

短 報
Note

Weight Loss During Winter and Cashmere Yields in Three Breeds of Mongolian Native Goat

By

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Summary : To establish excellent goat breeds in Mongolia, we have performed the cloning of genes related to cashmere production. As a genetic pool for this purpose, we have maintained Bayandelger (BD), Gobi Gurvan Saikhan (GGS), and Zalaajinst White (ZW) in Mongolia. In this study, the breed traits of the 3 goat populations were evaluated based on age-related and seasonal changes in body weight and cashmere production, and the following results were obtained.

1. Weight loss during winter was compared among individuals in the GGS, ZW, and BD populations. No significant difference was noted between GGS and ZW, but a significant difference was observed between the two populations and BD ($p < 0.05-0.01$) in spring at the age of 4 years. Weight loss was the lowest in BD (23.70%), followed by GGS (24.90%). The heaviest ZW showed the greatest weight loss during winter (36.06%) among the 3 populations.

2. The cashmere yields in GGS, ZW and BD were 333.11 ± 8.32 , 268.07 ± 12.30 , and 222.86 ± 5.32 g, respectively, and the cashmere diameters in these populations were 16–19, 15–16.5 and 12–15 μm , respectively. Therefore, considering the hair color trait, BD, with the thinnest cashmere, may be an excellent breed. The lowest weight loss during winter seen in this population may be associated with the heat-retaining effects of the thin cashmere.

3. In BD, the correlation coefficients between cashmere length (5.68 ± 0.39 cm) and production (222.86 ± 5.32 g), and between cashmere diameter (16.53 ± 0.10 μm) and production were 0.747 and 0.137, respectively, showing a marked correlation between length and production.

Key words : Cashmere yields, Mongolian native goat, Weight loss during winter

Introduction

Among 5 livestock species (cow, horse, goat, sheep, and camel) in Mongolia, the number of goats has been rapidly increasing in recent years¹. This is because of the economical merits of cashmere production. Until 1990, the ratio of the number of breeding sheep (15,000,000) to that of goats (5,000,000) was 3 : 1, but was 1 : 1.06 in 2004, resulting in a reversal of the production situation, because the number of goats increased to 12,000,000. Differences in grazing preference between sheep and goats and goat overgrazing have aroused concern about the devastation of the vegetation of

Mongolian grasslands².

In Mongolia, the excellent goat breeds obtained as a result of selection and improvement for cashmere production are Bayandergeriin Red, Erchim Mountain Black, Ulgii Red, and Durveljingiin Red³. To improve the productivity of the livestock industry in Mongolia by establishing excellent goat breeds, we have performed the cloning of genes related to cashmere production. As a genetic pool for this purpose, we have maintained Bayandelger (BD), Gobi Gurvan Saikhan (GGS), and Zalaajinst White (ZW) in Mongolia. In this study, age-related and seasonal changes in the body weight of these goat populations and their breed char-

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acteristics based on cashmere production were evaluated.

Materials and Methods

1) Number of surveyed animals

The numbers of goats in the GGS (hair color, black), ZW (white), and BD (brown) populations were 57, 28, and 179, respectively. Body weight (kg) and cashmere production (g) were measured. Individuals were weighed at birth and from the age of 1 to 4 years. Cashmere production was measured for 3 years between 2004 and 2006. In BD, both height, body length, chest circumference, chest depth (cm), cashmere length (cm), and its diameter (μm) could also be investigated⁴). Among the 3 goat populations, BD and ZW were breeds with excellent cashmere production traits, and GGS was selected as a control.

2) Statistical analysis

Differences among the breeds were analyzed by analysis of variance (Multiple Range Test). Paired data were used for the analysis of weight loss during winter.

Results and Discussion

1) Hair color in the 3 populations

As shown in Fig. 1-3, the hair colors of BD, GGS and ZW were brown, black and white, respectively. In general, goats frequently have brown hair. However, as shown in Fig. 4, the brown guard hair of BD was darker and glossier than that of brown goats of an unknown breed. The No. 2 goat had curly hair, but the BD goat (No. 1) had almost straight hair. High-quality cashmere is white.



Fig. 1 Brown hair color of Bayandelger (BD) breed in Mongolian native goat



Fig. 2 Black hair color of Gobi Gurvan Saikhan (GGS) breed in Mongolian native goat

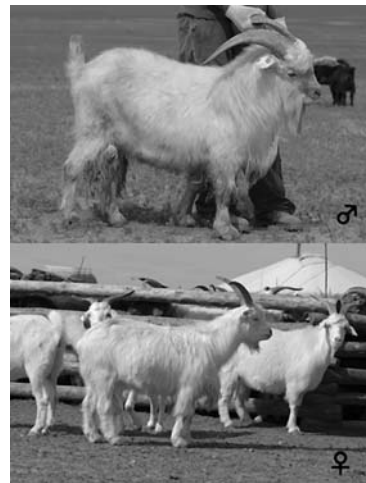


Fig. 3 White hair color of Zalaajinst White (ZW) breed in Mongolian native goat

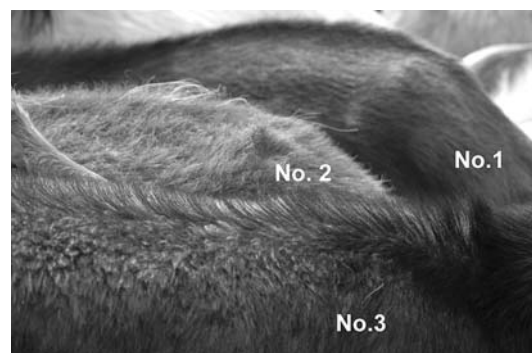


Fig. 4 Comparison with hair color in Bayandelger (BD) and other breeds in Mongolian native goat
No. 1 is BD breed with glossier hair, No. 2 is unknown breed with brown coat color, No. 3 is unknown breed of black coat color with cashmere

Table 1 Comparison with body weight and cashmere yields among three breeds of Mongolian native goat

Goat breeds	Birth weight(kg) Spring season	Body weight (kg) in spring season(3/10~4/10)				Body weight (kg) in autumn season(9/10~11/10)		
		2003(year-old)	2004(2 years old)	2005(3 years old)	2006(4 years old)	2003(year-old)	2004(2 years old)	2005(3 years old)
GGS(Black)	n=20		n=10	n=28	n=28	n=10	n=6	n=34
	2.17 ±0.10 a)		15.95 ±0.80	20.54 ±0.65	24.71 ±0.64	18.20 ±0.42	34.33 ±0.80	35.53 ±0.76 a)
ZW(White)	n=12		n=13	n=13	n=12	n=13		n=13
	1.98 ±0.10 a)		14.46 ±0.67	25.15 ±0.65	26.75 ±1.05	19.46 ±0.33		41.62 ±0.96 b)
BD(Brown)	n=48	n=60	n=60	n=51	n=58	n=60		n=56
	2.57 ±0.06 b)	14.58 ±0.33	14.01 ±0.24	23.73 ±0.27	29.12 ±0.44	18.42 ±0.32		38.59 ±0.39 c)
Goat breeds	Cashmere yields(g)			Average ± Standard Error				
	2004	2005	2006	A significant difference was recognized at a 1%(**) level between different codes(a, b, c)				
GGS(Black)	n=11	n=11	n=35	GGS: Gobi Gurvan Saikhan				
	239.46 ±12.81	346.73 ±14.34	358.26 ±7.31 a)	ZW: Zalaajinst white				
ZW(White)	n=5	n=12	n=11	BD: Bayandelger				
	236.80 ±15.97	299.50 ±17.63	248.00 ±21.59 b)					
BD(Brown)	n=59	n=41	n=58					
	174.95 ±6.21	253.49 ±11.73	242.00 ±8.41 c)					

Table 2 Loss rate of body weight in three breeds of Mongolian native goat (female) during winter

Breeds(Number)	Autumn in 2005•body Weight (kg)	Spring in 2006•body weight (kg)	Loss rate(%)
GGS•Black (n=8)	35.29±0.88 a)**	24.71±0.64 a)**	24.90 a)
ZW•White (n=12)	41.83±1.01 b)**	26.75±1.05 a)*	36.06 b) **
BD•Brown (n=54)	38.44±0.39 c)**	28.35±0.44 b)	23.70 a)

Loss rate shows a ratio of body weight in spring season to that in autumn season.

A significant difference was recognized at 1%(**) and 5 %(*) level between different code (a and b).

The paired samples were statistically analyzed by Multiple Range Test.

Average ± Standard Error

GGS: Gobi Gurvan Saikhan, ZW: Zalaajinst white, BD: Bayandelger

2) Body weights and weight reduction rates during winter in the 3 populations

At birth, BD was the heaviest, followed in order by GGS and ZW (Table 1). In the fall (September-November) at the age of 1 year, ZW was the heaviest over 19 kg while BD and GGS weighed between 18 and 19 kg. In the fall at the age of 3 years, ZW was the heaviest, followed in order by BD and GGS. The body weight in each goat population increased 15-22 fold at the age of 3 years compared with the birth weight.

Using body weight data in the fall of 2005 and spring (March-April) of 2006 in the same individuals in the GGS, ZW, and BD populations, the rate of weight loss during winter was compared among the 3 populations (Table 2). Body weight at the age of 3 years significantly differed among the 3 populations ($p < 0.01$). In spring, at the age of 4 years, body weight did not differ between GGS and ZW but significantly differed between these two populations and BD ($p < 0.05-0.01$). Weight loss was the lowest in BD (23.70%), followed by GGS (24.90%). The heaviest ZW showed the greatest weight loss (36.06%) among the 3 populations.

In BD, the body height, body length, chest circumference, and chest depth were 57.17 ± 0.31 , 62.51 ± 0.31 , 75.73 ± 0.35 , and 28.32 ± 0.16 cm, respectively, and the correlation coefficients between these items and body weight were 0.192, 0.480, 0.787, and 0.581, respectively, showing a marked correlation between chest circumference and

body weight. The correlation coefficients between body height and body length, between body height and chest circumference, and between body height and chest depth were 0.557, 0.222, and 0.552, respectively, and those between body length and chest circumference and between body length and chest depth were 0.559 and 0.559, respectively. The correlation coefficient between chest circumference and chest depth was 0.646.

3) Cashmere production in the 3 populations

The cashmere yields in GGS, ZW, and BD were 333.11 ± 8.32 , 268.07 ± 12.30 , and 222.86 ± 5.32 g, respectively (Table 3). The correlation coefficients between the cashmere yield and body weight in GGS, ZW, and BD were -0.044 , 0.468 , and 0.206 , respectively, showing no association. For BD, showing the lowest cashmere yield, weight loss rate during winter was the lowest. This may be associated with the natural traits, not the total amount of cashmere.

Based on the literature, in BD, GGS, and ZW, the colors of cashmere are gray, brown/black, and white, respectively, and its diameters are 12-15, 16-19 and 15-16.5 μm , respectively⁵⁾. In our study, the cashmere diameter was $16.426 \mu\text{m}$ in BD ($n=23$) and $18.200 \mu\text{m}$ in GGS ($n=1$). In the literature, the cashmere yields are 300-330 (σ^7) and 340 g (φ) in BD, 600-800 (σ^7) and 400-500 g (φ) in GGS, and 377 (σ^7) and 287 g (φ) in ZW⁵⁾.

Table 3 Relationship between body weight and cashmere traits in three breeds of Mongolian native goat

Goat breeds	Measure	Cashmere traits			Body weight (kg)
		Yield (g)	Length (cm)	Diameter (μ m)	
GGS (Black)	Number (n)	57			34
	M \pm S.E.	333.11 \pm 8.32			35.53 \pm 0.76
	Correlation coefficient	—			-0.044
ZW (White)	Number (n)	28			13
	M \pm S.E.	268.07 \pm 12.30			41.62 \pm 0.96
	Correlation coefficient	—			0.468
BD (Brown)	Number (n)	179	10	23	56
	M \pm S.E.	222.86 \pm 5.32	5.68 \pm 0.39	16.53 \pm 0.10	38.59 \pm 0.39
		—	0.749	0.137	0.206
	Correlation coefficient	—	—	-0.065	0.396 0.197

Cashmere yield was used from average data in 2004, 2005 and 2006

Average \pm Standard Error

GGS: Gobi Gurvan Saikhan, ZW: Zalaajinst white, BD: Bayandelger

Thus, considering the hair color trait, BD, with the thinnest cashmere and curly hair, may be an excellent breed (Fig.4). The lowest weight loss in BD may be because thin hair has an excellent capacity for heat retention.

In BD, cashmere length (5.680 ± 0.386 cm) and diameter (16.526 ± 0.103 μ m) were measured. The correlation coefficients between the two traits and cashmere production were 0.747 and 0.137, respectively, showing a marked correlation between length and production. There was no association (correlation coefficient, -0.261 -0.396) between cashmere length or diameter and the somatometric measurement items (body weight, body height, body length, chest circumference, and chest depth).

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モンゴル在来山羊 3 集団の冬季体重損耗率と カシミア毛生産量

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要約：モンゴル国における優良ヤギ品種の確立を目的としてカシミア毛生産関連遺伝子のクローニングを試みている。その研究対象のリソース・ファミリーとして Bayandelger (BD), Gobi Gurvan Saikhan (GGS) および Zalaajinst White (ZW) の 3 集団をモンゴル国内に維持している。今回、本ヤギ集団における体重の加齢および季節的変動、並びにカシミア毛生産量からそれらの品種特性を調査した結果、以下の成績が得られた。

1. GGS, ZW, BD 集団の同一個体の冬季間における体重の損耗率を比較した結果、4 歳齢の春には GGS と ZW 集団には有意差は認められなかったが、この 2 集団と BD 集団間に有意差が認められた ($p < 0.05 \sim 0.01$)。体重損耗率は BD 集団で最も低く 23.70% で、次いで GGS 集団の 24.90% であった。最も体重の重かった ZW 集団は冬季間の損耗が 36.06% で 3 集団の中で最も大きかった。

2. GGS, ZW および BD のカシミア毛生産量は、それぞれ 333.11 ± 8.32 g, 268.07 ± 12.30 g および 222.86 ± 5.32 g であった。カシミア毛の直径は 16-19, 15-16.5 および 12-15 μm であることから、BD 集団のカシミア毛が最も細く、毛色形質を考慮すると優良な品種と判断された。冬季間の体重損耗率が最も少ないのは、細い毛による体温保温効果と関係しているものと推察された。

3. BD 集団におけるカシミア毛の長さ (5.68 ± 0.39 cm), 直径 ($16.53 \pm 0.10 \mu\text{m}$) および毛生産量 (222.86 ± 5.32 g) のそれぞれの間における相関では、長さ と 生産量 の間に強い相関 (0.747) が認められた。

キーワード：カシミア毛生産, モンゴル在来山羊, 冬季体重損耗率

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