

THE EFFECTS OF SIMULTANEOUSLY HEATED PORK MEAT AND RESISTANT STARCH ON INTESTINAL HEALTH IN MICE

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I. INTRODUCTION

Substantial evidence from epidemiological studies showed that meat intake was associated with increased risks of cardiovascular disease, colorectal cancer etc. [1]. The intake of dietary fibre (including resistant starch, RS) could attenuate meat-induced colonic damage [2]. However, the question whether the attenuated functionality of RS will be maintained is interesting and remains open, based on the bioavailability of many compounds sensitive to thermal processing of food. Accordingly, we examined the effects of meat and RS with or without thermal processing on intestine health of mice.

II. MATERIALS AND METHODS

Sixty male four-week-old C57BL/6 mice were obtained from the Vital River Laboratory Animal Technology Co. Ltd. (Beijing, China), housed in ventilated cages within a pathogen-free barrier facility that maintained a 12-h light : 12-h dark cycle, and allowed to take water and food ad libitum. After 2 weeks acclimatization, they were assigned randomly to three formulated diets (1) Meat powder (M); (2) Co-consumption of M and RS (M+S); (3) Restructured thermal processed meat product containing RS (MS).

HAMS (Hi-maize 260), type RS2, was used as the source of RS and was added at a level of 10 g/100 g diet. The lean meat from hindquarter pork was minced, cooked, chilled, freeze-dried, and ground into powder (M). The powder was served as the source of protein and was added at a recommended dose of 20 g/100 g diet. The preparation of MS was referred to M and nearly 10% of RS was added into the minced meat to maintain a constant proportion of RS : meat (dry weight : dry weight 1:2) after freeze-drying.

All diets were prepared according to the American Institution of Nutrition (AIN-93G). All research protocols were approved by the Hefei University of Technology Standing Committee on Animals. Body weight and food intake were measured weekly. In the final 4 days of the experiment, fresh feces were collected. After 4 weeks, mice were fasted overnight and euthanized with CO₂, gut tissues were harvested. Feces were distilled and homogenized with ultrapure water for analysis of SCFAs and ammonia by gas chromatograph system fitted with a DB-WAX column and spectrophotometry method, respectively. Proliferative activity of distal colonic epithelial cells was measured as previously reported [3].

Comparison of multiple samples was conducted by ANOVA using SPSS 22 software (IBM). Values of $P < 0.05$ were considered to be statistically significant.

III. RESULTS AND DISCUSSION

A. Body weight gain and food intake

Compared with M group, the M+S could significantly increase food intake while exerting insignificant ($P > 0.05$) effect on body weight gain, and both food intake and body weight gain of MS showed remarkable increase ($P < 0.05$). The differences in food conversion rate were insignificant among three dietary groups (Table 1).

B. Fecal metabolites

As shown in Fig.1A, there were insignificant differences in acetate and total SCFAs among three dietary groups. RS (M+S) could apparently increase the propionate and butyrate in feces, MS could attenuate these augment in spite of unremarkable difference ($P > 0.05$) observed compared to M group. As for ammonia (Fig.1B), it exhibited a significant ($P < 0.05$) decrease in both M+S and MS groups in comparison to M group,

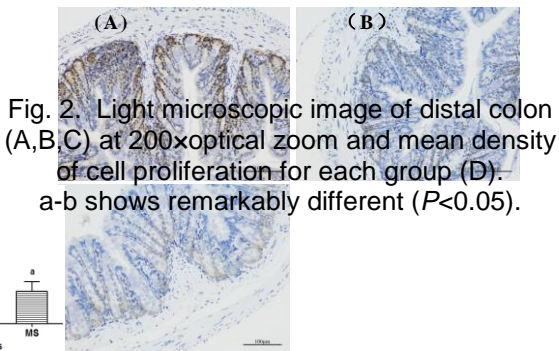
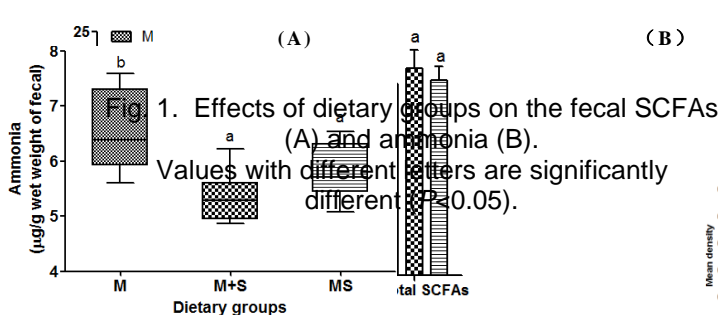
while the difference between the two groups was insignificant ($P>0.05$). The increased SCFAs and decreased ammonia reflected a more favorable colonic luminal environment [3].

Table 1 Body weight gain and food intake.
a-b Different letters in the same row indicate statistically significant differences at $P<0.05$

	M	M+S	MS
Body weight gain (g)	4.13±1.32 ^a	4.51±1.14 ^{ab}	5.07±1.03 ^b
Food intake (g)	65.96±2.89 ^a	72.71±0.43 ^b	76.00±4.41 ^b
Feed conversion rate (%)	6.68±1.97 ^a	6.24±1.85 ^a	7.15±1.40 ^a

C. Cell proliferation

Compared to M group, the RS (M+S) had an insignificant ($P>0.05$) effect on cell proliferation, whereas thermal process significantly ($P<0.05$) decreased proliferation although the reduction was insignificant compared with M+S group, which positively correlated with the ammonia variations (Fig. 2).



IV. CONCLUSION

The heated MS showed similar behaviors in growth performances, fecal metabolites and proliferation of colonic epithelia to the M+S group, indicating that RS still exerted a protective effect on the intestine health after thermal processing. It is a promising method to improve the functional properties of meat products.

ACKNOWLEDGEMENTS

We thank professor Jian Liu for his help during this experiment. This work was financially supported by Anhui Science and Technology Major Project in 2017 (17030701026) and Anhui Poultry Technology Committee Funds (AHCYJSTX-06).

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