Impact of Feeding Levels of Bermuda Grass Hay and Barnyard Millet on Growth and Morphological Characteristics in Male Korean Native Black Goats

Kwan-Woo Kim, Eun-Do Lee, Dong-Kyo Kim, Hee Chung Ji, Byamungu Mayange Tomple Animal Genetic Resources Research Center, National Institute of Animal Science, RDA

e-mail: <u>tomplemayange07@korea.kr</u>

버뮤다그래스 건초와 사료 피의 급여 수준이 수컷 재래흑염소의 성장 및 형태에 미치는 영향

김관우, 이은도, 김동교, 지희정, 톰플 농촌진흥청 국립축산과학원 가축유전자원센터

Abstract

This study evaluated the effects of feeding levels of Bermuda hay and Barnyard millet on growth and morphological characteristics in 4 growing male Korean native black goats (KNBG) (3 months old; 16.0 ± 0.7 kg BW). Goats were fed at either 1.5% or 2.0% of body weight (BW) for each forage type. Barnyard millet at 2.0% BW resulted in the highest final body weight (17.3 kg), weight gain (2.8 kg), and average daily gain (81.0 g/d), with the most efficient feed conversion (FCR = 6.2). In contrast, 1.5% Barnyard millet led to the lowest performance metrics. Bermuda hay at 2.0% BW had the highest dry matter intake (635.9 g) but lower efficiency (FCR = 16.4). Structurally, Bermuda hay at 2.0% BW produced the longest body length (61.8 cm), tallest shoulder height (54.8 cm), and widest chest (15.9 cm). Barnyard millet at 2.0% BW is effective for maximizing growth and feed efficiency, while Bermuda hay at 2.0% BW supports superior skeletal development in male KNBG.

1. Introduction

The effective population size of Korean native black goats (KNBG) has declined across generations [1], highlighting the need for improved management strategies to sustain productivity and genetic diversity. Among these, optimizing feeding practices is critical. Growth performance in small ruminants is influenced by multiple factors, including forage type, feeding level, and intake efficiency. While higher forage inclusion levels (e.g., >10% of DM) can enhance average daily gain through increased gut fill, they may simultaneously reduce feed efficiency due to lower nutrient density [2]. Barnyard millet has gained attention for its adaptability, high biomass yield, and enhanced nutritional quality, making it a promising forage option [3]. Similarly, Bermuda grass hay serves as a practical roughage source with growth outcomes comparable to conventional forages in small ruminants [4]. This study investigates the effects of different feeding levels of Barnyard millet and Bermuda hay on growth performance and morphological characteristics in growing male KNBG.

2. Materials and Methods

Four male KNBG, aged three months with an average initial BW of 16.0 ± 0.7 kg, were housed individually in iron pens ($1.2 \text{ m} \times 0.9 \text{ m}$). The study employed a 4×4 Latin Square design, where each goat received four dietary treatments across four periods. Treatments

consisted of Bermuda hay or Barnyard millet fed at 1.5% or 2.0% of body weight (BW). Growth performance indicators included initial and final BW, total weight gain (TWG), average daily gain (ADG), dry matter intake (DMI), and feed conversion ratio (FCR). Structural traits measured were body length, body depth, chest width, and chest girth. Data were analyzed using SAS software (version 9.1, SAS Institute, Cary, NC, USA), with statistical significance set at p < 0.05.

3. Results

3.1 Growth of goats fed varying levels of forage Barnyard millet at 2.0% BW yielded the highest final BW (17.3 kg), BW gain (2.8 kg), and ADG (81.0 g/d), while also achieving the lowest FCR (6.2), indicating superior feed efficiency. Bermuda hay at 2.0% BW showed the highest DMI (635.9 g) but lower efficiency (FCR = 16.4), suggesting more intake without proportional gain. Barnyard millet at 1.5% BW resulted in the lowest growth metrics and feed efficiency, indicating that both forage type and level significantly affect performance.

[Table 1	1	Ingredients	and	chemical	composition	of	the	diets
I Table I		Ingreulents	anu	Chemical	COMPOSITION	U1	une	ulets

Itomo	Bermud	Barnyar	Concentrat						
items	a hay	d millet	е						
Ingredient composition, % DM									
Cereal grains (corn, wheat)	-	-	35.3						
Bran types (corn, soybean)	-	-	22.0						
Meal types (palm kernel)	-	-	19.7						
Legumes	-	-	3.5						
Food processing	-	-	4.0						
Calcium salts	-	-	2.5						
Fat types	-	-	2.0						
Phosphates	-	-	1.2						
Salt (Refined salt)	-	-	0.8						
Trace minerals	-	-	0.4						
Buffer agents	-	-	0.8						
Additives	-	-	2.0						
Vitamins & others	-	-	0.8						
Premix base feed	-	-	4.0						
Chemical composition, % DM									
Dry matter	90.8	90.8	87.9						
Moisture content	9.2	9.2	12.1						
Ash	7.4	7.4	6.7						
Crude fiber	40.3	40.3	10.5						
Crude protein	5.5	5.5	16.1						
Esther extract	0.9	0.9	5.3						
Acid detergent fiber	40.2	40.2	13.3						

Neutral detergent fiber	66.1	66.1	28.0			
Non-fiber carbohydrates	20.1	20.1	43.9			
Pepsin digestibility	90.5	90.5	-			
Non-fiber carbohydrates (%) = 100 - (ash + CP + EE + NDF),						

3.2 Morphology of goats fed varying levels of

forage

Bermuda hay at 2.0% BW led to the most favorable structural outcomes, with the longest body length (61.8 cm), highest shoulder height (54.8 cm), and widest chest (15.9 cm). Barnyard millet at 2.0% BW also improved structural traits compared to its lower level, particularly showing the greatest chest girth (67.8 cm). Barnyard millet at 1.5% BW consistently resulted in the lowest values across all traits, indicating insufficient support for skeletal development at this level.

[Table 2] Growth performance of goats fed varying levels of Bermuda hay and barnyard millet

		Treat	ment					
Items	Bermu	da Hay	Barnyard millet		SEM	p-value		
	1.5%	2.0%	1.5%	2.0%		Х	Υ	X×Y
IBW, kg	17.3	19.4	13.0	14.4	0.7	-	_	_
FBW, kg	19.4	20.9	14.4	17.3	0.7	-	-	-
BWG, kg	2.2^{ab}	1.5b	1.4^{b}	2.8ª	0.2	0.050 5	0.091 2	0.031 3
DMI, g	524.6 b	635.9 ª	419.3 c	493.5 b	23.7	0.000 8	0.027 8	0.000 5
ADG, g/d	53.6 ^b	41.4 ^b	33.7 ^b	81.0ª	5.8	0.014 4	0.041 3	0.004 8
FCR	10.1ª b	16.4 ^a	18.1ª	6.2^{b}	2.0	0.043 8	0.174 4	0.008 0

SEM, standard error of the means (n = 4); X, 1.5% and 2.0% of Bermuda grass hay; Y, 1.5% and 2.0% of Barnyard millet ; IBW, initial body weight; FBW, final body weight; BWG, body weight gain; DMI, dry matter intake, ADG, average daily gain; FCR, feed conversion ratio;

 $^{a-b-c}$ Values with different superscripts in row are significantly different (p<0.05)

[Table 3] Morphological characteristics of goats fed varying levels of Bermuda hay and barnyard millet

		Trea	tment						
Items	Bermuda Hay		Barnyard millet		SEM	p-value			
	1.5%	2.0%	1.5%	2.0%		Х	Y	X×Y	
BL, cm	57.1 b	61.8 a	51.5 ^c	57.5 ^b	1.2	0.002 6	0.004 5	<.0001	
SH, cm	49.8 b	54.8 a	47.4 ^b	47.3 ^b	0.9	0.037 6	0.924 2	0.001 1	
CW, cm	14.1 b	15.9 a	12.9 ^c	14.8 ^b	0.3	0.052 6	0.022 7	0.000 2	
CG, cm	66.5 a	65.5 a	57.3 ^b	67.8 ^a	1.2	0.252 2	0.015 3	0.000 3	

SEM, standard error of the means (n = 4); X, 1.5% and 2.0% of Bermuda grass hay; Y, 1.5% and 2.0% of Barnyard millet; BL, body length; SH, shoulder height; CW, chest width; CG, chest

4. Conclusion

Barnyard millet at 2.0% BW is effective for maximizing growth and feed efficiency, while Bermuda hay at 2.0% BW supports superior skeletal development in male KNBG.

Reference

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