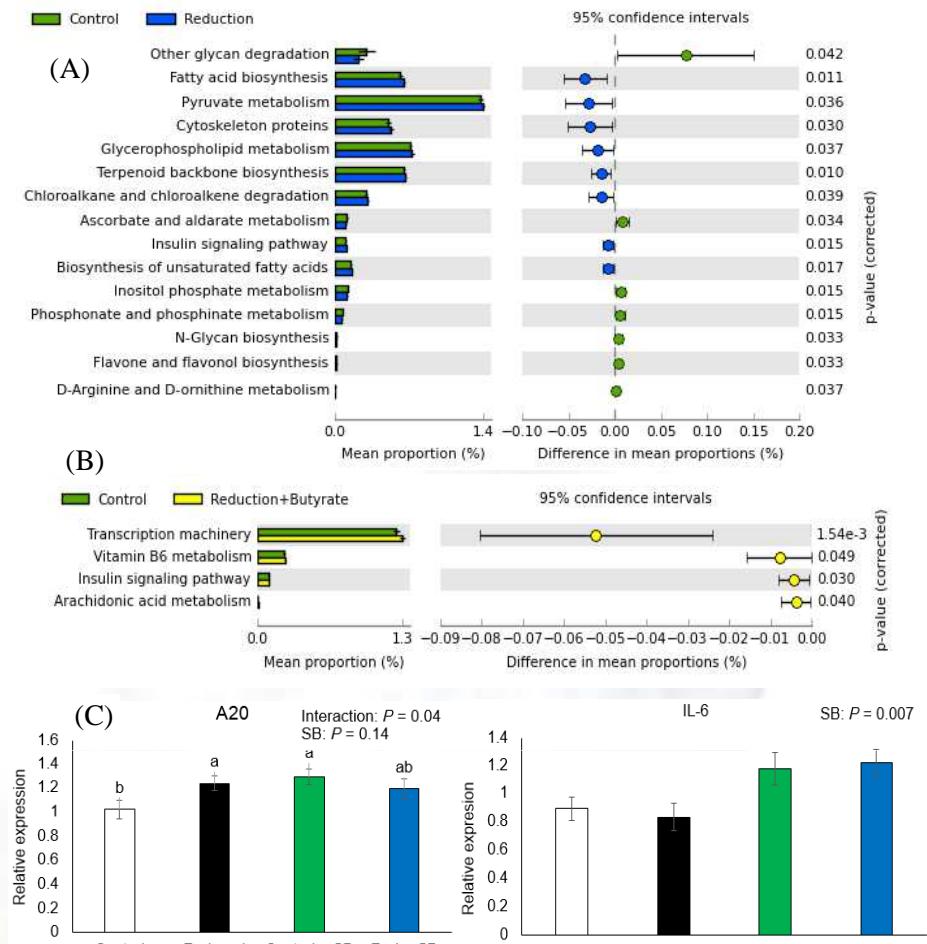


Figure 2: Predicted function (A and B) of the cecal microbiota and gene expression of the cecal tonsils (C) collected from broiler chickens fed control or nutritionally reduced diet with or without SB.

- Diets containing the first level of energy and amino acid reduction supplemented with SB led to the same BW gain observed in the control Trt (Fig. 1; $P < 0.05$);
- The nutritionally reduced diet altered the imputed function performed by the microbiota, and the SB supplementation reduced these variations, keeping the microbial function similar to that one observed in chickens fed a control diet (Fig. 2);
- The dietary supplementation of SB to broiler chickens modulated the immune response; SB upregulated the expression of ubiquitin-editing enzyme A20 in broilers fed control diets and increased IL-6 expression (Fig. 2).

Conclusions

- Sodium butyrate affected the host function contributing to a superior host phenotype, modulated the cecal microbiota and showed immune modulatory effects.

Reference

Guilloteau, P., et al. 2010. Dietary sodium butyrate supplementation increases digestibility and pancreatic secretion in young milk-fed calves. *J Dairy Sci*, 93, 5842-50.