Growth and Morphometric Responses of Growing Female Korean Native Black Goats to Varying Levels of Local and Imported Forages

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국내산 및 수입산 조사료의 급여 수준에 따른 암컷 재래흑염소의 성장 및 형태적 반응

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Abstract

This study investigated the impacts of feeding levels of imported and local forages on growth and morphometric development in female Korean native black goats (KNBG). Four goats (3 months old; 10.6±0.4 kg BW) were assigned to 4 dietary treatments: 1.5% and 2.0% of body weight (BW) as imported forage, and 1.5% and 2.0% BW as local forage, using a 4×4 Latin square design over 5 months. The 2.0% imported forage group showed the highest final BW (14.9 kg), body weight gain (2.7 kg), and average daily gain (75.8 g/d), alongside the lowest feed conversion ratio (6.0), indicating superior efficiency. In contrast, local forage at 1.5% BW showed the lowest growth performance (0.9 kg BWG, 20.3 g/d ADG, and FCR of 16.7). Morphometric traits, including body length, shoulder height, chest width, and chest girth, were also most favorable in the 2.0% imported forage group. These results suggest that higher levels of imported forage significantly enhance both growth performance and morphometric development in young female goats, while lower levels of local forage may limit development.

1. Introduction

The Korean native black goat is an indigenous breed comprising three registered strains: Jangsu, Tongyeong, and Dangjin [1]. Despite its cultural and agricultural significance, the breed is currently facing challenges such as a declining effective population size [2] and a lack of research on optimal nutritional management strategies. In particular, limited data are available comparing the effects of local and imported forages on growth and morphometric development in KNBGs [3]. This study was conducted to evaluate how varying feeding levels of local (barnyard millet) and imported (Bermuda hay) forages influence growth performance and skeletal traits in growing female KNBGs. By identifying effective forage combinations, the study aims to inform evidence-based feeding strategies that promote both productivity and long-term genetic sustainability of this native breed within Korean goat farming systems.

2. Materials and Methods

2.1 Animals and treatments

4 female KNBG with an average age of 3 months and initial BW of 10.6±0.4 kg. The goats were kept in individual iron-made pens measuring 120×90 cm (length×width). They were assigned to 4 treatments based on feed intake as a percentage of BW: 1.5% and 2.0% of BW as imported forage and 1.5% and 2.0% of BW as local forage.

2. 2 Measurements and design

Growth measurement was initial/FBW, BWG, ADG, DMI, and FCR; and the morphology was body length/depth, chest width/girth. A 4×4 Latin Square design was used, ensuring that each goat received all dietary treatments in a rotational sequence in 4 periods. The statistical analysis was conducted using SAS (version 9.1, SAS institute, Cary, NY, USA) and significance was established at a 5% probability level (p<0.05).

3. Results

3. 1 Growth Performance

Feeding level and forage type significantly influenced growth performance in young female KNBG. Goats fed imported forage at 2.0% of BW achieved the greatest final BW (14.9 kg), BWG (2.7 kg), and ADG (75.8 g/d), accompanied by the most efficient FCR (6.0). In contrast, goats on local forage at 1.5% BW exhibited the lowest growth performance, with final BW at 10.0 kg, ADG of 20.3 g/d, and the least efficient FCR (16.7). Dry matter intake followed a similar trend, highest in the 2.0% imported group (437.4 g) and lowest in the 1.5% local group (289.2 g), suggesting that both forage type and feeding level significantly impact intake and efficiency.

[Table 1] Ingredients and chemical composition of the diets

Items	Import	Local	Concentrate
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	92.3	90.8	87.9
Moisture content	7.7	9.2	12.1
Ash	7.2	7.4	6.7
Crude fiber	26.8	40.3	10.5
Crude protein	11.9	5.5	16.1
Esther extract	0.8	0.9	5.3
Acid detergent fiber	25.8	40.2	13.3
Neutral detergent fiber	62.0	66.1	28.0
Non-fiber carbohydrates	18.1	20.1	43.9
Pepsin digestibility	85.7	90.5	–

Non-fiber carbohydrates (%) = 100 – (ash + CP + EE + NDF), Import, imported forage (Bermuda grass hay), Local, local forage (Barnyard millet)

3. 2 Morphometric Traits

This parameter also improved with increased forage intake, particularly with imported forage. The 2.0% imported forage group recorded the most favorable structural development, including the longest body length (53.5 cm), widest chest width (13.5 cm), and highest chest girth (58.0 cm). Shoulder height remained consistent between the 1.5% and 2.0% imported forage groups (45.0–45.2 cm), but was significantly lower in goats fed local forage, especially at 1.5% BW (41.9 cm). Goats receiving local forage at 1.5% BW showed the poorest structural measurements across all indicators, highlighting the limitations of lower-level local forage in supporting skeletal development.

[Table 2] Effects of different feeding levels on growth performance in young female Korean goats

Items	Treatment				SEM	*p*-value		
	Imported forage		Local forage					
	Low	High	Low	High		I	L	I×L
IBW, kg	11.1	12.3	9.1	10.0	0.4	-	-	-
FBW, kg	12.3	14.9	10.0	11.1	0.6	-	-	-
BWG, kg	1.2^{b}	2.7^{a}	0.9^{b}	1.1^{b}	0.2	0.0049	0.5551	0.0041
DMI, g	362.8^{a}	437.4^{a}	289.2^{b}	332.5^{ab}	16.7	0.0661	0.0262	0.0005
ADG, g/d	34.3^{b}	75.8^{a}	20.3^{b}	31.5^{b}	6.0	0.0222	0.3432	0.0021
FCR	10.8^{ab}	6.0^{b}	16.7^{a}	11.9^{ab}	1.5	0.0104	0.4722	0.0288

SEM, standard error of the means (n = 4); Low, 1.5% of BW as imported forage or local forage; High, 2.0% of BW as imported forage or local forage; L, local level of 1.5% of both forages; H, high feeding level of 2.0% of both forages; IBW, initial body weight; FBW, final body weight; BWG, body weight gain; DMI, dry matter intake, ADG, average daily gain; FCR, feed conversion ratio;

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

[Table 3] Effects of different feeding levels on morphology in young female Korean goats

Items	Treatment				SEM	*p*-value		
	Imported forage		Local forage					
	Low	High	Low	High		I	L	I×L
BL, cm	47.2^{b}	53.5^{a}	46.4^{b}	48.4^{b}	1.2	0.0017	0.5314	<.0001
SH, cm	45.0^{a}	45.2^{a}	41.9^{b}	42.2^{b}	0.9	0.7645	0.8205	0.0011
CW, cm	11.5^{b}	13.5^{a}	9.9^{c}	11.8^{b}	0.3	0.0001	0.0019	0.0002
CG, cm	58.0^{a}	56.5^{a}	50.0^{c}	53.1^{b}	1.2	0.2452	0.0563	0.0003

SEM, standard error of the means (n = 4); Low, 1.5% of BW as imported forage or local forage; High, 2.0% of BW as imported forage or local forage; L, local level of 1.5% of both forages; H, high feeding level of 2.0% of both forages; BL, body length; SH, Shoulder height; CW, chest width; CG, chest girth;

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

4. Conclusion

Feeding young female KNBG with 2.0% BW of imported forage significantly improves growth rate and structural development compared to lower levels or local forage. While local forage at 2.0% of BW offers moderate improvements, lower feeding levels of local forage are insufficient to support optimal growth.

References

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