Change of behavior of *Bos grunniens* in the alpine rangeland in the eastern Tibetan Plateau

Nobumi Hasegawa [A], Rende Song [B], Guomei Li [C], Xumin Cao [D], Masahiro Tasumi [A], Sachiko Idota [A] and Akira Fukuda [E]

[A] Faculty of Agriculture, University of Miyazaki, Miyazaki, 889-2192, Japan
[B] Yushu Animal Husbandry and Veterinary Center, Yushu, 815000, People's Republic of China
[C] Yushu Prairie Center, Yushu, 815000, People's Republic of China
[D] China Animal Health and Epidemiology Center, Qingdao, People's Republic of China
[E] Graduate School of Science and Technology, Shizuoka University, Hamamatsu, 432-8561, Japan
Contact email: nhasegaw@cc.miyazaki-u.ac.jp

Keywords: Yak, grazing, rumination, degradation, Qinghai-Tibetan Plateau.

Introduction

Over 6 million yaks (*Bos grunniens*) are grazed in the alpine rangelands of the eastern Tibetan Plateau in Qinghai Province, China. Degradation of rangelands has been caused by increased numbers of domestic animals following the rise of the human population. In our previous study in northern and southern sites of Tibetan Plateau in Qinghai Province from 2003 to 2006, behavior of yaks and chemical composition of the faeces (Hasegawa *et al.* 2006; Hasegawa *et al.* 2008) and vegetation (Li *et al.* 2006; Song *et al.* 2006) were investigated and compared between the two sites, and it was suggested that the material circulation was lower and deterioration of rangeland was greater in the former than in the latter. In this study, behavioral observations of yaks in alpine rangeland of Yushu National Ranch from 2004 to 2012 were carried out to estimate the change of rangeland condition in the southern site of Tibetan Plateau.

Methods

Seven behavioral observations of 3 yak cows for 3 consecutive days were carried out from 2004 to 2012 in the alpine rangelands of Yushu National Ranch in Yushu Tibetan-Autonomous State, Qinghai Province, China (4000-4500 m in altitude). Four of them were done in warm seasons (WS): 16 to 18, Aug. in 2004 (W0408); 30 July to 1 Aug. in 2009 (W0907); 12 to 14 Aug. in 2010 (W1008); 11 to 13 Aug. in 2012 (W1208), and three of them were in cold seasons (CS): 27 to 29 Dec. in 2004 (C0412); 8 to 10 Apr. in 2008 (C0804); 17 to 19 Mar. in 2012 (C1203). Yak cows grazed freely in the rangeland in the daytime and were tied to a rope fixed on the ground during the night with no housing and no supplemental feeding through the year except C1203. Because of a heavy snow event in March 2012 in this area, yaks could not graze sufficiently in the snow-covered rangelands and small amounts of oaten hay were supplemented to the experimental yak herd to prevent death from hunger during the trial period.

Behavioral categories were recorded every 2 minutes and time of ruminating bolus and number of chewing in a bolus were measured during the night periods. Data were analyzed statistically by ANOVA or Wilcoxon/Kruskal - Wallis Test and Tukey-Kramer HSD Test.

Results and discussion

Behavior of yaks in WS and CS in the alpine rangelands of Yushu National Ranch was shown in Table 1. Grazing time significantly differed among observation periods ($P<0.0001$) and between seasons ($P<0.0001$), measuring at 524.3 min/day in WS and 441.2 min/day in CS on average. Rumination time significantly differed among observation periods ($P<0.0001$) and between seasons ($P<0.0001$), measuring at 386.2 min/day in WS and 238.0 min/day in CS on average. Rumination/grazing significantly differed among observation periods ($P<0.0001$) and between seasons ($P<0.0001$). In WS, it was greater in W1008 and W1208 than in W0408 and W0907. In CS, it was longest in C1203 when oaten hay was supplemented.

Rumination behavior of yaks in WS and CS was shown in Table 2. Time of a bolus significantly differed among observation periods ($P<0.0001$) and between seasons ($P<0.0084$) where the time of a bolus was 50.0 sec/bolus in WS and 52.7 sec/bolus in CS. Chewing number/bolus was 49.6/bolus in WS and 51.8/bolus in CS on average and significantly differed among observation periods ($P<0.0001$) and between seasons ($P<0.0004$).

Conclusion

There were significant differences between WS and CS in grazing characteristics, which likely reflected changes in feed quality between these two times of the year. Also, the differences between years within a season might reflect the changes of vegetation conditions and available amount of plants, which were affected by climatic change and a decrease of yak numbers.

Table 1. Behavior of yaks in warm and cold seasons in the alpine rangelands of Yushu National Ranch in Yushu Tibetan-Autonomous State, Qinghai Province, China.

Season	Observation period	Grazing (min/day)	Resting (min/day)	Rumination (min/day)	Rumination/Grazing
Warm (WS)	W0408	506.0b	469.1b	314.0bc	0.626c
	W0907	590.2a	352.0c	373.6ab	0.635c
	W1008	511.8b	330.4c	419.8a	0.826ab
	W1208	489.3b	348.7c	437.6a	0.895a
Cold (CS)	C0412	429.6c	594.0a	238.4de	0.556cd
	C0804	468.0bc	616.7a	195.3e	0.426d
	C1203	426.0c (505.3b)†	473.6b	280.2cd	0.666bc (0.562cd) ‡
P value by ANOVA		<0.0001	<0.0001	<0.0001	<0.0001
Average					
Warm season (WS)		524.3	375.1	386.2	0.716
Cold season (CS)		441.2 (467.6) †	561.4	238	0.549 (0.515) ‡
P value by Wilcoxon/Kruskal-Wallis Test		<0.0001	<0.0001	<0.0001	<0.0001

abcde: Means with different superscripts were significantly different by Tukey-Kramer HSD Test (P<0.05). †Data in parentheses in C1203 equal total of grazing and hay feeding times. ‡Data in parentheses in C1203 equal Rumination/(Grazing+Hay Feeding).

Table 2. Rumination behaviour of yaks in warm and cold seasons in the alpine rangelands of Yushu National Ranch in Yushu Tibetan-Autonomous State, Qinghai Province, China.

Season	Observation period	Time of a bolus (sec/bolus)	Chewing in a bolus (chewing No/bolus)	Chewing time (sec/chewing)
Warm (WS)	W0408	50.9ab	51.6bc	1.001ab
	W0907	46.7b	47.1d	0.999b
	W1008	55.1a	53.4ab	1.053ab
	W1208	49.0b	48.4cd	1.040ab
Cold (CS)	C0412	55.9a	52.3bc	1.085a
	C0804	47.2b	50.1bcd	0.976b
	C1203	55.6a	53.2ab	1.081a
P value by Wilcoxon/Kruskal-Wallis Test		<0.0001	<0.0001	<0.0001
Average				
Warm season (WS)		50	49.6	1.025
Cold season (CS)		52.7	51.8	1.045
P value by Wilcoxon/Kruskal-Wallis Test		0.0084	0.0129	0.0004

abcd: Means with different superscripts were significantly different by Tukey-Kramer HSD Test (p<0.05).

Acknowledgement

We would like to thank Mr. Gamadeqing, Head of Yushu National Ranch and researchers of Yushu Animal Husbandry and Veterinary Center and Yushu Prairie Station. The parts of this research and were supported by Grand-in-Aids for Scientific Research (A) No. 15255020 in 2004 and No. 23255015 in 2012 from Japan Society for Promotion of Science.

References

Hasegawa N, Song R, Kozono M, Idota S, Nishiwaki A, Li G, Fukuda A, Zhou Q (2006) Differences in yak (*Bos grunniens*) grazing behaviour and chemical composition of feces in the southern and northern Qinghai-Tibetan Plateau in China. *Acta Prataculturae Sinica* **15** (suppl.), 286-288.

Hasegawa N, Song R, Li G, Fukuda A, Feng S (2008) Grazing behaviour of yak (*Bos grunniens*) in warm- and cold-season paddocks of *Potentilla fruticosa* alpine rangeland in Northern Qinghai-Tibetan Plateau. Proc. XXI IGC & VIII IRC **1**, 501.

Li G, Idota S, Hasegawa N, Song R, Wang Y, Feng S (2006) Effect of long-term seasonal grazing of yak (*Bos grunniens*) on botanical diversity of *Potentilla fruticosa* alpine rangeland in Qing-Zang Plateau. *Acta Prataculturae Sinica* **15** (suppl.), 149-151.

Song R, Hasegawa N, Idota S, Li G, Nishiwaki A, Jiu C, Xu N, Zhou Q (2006) Botanical composition, aboveground biomass and grazing behaviour of yak (*Bos grunniens*) in the southern rangeland of Qinghai Province, China. *Acta Prataculturae Sinica* **15** (suppl.), 289-291.