GROWTH PERFORMANCE, CARCASS TRAITS AND MEAT QUALITY RESPONSES TO DIFFERENT DIETARY NDF TO STARCH RATIOS IN FATTENING YAKS

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I. INTRODUCTION

The yak (*Bos grunniens*) is predominant livestock on the Qinghai-Tibet Plateau, providing necessary means of livelihood for Tibetans, such as beef, milk, fuel, transportation, etc[1]. Yaks have long been grazing on natural grassland since their domestication. However, due to the traditional feeding pattern, deficiency of grass and extremely cold weather in winter at high altitude, long slaughtering cycle (6-7 years old and beyond) and poor meat quality become the crucial problems of yak industry. Research efforts have recently been devoted to exploration of changing feeding methods (supplementary feeding, barn feeding, etc.) [2,3]. Carbohydrate is a key nutrient in ruminant ration, including easily fermentable starch and neutral detergent fiber (NDF) which represents dietary structural carbohydrates. Therefore, the objective of this study was to investigate the effect of different dietary NDF:starch ratios on growth performance, carcass traits and meat quality of fattening yaks.

II. MATERIALS AND METHODS

The Institutional Animal Care and Use Committee of the Sichuan Academy of Grassland Sciences approved all procedures in the study. Yaks (n=51, 3-4 years old) with similar body weight (247.48±24.02 kg) were assigned randomly to 1 of 3 treatments. Yaks in different treatment received (1) diet of high NDF to starch ratio (HNS, NDF/starch=2.45), (2) diet of medium NDF to starch ratio (MNS, NDF/starch=1.96), or (3) diet of low NDF to starch ratio (LNS, NDF/starch=1.57) with similar crude protein content and gross energy, respectively. There were 17 yaks for each treatment. The experimental diets fed as TMR consisted of concentrate, corn silage, wheat straw and corn straw.

After adaptation period of 7 d and experimental period of 115 d, all yaks were weighed. Four yaks in each treatment were randomly selected for slaughtering measurements following standard procedure, respectively. *Longissimus dorsi* samples were collected to analysis meat quality and nutrients composition. Statistical analyses were performed using the one-way ANOVA procedure of SAS (SAS Institute Inc.).

III. RESULTS AND DISCUSSION

Table 1. Effect of different dietary NDF:starch ratios on the growth performance of fattening yaks

Items	HNS	MNS	LNS[1]	SEM	P-value
Initial body weight, kg	250	248	245	6.32	0.871
Final body weight, kg[2]	332^{B}	343^{AB}	350^{A}	5.64	0.084
Body weight change, kg	82.7^{C}	95.5^{B}	105^{A}	3.01	<0.001
Dry matter intake, kg	6.93	7.09	7.20	0.25	0.687
Average daily gain, g/d	719^{C}	831^{B}	913^{A}	26.2	<0.001

[1]HNS=diet of high NDF to starch ratio; MNS=diet of medium NDF to starch ratio; LNS=diet of low NDF to starch ratio.
[2]Values in the same row with different letter superscripts differed significantly (P<0.05).

We observed a significant increase of final body weight for yaks fed LNS diet compared with those fed HNS ($P < 0.05$, Table 1). Average daily gain differed significantly among treatments with yaks received LNS showing the highest growth ($P < 0.05$).

After slaughtering measurements, no effect on the weights of heart, liver, spleen, lung, kidney and visceral fat occurred with different dietary NDF:starch ratios. Whereas, HNS and MNS diets resulted in greater rumen weight in comparison with LNS ($P < 0.05$). Notably, the dressing percentage and net meat percentage of yaks fed LNS diet were significantly higher than those fed HNS ($P < 0.05$).

For meat quality, the cooking loss and shear force of *Longissimus dorsi* were significantly reduced in LNS treatment than in HNS ($P < 0.05$). And we found a significant increase of intramuscular fat content for yaks received LNS diet compared with HNS ($P < 0.05$). The fatty acids composition in intramuscular fat including SFA, MUFA, PUFA and SFA/UFA did not differ significantly among treatments. No effect of treatments on the mineral calcium, iron, zinc, selenium, magnesium, sodium concentrations in *Longissimus dorsi* was observed, meanwhile, the contents of heavy metal element arsenic, mercury, cadmium and plumbum were far below national limit standard or not detected.

Table 2. Effect of different dietary NDF:starch ratios on the carcass traits of fattening yaks

Items	HNS	MNS	LNS	SEM	P-value
Rib-eye area, cm^2	44.3	48.5	49.3	3.12	0.551
Carcass weight, kg	177	181	187	3.55	0.244
Net meat weight, kg	152	156	161	3.36	0.238
Dressing percentage, %	50.4^{B}	51.4^{AB}	52.9^{A}	0.56	0.036
Net meat percentage , %	43.3^{B}	44.3^{AB}	45.7^{A}	0.56	0.042

Table 3. Effect of different dietary NDF:starch ratios on the meat quality and nutrients composition of fattening yaks

Items[1]	HNS	MNS	LNS	SEM	P-value
Cooking loss, %	36.7^{A}	35.3^{AB}	31.7^{B}	0.64	0.090
Shear force, kg	7.90^{A}	7.02^{AB}	5.82^{B}	0.42	0.025
Protein, %	23.4	23.3	23.9	0.39	0.608
Intramuscular fat, %	1.05^{C}	1.75^{B}	2.28^{A}	0.13	0.001
SFA, %	53.2	53.7	53.3	1.70	0.980
MUFA, %	41.2	42.6	42.5	2.07	0.875
PUFA, %	5.59	3.70	4.22	0.95	0.423
SFA/UFA	1.14	1.17	1.15	0.08	0.968

[1]SFA=Saturated fatty acids; MUFA=Monounsaturated fatty acids; PUFA=Polyunsaturated fatty acids; UFA=Unsaturated fatty acids.

IV. CONCLUSION

The findings of this study indicate that yak was able to digest and utilize the high starch ration. Yaks fed the low NDF to starch ratio diet had increased growth performance and meat production capacity. On the basis of reduced shear force and cooking loss, along with elevated intramuscular fat content, the meat quality of yak could be improved by diet with low NDF to starch ratio. Further investigation on the molecular mechanism of lipid metabolism in intramuscular fat is currently ongoing in our laboratory.

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