

## Lamb Growth Studies in Tsagaan-Uul breed

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### Abstract

The live weight of Tsagaan-Uul male lambs at weaning, around five months of age, shows a notable increase, with male lambs gaining an average of 8.4 kg and female lambs gaining 8.2 kg. Remarkably, both male and female lambs experience a growth increase of 1.2 times during the two months following weaning. During the early stages of life, from one to three months, male lambs exhibit live weights ranging from 5.63 to 7.73 kg, while female lambs weigh between 5.41 and 6.85 kg. At separation from their mothers, typically around four to six months old, male lambs weigh between 4.07 and 4.26 kg, and female lambs range from 3.77 to 4.01 kg. In the first month post-birth, lambs experience significant growth, increasing their live weight by 168.8 to 204.7 percent. However, this growth rate notably declines starting in the second month, reducing by a factor of 2.95 to 2.97 times. After weaning, when lambs are around four to five months old, the growth rate decreases further, declining by 3.89 to 4.66 times compared to their growth at two months of age, indicating a substantial slowdown in growth intensity. Under natural grazing conditions, the live weight of Tsagaan-Uul male lambs increases at a rate of 127 to 258 grams per day, while female lambs show a daily weight gain of 98 to 201 grams during their first seven months of life. Specifically, free-grazing male lambs achieve an average daily weight gain exceeding 200 grams until they reach two months of age. However, by seven months, particularly in the first ten days of September, their daily weight gain decreased by 2.03 to 2.05 times compared to the rate observed in the first month.

**Keywords:** Tsagaan-Uul, live weight, meat characteristic, lamb

### Introduction

Lamb growth performance is an important indicator of genetic potential, environmental adaptation, and nutritional management practices in sheep production. Numerous factors including breed type, feeding system, pasture quality, and maternal health significantly influence growth parameters such as body weight gain and muscle development. In Mongolia, where extensive pasture-based systems dominate, local breeds such as Tsagaan-Uul sheep are widely raised for their adaptability and meat quality. Previous studies on Mongolian sheep breeds have focused on growth potential under traditional herding systems [1]-[3]. Research has highlighted the influence of seasonality and maternal nutrition on lamb performance [2], [4], while environmental factors such as pasture degradation have also been identified as growth-limiting [5]. Comparative

studies among Mongolian breeds show notable variation in daily weight gains [7], [16], [20], consistent with breed-specific responses to grazing conditions and regional climates. Internationally, similar research has been conducted on various indigenous sheep breeds, including Santa Inês in Brazil, which demonstrated clear growth trajectories in response to environmental and management variables [24]. Likewise, the Daglıç breed in Turkey showed average daily gains of approximately 179 g/day under pasture-based systems [25]. This study evaluates the growth performance of Tsagaan-Uul lambs in the Kharkhorin region under natural grazing conditions, aiming to determine daily weight gain patterns by sex and age group and compare findings to national and international benchmarks.

## Material and methods

In 2019, we conducted this study on the sheep of the core flock of the Tsagaan-Uul breed, which are raised in the natural and ecological pasture conditions of Tsagaan-Uul Sum, Khuvsgul Province. This study investigates the live weight at birth and subsequent growth patterns of 15 rams

and 15 female lambs from birth to seven months of age. We assessed daily weight gain, relative growth, and absolute growth using standardized methodologies. Data were analyzed with Prism 10.3.1 software to identify differences in growth rates between sexes.

Daily weight gain is a critical metric for assessing growth, as it specifically reflects the dynamic growth patterns that occur during the

developmental stages of young sheep. This measure indicates the number of grams gained per day and is defined by the following formula:

$$D = \frac{W_2 - W_1}{t} \times 100$$

**D** - Additional weight per day, **W<sub>1</sub>** - Last weight, **W<sub>0</sub>** - First weight, **t** – Time

### Equation 1. Extreme growth

**Absolute growth** is an indicator determined by the difference in weight measured between two different time periods.

$$K = W_2 - W_1$$

**K** - Pole gain, **W<sub>2</sub>** - Last weight, **W<sub>1</sub>** - First weight

**Relative growth** indicates the percentage increase in the weight of the animal from the first measurement to the next. Relative growth was calculated using the following formula:

$$K = \frac{W_2 - W_1}{W_1} \times 100$$

**K**-Relative growth, **W<sub>1</sub>** - Last weight, **W<sub>0</sub>** - First weight

### Equation 2. Relative growth

## Result

Fifteen male and female lambs were randomly selected from the core breeding flock for the study. Their live weights at birth and at 1 to 7 months of

age were recorded during the first ten days of each month using standard methods.

**Table 1.**

Liveweight of lambs (n= 15) from Tsagaan-Uul breed

Liveweight of lambs, kg (n= 15)					
Age	Sex	M±m	Sd	Cv (%)	P value
At birth	Male	3.78±0.33	0.09	8.79	Ns
	female	3.59±0.33	0.09	9.18	
1 month	Male	11.1±1.24	0.32	10.8	****
	female	9.61±0.82	0.21	8.55	
2 months	Male	18.03±1.65	0.43	9.17	**
	female	16.15±1.39	0.36	8.58	
3 months	Male	23.47±1.43	0.37	6.09	**
	female	21.75±1.48	0.38	6.82	
4 months	Male	27.73±1.26	0.32	4.53	***
	female	25.75±1.4	0.36	5.42	

5 months	Male	31.79±1.92	0.5	6.05	**
	female	29.53±1.63	0.42	5.53	
6 months	Male	35.7±1.41	0.36	3.94	***
	female	33.64±1.45	0.37	4.31	
7 months	Male	39.52±1.34	0.35	3.49	****
	female	36.57±1.24	0.32	3.38	

At birth, there were no significant differences in live weight based on sex; however, differences began to emerge as the lambs grew. At weaning, at five months of age, male lambs exhibited an increase in live weight of 8.4 kg, while female lambs increased by 8.2 kg. During the two months following weaning, the live weight of both male

and female lambs increased by a factor of 1.2. An evolution coefficient below 10 during the first seven months post-birth indicates a leveling of live weight. The absence of differences in live weight at birth suggests that fetal development is not influenced by sex. However, postnatal evolutionary development varies according to sex.

**Table 2.**  
Liveweight of lamb from Tsagaan-Uul sheep compared with research results from previous studies

Breed	Birth weight, kg		Weaning weight, kg		Weight at the age of 6-7 months, kg		Reference
	male	female	Male	Female	Male	female	
Tagaan-Uul breed	3.78	3.59	35.7	33.6	39.52	36.6	Our
Mongolian breed	3.64	3.42	-	-	35.85	34.24	D.Baartartuya et al, [12]
Torguud breed	3.5-6.0	3.5-3.6	-	-	35.4		N.Sukhee et al, [6]
Rambouillet		3.6		37.7	-		M.Asadi-Fozi [9]
Bayad breed		4.15	-	-	34.5		T.Sodnompil [7]
Kerei breed		4.01	-	-	33.8		O.Khatiran [8]
Romanov hybrid	3.71	2.89	17.81-23.93	17.14-22.32	-	-	D.Turkyilmaz [10]
Gellaper hybrid	3.8-4.0	3.5-3.6	22.7-24.3	20.9-24.3	-	-	S.Washaya [11]
Swakara hybrid	3.2-3.5	3.1-3.2	24.3-27.1	23.3-24.9	-	-	

The birth weight of Tsagaan-Uul lambs is lower than that of the improved Bayad and Kerei breeds, higher than that of the Swakara hybrid, and comparable to lambs from the Romanov, Gellaper,

and Torgud breeds. At weaning, at 6 to 7 months of age, Tsagaan-Uul lambs exhibit better weights than other breeds, although they are inferior to Rambouillet lambs.

Table 3.

Absolute growth and relative growth of the lambs (n= 15)

Age	Sex	Absolute growth, kg (n=15)		Relative growth % (n=15)		Daily growth, kg (n=15)	
		M±m	Cv (%)	M±m	Cv (%)	M±m	Cv (%)
From birth to 1 month, kg	male	204.7±23.32	11.39	7.73±1.02	13.22	0.258±0.034	13.23
	female	168.8±17.06	10.11	6.85±0.61	10.16	0.201±0.020	10.19
1-2 months	male	68.77±17.01	11.97	6.53±0.74	11.28	0.218±0.025	11.3
	female	57.10±6.83	24.43	6.53±1.36	20.78	0.213±0.045	20.82
2-3 months	male	30.55±6.30	20.64	5.63±0.91	16.81	0.187±0.030	16.79
	female	35.09±7.56	21.55	5.41±1.05	18.69	0.181±0.035	18.69
3-4 months	male	18.63±5.38	22.13	4.26±0.8	18.86	0.142±0.027	18.73
	female	18.29±4.05	28.87	4.01±1.0	24.93	0.134±0.033	24.97
4-5 months	male	14.75±4.75	32.41	4.07±1.32	32.49	0.136±0.044	32.29
	female	14.66±5.05	34.23	3.77±1.23	32.67	0.126±0.041	32.63
5-6 months	male	14.08±4.60	38.33	4.11±1.32	34.97	0.130±0.045	34.92
	female	12.51±4.80	34.07	3.91±1.37	32.17	0.137±0.044	32.15
6-7 months	male	10.74±2.21	20.61	3.82±0.74	19.44	0.127±0.025	19.44
	female	8.77±2.60	29.58	2.93±0.79	26.93	0.098±0.026	26.84

The live weight of male lambs aged 1 to 3 months ranges from 5.63 to 7.73 kg, while female lambs weigh between 5.41 and 6.85 kg. At the time of separation from their mothers, between 4 and 6 months of age, male lambs weigh between 4.07 and 4.26 kg, while female lambs weigh between 3.77 and 4.01 kg. Absolute growth for both male and female lambs at ages 1 month, 3 to 4 months, and 6 to 7 months is similar. However, significant differences were observed during the following periods: from 1 to 2 months of age ( $P < 0.032$ ), from 2 to 3 months of age ( $P < 0.001$ ), and from 4 to 5 months to 5 to 6 months ( $P < 0.001$ ). This variation may be attributed to the more pronounced sexual characteristics in male lambs, including the thickening of the horns, nose, and testicles. During the first month after birth, lambs experience a live weight increase of 168.8 to 204.7

percent. However, starting in the second month, the growth rate decreases by a factor of 2.95 to 2.97. After weaning, at 4 to 5 months of age, the growth rate declines by 3.89 to 4.66 times compared to that observed at 2 months of age, indicating a slowdown in growth intensity. Under natural grazing conditions without supplemental feed, male Tsagaan-Uul lambs gain weight at a rate of 127 to 258 grams per day, while female lambs gain between 98 and 201 grams per day during the first 7 months after birth. Male Tsagaan-Uul lambs raised on pasture achieve a daily weight gain of over 200 grams until they reach 2 months of age. By 7 months old, particularly in the first 10 days of September, daily weight gain decreases by a factor of 2.03 to 2.05 compared to the first month.

### Dicussion

This study provides significant insights into the growth patterns of Tsagaan-Uul sheep, particularly in relation to other Mongolian breeds such as Bayad, Mongolian, and Kerey. Our findings indicate that male lambs of the Tsagaan-Uul breed have an average birth weight of 3.78 kg, while female lambs weigh approximately 3.6 kg. These values align closely with existing literature, notably the birth weights reported for male Torguud lambs (3.5–6.0 kg) and female lambs (3.5–5.6 kg), reinforcing the consistency of our results within the regional context [6], [12], [15].

Throughout the growth period, Tsagaan-Uul male lambs reach an average weight of 39.52 kg and female lambs 36.6 kg by seven months of age. While these weights are somewhat lower than those recorded for the Bayad and Kerey breeds, they surpass the growth metrics reported for local Mongolian and some foreign breeds. This suggests that the Tsagaan-Uul breed exhibits promising growth potential for meat production under specific agricultural and ecological conditions.

Such observations correspond with findings from other studies which have identified variations in growth patterns among sheep breeds, influenced by both genetic potential and environmental conditions [13], [14]. Our study reports daily weight gains ranging from 201 to 258 g during the first month, 130 to 137 g at four months, and 98 to 127 g by seven months. These benchmarks are crucial for understanding growth trajectories in Tsagaan-Uul lambs and are comparable to those documented for other lamb populations. For example, male Torguud lambs exhibit average daily gains of 165–168 g, while F1 hybrid populations show gains between 169.7 and 183.3 g. This consistency suggests that despite slightly lower absolute weights, Tsagaan-Uul lambs can compete effectively in terms of growth rates [7], [16], [8], [17].

Similar studies on breeds such as Dorper and Suffolk have highlighted the critical impact of early growth rates on overall production potential and economic viability [18]. Differences observed in absolute weight and growth rates among breeds can be attributed to multiple factors, including genetic variation, nutritional differences, and environmental influences. The enhanced growth rates in hybrid populations likely reflect genetic advantages derived from crossbreeding, which may not be present in purebred Tsagaan-Uul lambs. This highlights the importance of further

### **Conclusion**

The study demonstrates that Tsagaan-Uul lambs exhibit live weights at birth and one month of age comparable to those of improved and other regional breeds. This similarity likely reflects the strong influence of maternal factors such as body condition, nutrition, and health during fetal development, rather than sire genetics. By six to seven months, male lambs selected for breeding reach an average live weight of  $39.52 \pm 1.34$  kg, while females average  $36.57 \pm 1.24$  kg, indicating the breed's capacity to mature into productive

### **Conflict of interests**

The authors declare no conflict of interests.

### **Authors' contribution**

TA writing-original draft preparation, GS and ET contributed supplementary materials, review and supervision, and DD writing-review and editing.

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research into the genetic and environmental determinants of growth performance in this breed [9], [19].

Additionally, the quality and availability of nutrition especially access to high-quality forage during critical growth stages play a significant role in weight variation across breeds [20], [21].

While this study contributes valuable data to the understanding of Tsagaan-Uul lamb growth, certain limitations must be acknowledged. The sample size, though representative, may not fully capture the breed's genetic diversity. Moreover, uncontrolled external factors such as feed quality variations, health status, and environmental conditions could have influenced weight gain and overall growth outcomes [10], [22].

Future studies employing controlled feeding regimes and larger, genetically diverse populations would offer more precise insights into the growth potential and variability within this breed. In conclusion, the findings offer an important comparative perspective to existing literature on sheep growth patterns and reinforce the significance of the Tsagaan-Uul breed in Mongolian sheep husbandry. Future research should focus on larger-scale, controlled experimental designs to further elucidate growth potential and optimize management practices aimed at improving production efficiency.

young breeders. These results suggest that Tsagaan-Uul sheep possess valuable potential to serve as genetic improvers in profitable sheep breeding programs. Moreover, lamb production performance can be further enhanced by adopting fattening strategies tailored to live weight and growth patterns. Considering the current pregnancy rate of 55 percent across the flock, herders could significantly increase income by focusing on improving reproduction rates and overall flock productivity

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