

EFFECTS OF HIGH PROTEIN DIET SUPPLEMENTED WITH PROBIOTICS AND PROTEASE ON GROWTH PERFORMANCE, AND DIARRHEA INCIDENCE OF WEANED PIGLETS

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INTRODUCTION

Maintaining piglet health is important around weaning to promote growth and maximize efficiency. Dietary protein levels and sources are important causes of diarrhea in weaned piglets. Although researchers recommend low protein weaner pig diets to reduce the diarrhea risk, most farmers prefer high protein diet for the benefit of growth performance insurance and limitation of protein sources.

OBJECTIVE

The purpose of this study was to investigate the effects of dietary probiotics, protease and their combination on growth performance, diarrhea index, and microorganism constructure of weaned piglets fed with high-protein diets.

MATERIALS AND METHODS

160 weaned piglets 21±2 days of age; initial weight 6.12±0.3kg

5 treatments groups:

- **LP**, low-protein diet (18.27% crude protein)
- **HP**, high-protein diet (20.97% crude protein)
- **HPPRO**, high-protein diet supplemented with 300g/T probiotics (*Bacillus* sp. ATCC PTA-6736; 2×10^{11} /kg)
- **HPPRS**, high-protein diet with 300g/T protease (Kemzyme® Protease, 8000U/g)
- **HPPRO-PRS**, high-protein diet supplemented with 300g/T probiotics and 300g/T protease

The diet formula is consisted of corn, cooked corn, cooked soybean, soybean protein concentrate, fishmeal, low protein whey powder.

Growth performance and diarrhea index were measured for the entire 21 day trial. Blood, cecum and colon content samples were collected on day 23.

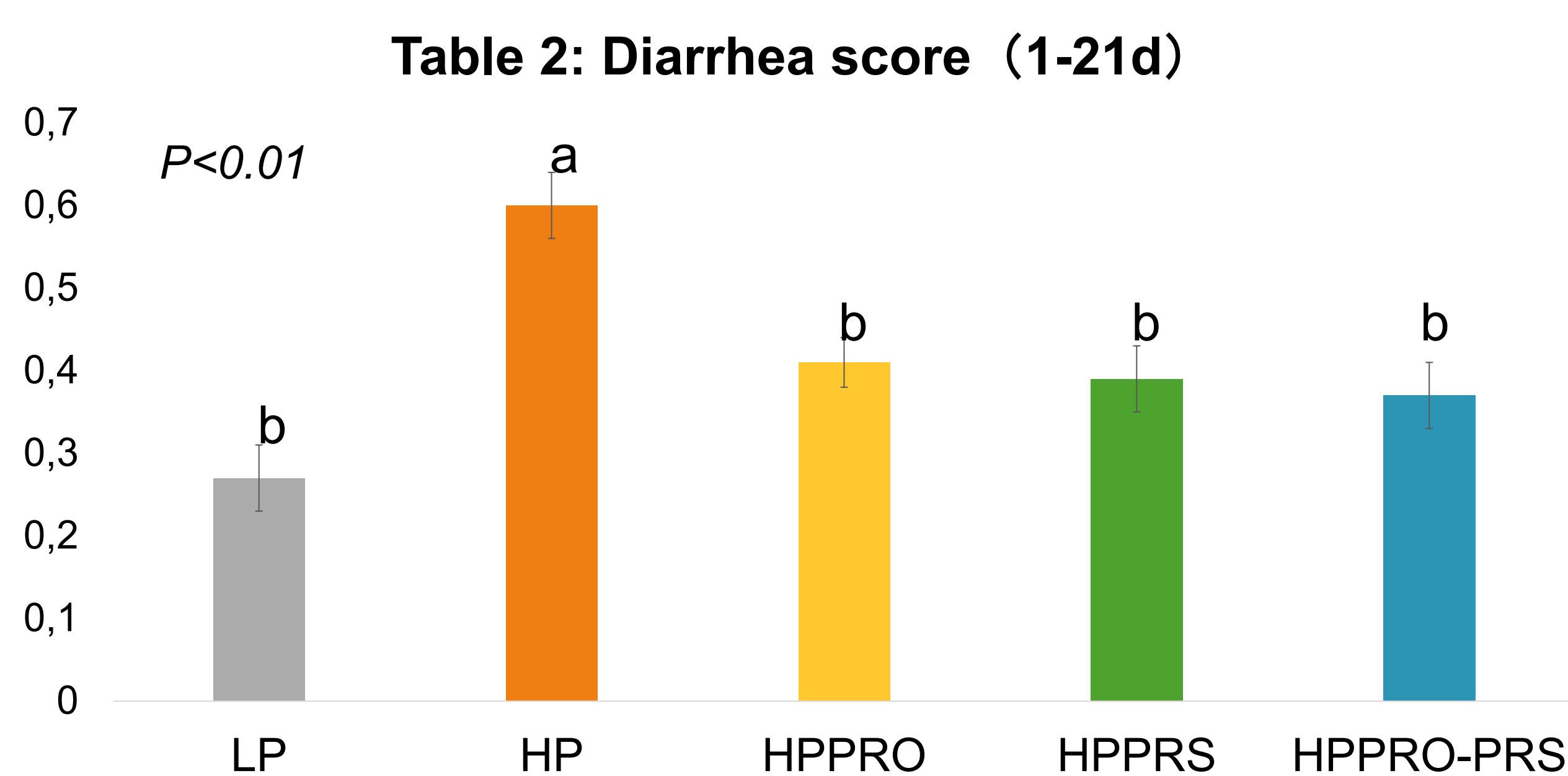
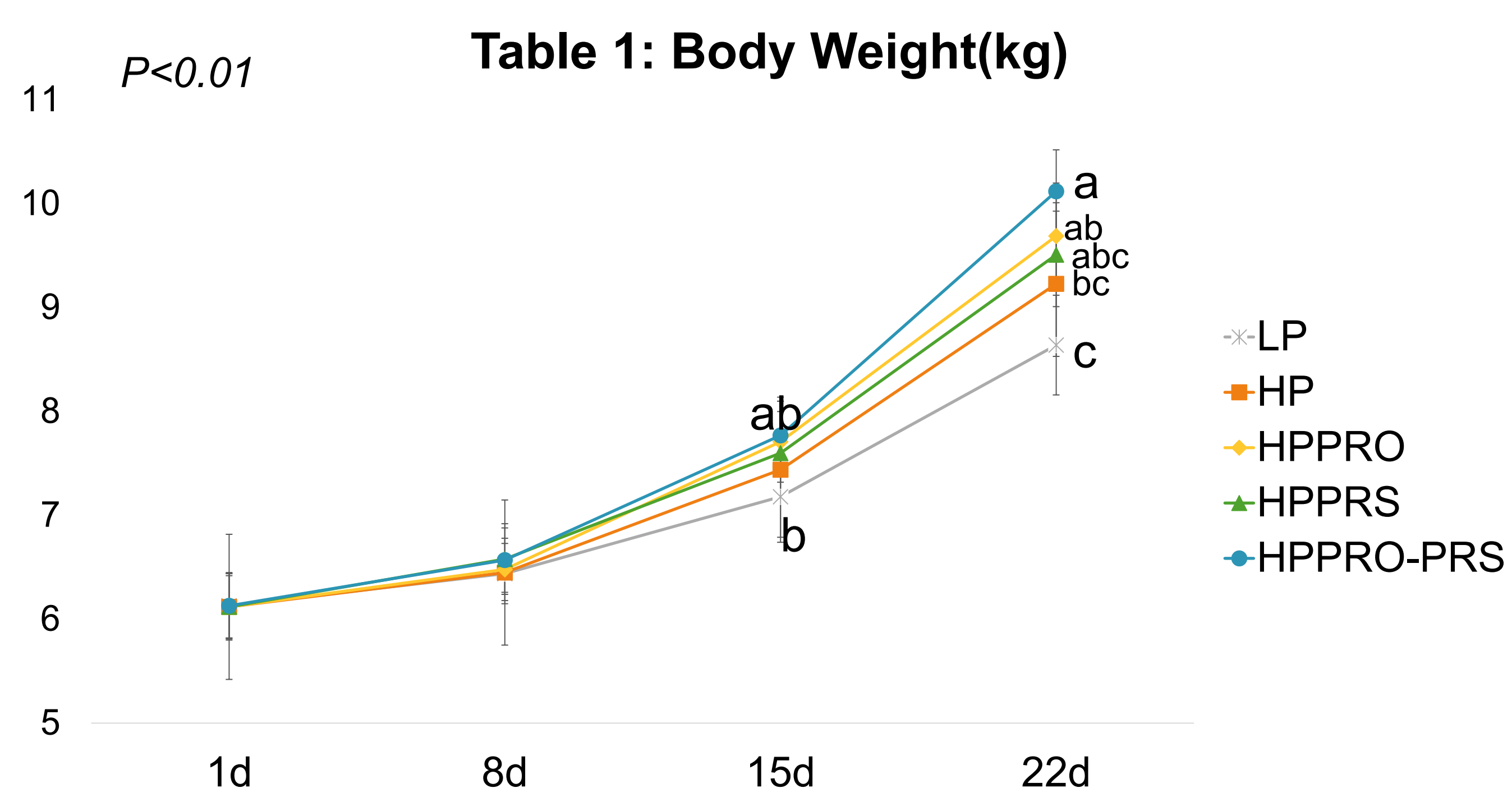
The intestinal flora of colonic chymus was detected by 16sRNA sampling. The α diversity index was calculated using QIIME2 software. QIIME2 software was used to calculate Unifrac distance, and R software was used to draw PCA, PCoA and NMDS dimensionality reduction maps.

RESULTS

Compared with LP group, the HP group had no significant effect on the growth performance of the piglets (Table 1), but HPPRO group and HPPRO-PRS group alike, significantly increased the body weight on day 15 and day 22 ($P < 0.01$). Piglets in HPPRO and HPPRO-PRS group has significant higher ADG and ADFI ($P < 0.01$) on day 22. Piglet diarrhea in HP group was significantly increased during the whole experiment period ($P > 0.01$) (Table 2). Piglet diarrhea in the HPPRO, HPPRS and HPPRO-PRS groups were

higher than for the LP group ($P > 0.05$), but significantly decreased compared with HP group ($P < 0.01$).

RESULTS cont.



The relative abundance of P-251-O5 (*Micrococcus pentosus*) in colonic microorganisms HPPRO group was significantly increased ($P < 0.05$). Compared with HP group, the relative abundance of *Actinobacillus* in colon microorganisms of piglets in HPPRO group was significantly decreased ($P < 0.05$).

T-test showed that the abundance of *Megasphaera* in colon microorganisms of piglets in HP group was significantly increased ($P < 0.05$) compared with LP group. The abundance of *Collinsella*, *Fibrobacter*, *Agathobacter*, *Foumierella*, *Anaerostipes*, *Fibrobacter Fibrinella*, *Lachnospira*, *Mogibacterium*, *Megasphaera*, *Lachnospiraceae - UCG-009* in colon microorganisms of piglets in HPPRO group was significantly increased ($P < 0.05$), *Oribacterium* tended to increase ($P = 0.05$).

Compared with HP group, piglets in HPPRO group were found *Clostridium_sensu_stricto_1* (*Clostridium difficile*), UCG-005, NK4A214_group, *Christensenellaceae_R-7_group* and *Eubacterium_ruminantium_group* was significantly increased ($P < 0.05$).

DISCUSSION AND CONCLUSION

In this experiment, compared with low protein diet, feeding high protein diet increased the diarrhea index of weaned piglets. The addition of probiotics and/or protease to high protein diet could reduce the diarrhea index and improve growth performance of the piglets. Additional investigations showed that the addition of probiotics to high-protein diet improved reduced the abundance of harmful microorganisms in colon digestive tract.

References: Available on request