EFFECT OF *LACTIPLANTIBACILLUS PLANTARUM* N-1 AND ITS SYNERGIES WITH OLIGOMERIC ISOMALTOSE ON THE GROWTH PERFORMANCE AND MEAT QUALITY IN HU SHEEP

Zhiqiang Zhou [1], Dongmei Luo [2], Zhiwei Zhou [2], Tianwu An [3, *] and Qun Sun [1, 2, *]

[1]College of Biomass Science and Engineering, Sichuan University, Chengdu 610064, China

[2]College of Life Sciences, Sichuan University, Chengdu 610064, China

[3] Sichuan Academy of Grassland Sciences, Chengdu 611731, China

*Corresponding author email: antianwu@126.com (T.A.); qunsun@scu.edu.cn (Q.S.)

I. INTRODUCTION

Probiotics have gained tremendous attention as an alternative to antibiotics [1], while synbiotics may exhibit a greater growth promoting effect than their counterpart probiotics due to the prebiotics' promotion on the growth and reproduction of probiotics. The objective of this study was to investigate the potential probiotic effect of *L. plantarum* N-1, and the combination of N-1 with oligomeric isomaltose on the growth performance of lambs from intramuscular fat deposition of lambs and evaluated the potential of probiotics and synbiotics to improve lamb meat quality.

II. MATERIALS AND METHODS

Fifteen newborn male lambs were randomly assigned to the control, probiotics treatment group, and synbiotics treatment group according to their weight. Each group was kept in separate pens and fed by breastfeeding until the end of the experiment. Additionally, based on the daily basal diet, the probiotics group was fed (by gavage) *Lactiplantibacillus plantarum* N-1 (1×10^9 CFU/g per kilogram body weight), the synbiotics group was fed N-1 (1×10^9 CFU/g per kilogram body weight) and oligomeric isomaltose (0.08 g/kg body weight), and the control group was fed the same amount of water. The study lasted for 60 days and the *longissimus thoracis* (LT) was collected for meat quality analysis. Statistical analysis was performed using SPSS 26.0, and significant differences were determined by analysis of variance (ANOVA) followed by the Tukey test. Results are expressed as mean ± standard error. In the charts, "Con", "Pro", and "Syn" represent the control group, probiotic group, and synbiotic group, respectively.

III. RESULTS AND DISCUSSION

The results showed that dietary supplementation of N-1 tended to improve growth performance and meat quality of Hu sheep, while the synergism of N-1 with oligomeric isomaltose significantly improved their growth performance and meat quality ($P < 0.05$).

Table 1. The chemical composition and mineral elements in *longissimus thoracis.*

Parameters (μg/g)	Control	Probiotics	Synbiotics	SEM	P-value
K	5038 [a]	4322 [b]	4830 [ab]	109	0.009
Ca	37.7	42.3	46.5	2.72	0.446
Na	631	661	559	21.4	0.139
Mg	247	248	256	3.06	0.408
Cu	1.16	1.10	1.40	0.09	0.348
Fe	13.7	16.2	13.5	1.29	0.668
Zn	25.8 [b]	27.3 [ab]	33.1 [a]	1.44	0.085
Moisture content (%)	75.3	76.2	75.78	0.35	0.443
Crude fat content (%)	3.32 [b]	4.16 [b]	5.00 [a]	0.30	0.065
Crude protein content (%)	18.2	18.1	18.7	0.22	0.493
Ash content (%)	1.08	1.02	1.06	0.02	0.344

Means with different letters within the same parameter group differ significantly (α = 0.05 level).

Both the dietary supplementation of N-1 and synbiotics ($P < 0.05$) increased the body weight and body size of Hu sheep. Synbiotic treatment reduced serum cholesterol and improved LT fat content by increasing the transcription level of fatty acid synthase to enhance fat deposition in LT, as determined via RT-qPCR analysis. Moreover, synbiotics increased zinc content and improved LT tenderness by decreasing shear force and significantly increased the levels of certain essential (Thr, Phe, and Met) and non-essential (Asp, Ser, and Tyr) amino acids of LT ($P < 0.05$). Additionally, synbiotics inhibited the production of carbonyl groups and TBARS in LT and thus maintained antioxidant stability. In conclusion, it is recommended that the use of synbiotics in livestock breeding be promoted to improve sheep production and meat quality.

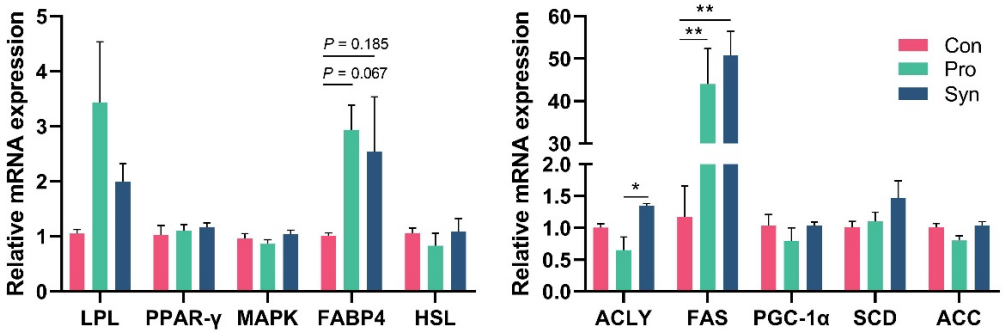

Figure 1. The effect of probiotics and synbiotics on mRNA expression of *longissimus thoracis* lipid synthesis-related genes (*P < 0.05, ** P < 0.01).

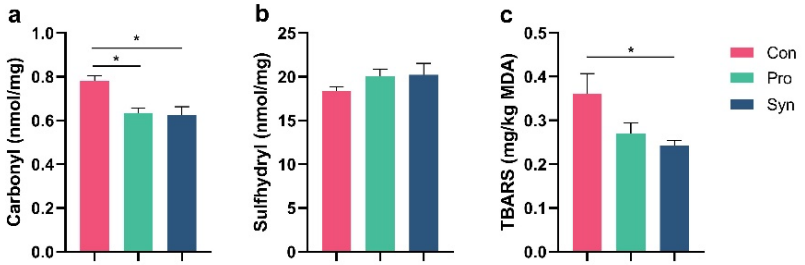

Figure 2. Antioxidant activity of *longissimus thoracis* muscle and MP in Hu sheep. (a) Carbonyl content in MP; (b) Sulfhydryl content in MP; (c) TBARS content in longissimus thoracis muscle tissue (*P < 0.05).

IV. CONCLUSION

In the present study, dietary supplementation of *Lactiplantibacillus plantarum* N-1 or its synergies with oligomeric isomaltose improved the growth performance and meat quality of Hu sheep, and oligomeric isomaltose enhanced the probiotic effect of N-1. This study contributes to our understanding of the role of *Lactiplantibacillus plantarum*-like probiotics in Hu sheep breeding. In conclusion, based on our findings, it is recommended to add N-1 to the diets of Hu sheep, and the addition of prebiotics (such as oligomeric isomaltose) as synergists is recommended to enhance the probiotic effect of N-1.

ACKNOWLEDGEMENTS

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