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## 复合芽孢杆菌制剂对肉兔肠道发育和免疫功能的影响

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### A Composite Bacillus Preparation: Effects on Intestinal Development and Immune Function of Meat Rabbits

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**摘要** 本试验旨在研究复合芽孢杆菌制剂对肉兔肠道发育和免疫功能的影响。选取体重相近、35日龄断奶的新西兰肉兔160只, 随机分为5组, 每组4个重复, 每个重复8只(公母各占1/2)。对照组饲喂基础饲料, 抗生素组饲喂在基础饲料中添加400 mg/kg 4%恩拉霉素的试验饲料, 试验1、2、3组分别饲喂基础饲料中添加200、300和400 mg/kg复合芽孢杆菌制剂的试验饲料。复合芽孢杆菌组成为枯草芽孢杆菌(*B. subtilis*)和地衣芽孢杆菌(*B. licheniformis*), 二者各占1/2, 总活菌数 $\geq 1.5 \times 10^{10}$  CFU/g。试验期8周。结果表明: 试验1、2、3组均可降低肠道内容物pH, 其中试验3组可显著降低小肠各段内容物pH ( $P < 0.05$ ); 试验2、3组显著提高了小肠各段绒毛高度和隐窝深度比值 ( $P < 0.05$ ); 试验1、2、3组均显著降低了盲肠中大肠杆菌和总好氧菌数量 ( $P < 0.05$ ), 同时显著增加了乳酸杆菌、双歧杆菌及总厌氧菌数量 ( $P < 0.05$ ); 试验2、3组显著提高了血清中免疫球蛋白M、补体3、补体4的含量 ( $P < 0.05$ ), 试验1、2、3组肠黏膜分泌型免疫球蛋白A含量均显著高于对照组 ( $P < 0.05$ )。结果提示, 在饲料中添加复合芽孢杆菌制剂可以促进肉兔肠道发育, 刺激盲肠有益菌的增殖并抑制有害菌的增殖, 同时还可提高机体的免疫功能。本试验条件下, 该复合芽孢杆菌制剂在肉兔饲料中的适宜添加量为300~400 mg/kg。

**关键词:** 芽孢杆菌 肉兔 肠道发育 免疫功能

**Abstract:** This study was conducted to investigate the effects of composite bacillus preparation (CBP) on intestinal development and immune function of meat rabbits. A total of 160 New Zealand meat rabbits aged 35 days were randomly assigned into five groups with 4 replicates in each group and 8 rabbits per replicate (half male and half female). Rabbits in control group were fed a basal diet, those in antibiotics group were fed the basal diet supplemented with 400 mg/kg enramycin (4%), while those in test groups 1, 2 and 3 were fed the basal diet supplemented with CBP at 200, 300 and 400 mg/kg, respectively. The CBP was consist of 50% *B. subtilis* and 50% *B. licheniformis*, and total live bacterial number of it was  $\geq 1.5 \times 10^{10}$  CFU/g. The test lasted for 8 weeks. The results showed as follows: intestinal content pH in test groups 1, 2 and 3 were decreased, and whole intestinal content pH was significantly decrease in test group 3 ( $P < 0.05$ ); villus height/crypt depth in test groups 2 and 3 was significantly increased ( $P < 0.05$ ); the number of *E. coli* and total aerobic bacteria in cecum in test groups 1, 2 and 3 was significantly decreased, while that of *lactobacilli*, *bifidobacteria* and total anaerobic bacteria was significantly increased ( $P < 0.05$ ); serum immunoglobulin M, complements 3 and 4 contents in test groups 2 and 3 were significantly increased ( $P < 0.05$ ), meanwhile, intestinal mucosal secreted immunoglobulin A content in test groups 1, 2 and 3 was significantly increased ( $P < 0.05$ ). It is concluded that supplementation of CBP can promote intestinal development, stimulate the proliferation of beneficial bacteria and inhibit the harmful ones in the cecum, as well as improve immune function. It is suggested that the optimal supplemental level in meat rabbit's diet is 300 to 400 mg/kg.

**Keywords:** composite bacillus preparation, meat rabbit, intestinal development, immune function

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