Fodder Supply in Cold Season in Gobi Nomadic Area, Mongolia

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ABSTRACT : Fodder supply condition was studied at 41 nomadic families in *Gobi*, Southern Semi-Desert area in Mongolia, from Dec. 1994 to Apr. 1995 to determine problems in cold, feed deficient season for establishment of sustainable livestock production system. The conditions of two family groups: those located in sparse vegetation (FG1), and those in comparably dense (FG2), were also compared. Commercial concentrate feed (concentrate), hay and *Zoodoi* were prepared for supplementation. *Zoodoi* was hand-made feed made mainly of *Allium mongolicum* and *Allium polyrrhizum*. *Allium mongolicum* tended to be used at FG1 frequently, and *Allium polyrrhizum* at FG2 depend on differences of micro vegetation. 44%, 90% and 39% of families prepared 165.6 kg of concentrate, 301.6 kg of hay and 6.8 kg of *Zoodoi* per sheep and goat (small livestock) on the average, respectively. The ratio of families that used concentrate at FG1 was smaller than those at FG2, though there were no significant differences on the amount. More hay was fed at FG1 than at FG2, and *Zoodoi* tended to be fed more in the FG1 group. Recipients were mostly restricted to young, female and sick small livestock that use the feeds effectively. More families gave concentrate and hay to the young than to the females and sick. They also gave more *Zoodoi* to young and sick animals than to females in this area. In the FG1 group, no differences were found between recipients on the concentrate supply. More families supplied hay to young animals than to sick ones, and *Zoodoi* was fed more to sick animals than to young and females. On the other hand, those in the FG2 found, more families fed fodders to young than to female and sick regardless of the kinds of feeds. The amount of fodder supplementation in the studied area was restricted, but accurate techniques of nomads to adapt the situation were clarified. ***(Asian-Aust. J. Anim. Sci. 2003. Vol 17, No. 2 : 203-206)***

Key Words : Pastoralism, Grazing, Sheep and Goats, Forage, Sustainable Livestock Production, Winter-spring Disaster

INTRODUCTION

Sustainable livestock production systems are examined world wide in the present day. Nomadic livestock production system, for over two millenniums, has been the major economic activity in Mongolia. The nomads have used opened natural pasture thoroughout the year by carrying sheep, goats, cattle, horses and camels. Biomass of natural pasture is maximum in early autumn and decreases gradually during cold season. The livestock lose 20 to 25 percent of their weights in relation to their autumn weights (Enkhamgalan, 1995).

In the socialist era, from 1960s to 1991, nearly all livestock were communized and managed by agricultural cooperatives. Hay and concentrate (as wheat bran mainly) were produced industrially by cooperative farms situated in the northern fertile area (*Khangai*) where annual precipitation was over 200 to 400 mm. These feeds were delivered to the cooperatives in the nomadic area, and fed to livestock by on-site working parties managing the livestock. In the early 1990s, socio-economical structure had liberalized. Livestock had been in widespread private ownership, and nomadic families had needed to prepare fodder by themselves. Industrial fodder production at this time also decreased steeply (Jigjidsuren, 1993; Enkhamgalan, 1995). However, there has been no information found detailing the fodder supply condition at individual households after liberalization. This study aims to contribute to the construction of the sustainable livestock production system in Mongolia by studying the fodder supply condition in *The Gobi Desert (Gobi)*, where the natural situation is more severe than that in *Khangai*.

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RESEARCH METHODS

Outline of studied site

Bulgan district (*Bulgan*), *Omnogobi* province (*Omnogobi*) was selected for present study. The *Omnogobi* (area 165,000 km^2) is located in central-southern part of Mongolia, bordering China for 800 km. This province has typical *Gobi* characteristics, i.e., annual precipitation is only 50 to 120 mm, vegetative types are steppe-desert or desert, and dominant livestock are goats and camels. Mountains over 2,000 m in height run the southern boarder of *Bulgan (*area 7,360 km^2), situated in northwestern part of *Omnogobi*. The eminent mountains may provide a protected area for this district's tender natural environment compared with other parts of the *Gobi*. Annual precipitation at the center of the *Bulgan* was 124.7 mm, averaged during 1985 to 1994. Nearly all nomad families care for four or five species of livestock. Less sheep and cattle, more camels and goats were hold compared with the average of country. More cattle and less camels were grazed compared with the average of the province. The *Bulgan* area could be divided

Table 1. Livestock structure of studied families at present of Dec.1994 in Gobi, Mongolia

Groups	No. of studied families	Livestock (heads/family)				
		Sheep	Goats	Cattle	Horses	Camels
FG1[1,2)]	19	92[a]	86[b]	4[b]	20	30[a]
FG2	22	42[b]	144[a]	25[a]	20	2[b]
Total	41	65	117	16	20	15

[1)] FG1=family group 1, that migrate in sparse vegetation; FG2=family group 2, that migrate in dense vegetation.
[2)] Means within the same column with different superscripts letters, [a] and [b], significantly different at p<0.05.

Table 2. Percentage of families that prepared concentrate, hay and *Zoodoi*, and average amounts of fodders per family that prepared them for cold season in Gobi, Mongolia

Groups	No. of studied households	Fodders (%, kg/family)					
		Concentrate[1)]		Hay		*Zoodoi*[3)]	
FG1[1, 2)]	19	26[bB],	124.0[b]	84[A],	533.8[a]	42[B],	8.8[a]
FG2	22	59[aB],	181.5[a]	95[A],	124.8[b]	36[B],	4.7[b]
Total	41	44[B],	165.6	90[A],	301.6	39[B],	6.8

[1)] FG1=family group 1, that migrate in sparse vegetation; FG2=family group 2, that migrate in dense vegetation; Concentrate=commercial concentrate feed. [2)] Means within the same column with different superscripts letters, a and b, significantly different at P <0.05. Means within the same row with different superscripts letters, A and B, significantly different at p<0.05. [3)] Fodder made of *Allium mongolicum* and/or *Allium polyrrhizum* mainly.

Table 3. Percentages of households that made *Zoodoi*[1)] of each material in *Gobi, Mongolia*

Groups	No. of studied households	Materials (%)		
		Allium mongolicum	*Allium polyrrhizum*	Wheat bran
FG1[2, 3)]	8	75[A]	50[AB]	13[B]
FG2	8	50[A]	88[A]	0[B]
Total	16	63[A]	69[A]	6[B]

[1)] Fodder made of *Allium mongolicum* and/or *Allium polyrrhizum* mainly. [2)] FG1=family group 1, that migrate in sparse vegetation; FG2=family group 2, that migrate in dense vegetation. [3)] Means within the same row with different superscripts letters, A and B, significantly different at p<0.05.

into northern and southern parts, by topographical differences. Features of the north are little slope, sand or sandy soil with complex vegetation types, i.e., *legume*, *lily*, *grass*, *goosefoot families*. These are dominant in the northern part. Oppositely, the southern part features, gentle or rapid slopes from the center up to the mountains with a simple vegetative structure, i.e., *grass* and *lily families*. Nomad families migrated from their winter-spring base camps, where there were thermal stalls with storm walls prepared. These groups were migrated only in the northern or southern parts, respectively (Yamasaki et al., 1996).

Research methods

Field studies were conducted from Dec. 1994 to Apr. 1995 with 41 families (19 families of FG1 and 22 families of FG2). They were selected randomly across *Bulgan*. Kinds, materials, amounts, and recipients of fodders were determined by word-of-mouth. Livestock structures of studied families up to December 1994 were collected from the statistical data of *Bulgan*. The number of carrying livestock and amounts of fodders computed into kilograms were analyzed statistically by the t-test between FG1 and FG2 groups. The families that prepared the feed, used every material available for hand-making feed and carried recipient livestock of the feed were compared by the chi-square test between the groups and/or the feeds. Minitab version 13.2 (Royan et al., 1998) was used for statistical analysis.

RESULTS

Table 1 shows livestock structure of studied families. Sheep and camels were used more in the FG1 group, and goats and cattle were used more in the FG2 group (p<0.05). Livestock rates of these groups would be almost the same, as no significant differences were found between the two groups on the total head of small livestock or on that of cattle, horses and camels.

Fodders were prepared at the studied families except for one family. Powdered and/or pelletized wheat bran was used as concentrate. Concentrate and an amount of hay was supplied commercially. *Zoodoi* was the most representative hand-made cake which was centimeters in diameter, mainly made of *Allium mongolicum* and/or *Allium polyrrhizum*. Other hand-made feeds, *Hojir-Seus* mixture and *Seusin Zoodoi*, were also known as a digester by nomads. *Hojir* was rock or exuded salt. *Seus* was rumen fluid and *Seusin Zoodoi* was *Zoodoi* with rumen fluid. A small amount of families made *Hojir-Seus*, and none made *Seusin Zoodoi* in the studied year.

Percentages of families that prepared concentrate, hay and *Zoodoi*, and amount of these feeds per family were showed in Table 2. Forty four percent, 90 and 39% of families prepared 165.6 kg of concentrate, 301.6 kg of hay and 6.8 kg of *Zoodoi* per one family, respectively. Significantly less families prepared concentrate at FG1 than FG2 (p<0.05). Also less amount of concentrate was

purchased. A significantly more amount of hay was prepared at the FG1 group than at the FG2 group ($p<0.05$). Comparably more *Zoodoi* was prepared at the FG1 group. Table 3 shows the percentages of studied families which made *Zoodoi* of *Allium mongolicum*, *Allium polyrrhizum* or wheat bran, respectively. Every family used *Allium mongolicum* and/or *Allium polyrrhizum*, but wheat bran was used only by one family. *Allium mongolicum* tended to be used more by the FG1 group, and *Allium polyrrhizum* at the FG2. Besides the above materials, curd as a milk by-product (*aartsu*) or *Hojir* was added to *Zoodoi* in some cases. Adding *aartsu* for *Zoodoi* might be intended to raise the nutrient value and the palatability, because it is rich in protein. *Hojir* was used for mineral supplement.

Recipients of supplementation were restricted, except a case in one family, to smaller livestock. These individuals would be the young of the first and second year, females and sick animals. Nomads thought some individuals were sick who tended to graze less during the grazing migration. These animals were most notably of the second year animals with late weaning dates who tended to be much smaller in body size compared to other of the same birth year. Table 4 shows small livestock recipients of fodders. Significantly more families fed concentrate and hay for young animals than for that were female or sick ($p<0.05$). *Zoodoi* was fed significantly more frequently to young and sick animals than for females ($p<0.05$). In the FG1 group, more families used hay for young stock and females than for sick animals, and used *Zoodoi* for the sick animals than for young and female individuals, respectively ($p<0.05$), instead of no significant differences in the case of concentrate. In the FG2 group, all families gave every type of fodder to the young stock, therefore, more families gave fodder to the young stock than for females and sick animals ($p<0.05$).

DISCUSSION

Fodder supply system has been changed in the last several decades. Hay might have been prepared generally and traditionally before the socialist era in Mongolia. As concentrates are not self-sufficient in a nomadic area, and the domestic wheat production were invested largely during socialist era, its feeding had been obviously started and increased by the national organization (State Statistical Office of MPR, 1991; Enkhamgalan, 1995). *Zoodoi* might be a unique and traditional supplement in the *Gobi* because *Allium mongolicum* and *Allium polyrrhizum* are dominate in the *Gobi* but not in the *Khangai*.

Although hay was generally utilized by the studied families to compensate for insufficient forage, it was calculated at less than 1.6 kg per small animal for one cold season. Hay is estimated to be the cheapest source of livestock fodder in Mongolia (Jigjidsuren, 1993), and small amounts of prepared hay might mean that families in the study tended to prepare it from nearby pasture. Concentrate and *Zoodoi* were prepared by only half of informants, and the amount of these feeds were also small. These results show that feed preparations were quite restricted, due to some of the following factors. Firstly, the processes of liberalization and introducing a market economy would have an affect. Not only by the sever situation of the fodder production system in *Khangai*, nomad peoples might not want to buy the feeds that they had gotten free in the socialist era. And, commercial feeds were more expensive in *Gobi* than in *Khangai* because of the high costs and margins for transportation. Second, poor vegetation in the *Gobi* compared with in the *Khangai* would prevent the preparation. Frequencies and ranges of tall plants, those suitable for hay, for example *grass family*, are limited in the *Gobi*. Thirdly, were the constraints of family labor. Cutting hay and processing *Zoodoi* were very labor-intensive with strong seasonality from summer to autumn.

As for horses and camels, nomadic people had never mentioned the need of a fodder supply during cold seasons. Horses were not brought back from the grazing pastures to base camps. Only cow camels with first or second year calves were brought to the camps (Purev, 1990), and they were seemed to grow up well with no supplementation. Calves that born from winter to early spring needed to be

Table 4. Percentages of families that carried recipient sheep and goats of fodders in Gobi, Mongolia

Supplemental feeds	Groups	No. of studied households	Recipients (%)		
			Young	Female	Sick
Concentrate[1)]	FG1[1)]	4	75	50	50
	FG2[3)]	13	100^{A}	46^{B}	62^{B}
	Total	17	94^{A}	47^{B}	59^{B}
Hay	FG1	16	63^{aA}	50^{AB}	1^{B}
	FG2	21	100^{bA}	29^{B}	33^{B}
	Total	37	84^{A}	38^{B}	27^{B}
Zoodoi[2)]	FG1	8	25^{aB}	25^{B}	88^{aA}
	FG2	8	100^{bA}	0^{B}	25^{bB}
	Total	16	63^{A}	13^{B}	56^{A}

[1)] FG1=family group 1, that migrate in sparse vegetation; FG2=family group 2, that migrate in dense vegetation; Concentrate=commercial concentrate feed. [2)] Fodder made of *Allium mongolicum* and/or *Allium polyrrhizum* mainly. [3)] Means within the same column with different superscripts letters, [a] and [b], significantly different at $p<0.05$. Means within the same row with different superscripts letters, A and B, significantly different at $p<0.05$.

fed hay (Umesao, 1990). But, calves were generally delivered from April to October in the study site, therefore, small livestock animals were stressed that were not resistant to the coldness and feed deficiency. Recipients had also been limited from that in socialist era as follows (Onuki, 1985): Firstly, pregnant small livestock were not given feed. Second, females that were expected to deliver in a day were grazed with other females and castrated, because it was not sure whether the individuals would deliver in a day. These methods of fodder supplementation would be the technique of nomad peoples to adapt to the situation.

Some differences were found on the fodder supply condition between FG1 and FG2. FG1, in sparse vegetation area, emphasized preparations of roughage and needed fodder supply for not only young but also female and sick that could manage to feed in pasture. Oppositely, FG2 could prepare less amount of roughage and emphasize preparation of concentrate and feeding for young, because they situated in comparably dense vegetation. Differences were also found on materials of *Zoodoi*. Both *Allium mongolicum* and *Allium polyrrhizum* were used at FG1, but *Allium polyrrhizum* was used more frequently at FG2. These differences between FG1 and FG2 would be understood as adaptation of individual families for the differences of micro-vegetation.

From above discussions, restricted situation of fodder supplementation and factors that would affect, accurate techniques of nomad families to adapt to the situations in *The Gobi Desert* were clarified. However, national and international programs that aim to increase industrial fodder production would be very important to munite in advance for unusual natural conditions (Tserendash. 1990; Jigjidsuren, 1993; Robin, 1993). On the other hand, there are some 2,500 species of natural plants in the country, and their nutritive values are high in carbohydrate, protein, vitamin and minerals compared with that of wetter countries (Tserendulam, 1990; Tserendulam and Togtokh, 1999). Nomad peoples could recognize fodder plants and those nutritive value well (Sanchir, 1999). Therefore, evaluation of hand-made fodders and natural plants would be needed by the collaboration between nomads' indigenous knowledge and animal science to develop the situation.

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