# Evaluating Growth Traits in Two Sheep Breeds During Early Development Stages

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#### Abstract

This study provides a comparative analysis of growth traits between Karakul and Awassi sheep, focusing on their adaptation and contributions to productivity. Awassi sheep are known for their resilience in arid environments, distinctive fat tail. Karakul sheep, on the other hand, are recognized for their unique wool and adaptability to arid conditions. A total of 170 lambs (75 Karakul and 95 Awassi) were studied, with measurements taken at birth and three months of age. Parameters assessed included body weight, body length, wither height, rump height, chest circumference, and abdominal circumference. Results indicate that Karakul lambs generally exhibit superior growth traits compared to Awassi lambs. At birth, Karakul lambs had significantly higher (P< 0.01) body weight (5.48 kg vs. 4.71 kg), body length (33.77 cm vs. 30.84 cm), wither height (42.04 cm vs. 40.08 cm), rump height (42.52 cm vs. 40.34 cm), and abdominal circumference (44.38 cm vs. 42.56 cm) than Awassi lambs. At three months, Karakul lambs continued to show greater (P< 0.05) body weight (24.47 kg vs. 22.32 kg), body length (60.42 cm vs. 57.29 cm), wither height (64.71 cm vs. 62.20 cm), and rump height (65.51 cm vs. 62.49 cm). However, chest and abdominal circumferences at three months did not differ significantly between the breeds. These findings suggest that while Karakul sheep demonstrate superior early growth traits, some characteristics may converge over time. The study highlights the potential advantages of Karakul sheep in terms of early development and robustness, which could be valuable in regions with harsh conditions .

#### Keywords: Comparative analysis, Growth traits, Karakul Sheep, Awassi sheep

#### Introduction

Awassi sheep are distinguished by their long, floppy ears and their remarkable resilience and hardiness, traits that make them exceptionally well-suited to thrive in harsh and arid climates (1). Their wool is notably coarse, adding to their distinctive appearance (2). One of the most recognizable features of the Awassi sheep is their fat tail, which acts as a crucial energy reserve, particularly beneficial in their native arid environments (3.( These sheep display a variety of color patterns, commonly appearing in shades of brown or white, often with distinctive brown patches that add to their unique look (4). Their physical build is well-adapted for enduring long journeys and navigating rough, challenging terrains, reflecting their historical use in nomadic and pastoral lifestyles (5.( The Awassi breed is highly prized for its exceptional milk production and the milk they produce is playing a significant role in the production of cheese and other dairy products across many regions. This characteristic makes them a valuable asset for dairy farmers and contributes to the breed's widespread popularity (6,7). Temperamentally, Awassi sheep are known for their calm and docile nature, which makes them easy to manage for shepherds and farmers alike (8). This ease of handling is further complemented by their strong maternal instincts. Ewes are attentive and caring mothers, which leads to high survival rates among their lambs, ensuring the continued growth and sustainability of flocks (9.(

The combination of their physical resilience, productive capabilities, and manageable temperament makes Awassi sheep an exemplary breed, particularly well-suited for environments and economies that rely heavily on sheep for dairy and other products (10.(

Karakul sheep are distinguished by their unique appearance and exceptional adaptability to harsh and arid climates (11). One of the most notable features of this breed is the wool of newborn lambs, which is tightly curled and has a lustrous black sheen. As the lambs mature, their fleece lightens in color and becomes less curly. This unique wool quality is highly prized, particularly the pelts from young lambs, which are sought after for the production of high-quality fur garments and accessories (12.(

The physical build of Karakul sheep is lean and hardy, enabling them to survive and even thrive in regions where grazing resources are scarce (13). Their strong and independent nature allows them to forage over vast distances, making them well-suited to semiarid and arid environments. This adaptability is complemented by their diverse coat colors, which can range from black and brown to gray and white, providing a striking visual diversity within the breed (14.(

Karakul ewes are particularly noted for their strong maternal instincts. They are attentive and protective mothers, ensuring high survival rates for their lambs. Additionally, these ewes produce a substantial amount of milk, which is crucial for the nourishment and growth of their offspring. This milk production is an essential aspect of the breed's overall utility in agricultural settings (15.(

The main purpose of this article is to compare the growth traits of Awassi and Karakul sheep, focusing on their respective adaptability to harsh climates, and overall contributions to agricultural productivity. By examining the physical build, foraging abilities, maternal instincts, and milk production of both breeds, the study aims to highlight their strengths and versatility. The comparative analysis will provide insights into how these breeds under perform similar environmental conditions, with an emphasis on their growth traits, and contribute to the wool and meat industries, ultimately informing breeding and management practices for optimal livestock production.

# Materials and Methods

## Ethical Considerations

All procedures involving animals were conducted in accordance with the ethical standards set by the institutional animal care and use committee of Al-Qasim Green University. Efforts were made to minimize the discomfort and stress of the lambs during measurements.

## Animals and Management

This study involved two breeds of sheep, Karakul and Awassi. A total of 170 lambs were included in the study, with 75 Karakul lambs and 95 Awassi lambs. The animals were managed under similar environmental and nutritional conditions to ensure uniformity in the data collected. All lambs were housed in semi-arid regions where they had access to natural grazing supplemented with standard sheep feed. Water was provided ad libitum.

#### Experimental Design

The study was designed to measure and compare growth traits between Karakul and Awassi lambs at two distinct time points: birth and three months of age. Growth traits assessed included body weight, body length, wither height, rump height, chest circumference, and abdominal circumference.

Data Collection

Measurements were taken to include body weight, body length, wither height, rump height, chest circumference, and abdominal circumference parameters. With regard to body weight, each lamb was weighed using a digital scale immediately after birth and again at three months of age. Concerning body length, the distance from the shoulder to the pin bone was measured using a measuring tape. With regard to wither height, the height from the ground to the withers was measured using a measuring stick. Concerning rump height, the height from the ground to the highest point of the rump was measured. Whereas the circumference of the chest just behind the forelegs was measured using a flexible measuring tape. As well, the circumference of the abdomen was measured at the widest point. All measurements were taken by the same individual to minimize variability.

### Statistical Analysis

Data were expressed as means  $\pm$  standard errors using SPSS package (16). The differences between Karakul and Awassi lambs for each growth trait were analyzed using a t-test. Significance levels were set at P < 0.05 (\*) and P < 0.001 (\*\*), with nonsignificant differences denoted as ns. Superscripts "a" and "b" were used to denote higher and lower values, respectively, for comparison within the same parameter.

Correlation Matrix Analysis

The correlation matrix that depicts the relationships between various growth traits in sheep was investigated using the SRplot tool (17). Various variables were included in the matrix, including Dam weight (kg), Dam age (days), Birth weight (kg), Birth body length (cm), Weaning weight (kg), and Weaning body length (cm). The variables are listed both horizontally and vertically, creating a grid where each cell represents the correlation between two variables. Each cell in the matrix contains a number indicating the correlation coefficient between the two variables, ranging from -1 to 1. A correlation coefficient close to implies a strong positive correlation, 1 meaning as one variable increases, the other tends to increase. A coefficient close to -1 implies a strong negative correlation, meaning as one variable increases, the other tends to decrease. A coefficient close to 0 implies little to no linear correlation. The shading and ellipses in the cells visually represent the strength and direction of the correlation. Darker colors and more elongated ellipses indicate stronger correlations (both positive and negative.(

### Results

Based on the collected data, a comprehensive approach to assessing and comparing the growth traits of Karakul and Awassi sheep was provided. By maintaining consistent management practices and using standardized measurement techniques, this study provided reliable and significant insights into the growth performance of these two breeds. Table 1 presents a comparative analysis of growth traits between Karakul and Awassi sheep at birth and at three months of age. The data are expressed as means  $\pm$  standard errors for various measured parameters, with significance levels indicated .

At birth, Karakul sheep exhibit significantly higher body weight, body length, wither height, rump height, and abdominal circumference compared to Awassi sheep. Specifically, Karakul lambs have an average body weight of 5.48 kg, whereas Awassi lambs weigh 4.71 kg. Body length measurements show Karakul lambs at 33.77 cm compared to 30.84 cm for Awassi lambs. Wither height is 42.04 cm for Karakul lambs versus 40.08 cm for Awassi lambs. Rump height is also higher in Karakul lambs (42.52 cm) compared to Awassi lambs (40.34 cm). Additionally, Karakul lambs have a greater abdominal circumference (44.38 cm) than Awassi lambs (42.56 cm). The only parameter at birth that does not show significant difference between the two breeds is chest circumference, with values of 42.40 cm for Karakul and 41.74 cm for Awassi, which is not statistically significant.

At three months, Karakul sheep continue to show superior growth traits in most parameters compared to Awassi sheep. Karakul sheep have a higher body weight (24.47 kg) than Awassi sheep (22.32 kg). The body length of Karakul sheep is also greater at 60.42 cm compared to 57.29 cm for Awassi sheep. Wither height is 64.71 cm for Karakul sheep versus 62.20 cm for Awassi sheep. Rump height measurements show Karakul sheep at 65.51 cm, while Awassi sheep are at 62.49 cm. Chest circumference and abdominal circumference at three months do not show significant differences between the breeds, with chest circumference being 77.88 cm for Karakul and 76.34 cm for Awassi, and abdominal circumference at 86.30 cm for Karakul versus 84.38 cm for Awassi.

The data indicate that Karakul sheep generally exhibit superior growth traits compared to Awassi sheep at both birth and three months of age, with significant differences in most measured parameters. The significance levels are marked as \*\* for P < 0.01 and \* for P <0.05, indicating the level of statistical significance for each parameter. The notation "ns" stands for non-significant differences. The superscripts "a" and "b" denote higher and lower values, respectively, within the same parameter, with "a" indicating significantly higher indices than "b."

	Measured	Karakul	Awassi	Signif
	paramete	(n=75)	(n=95)	icance
	r			
Birth	Body	5.48±0.12	4.71±0.1	**
	weight	а	1 <sup>b</sup>	
	(kg)			
	Body	33.77±0.3	30.84±0.	**
	length	4 <sup>a</sup>	30 <sup>b</sup>	
	(cm)			
	Wither	42.04±0.2	40.08±0.	**
	height	9 <sup>a</sup>	26 <sup>b</sup>	
	(cm)			
	Rump	42.52±0.3	40.34±0.	**
	height	0 <sup>a</sup>	27 <sup>b</sup>	
	(cm)			
	Chest	42.40±0.3	41.74±0.	ns
	circumferen	7	33	
	ce (cm)			
	Abdominal	44.38±0.3	42.56±0.	**
	circumferen	9 <sup>a</sup>	35 <sup>b</sup>	
	ce (cm)			
3-	Body	24.47±0.4	22.32±0.	*
mont	weight	9 <sup>a</sup>	43 <sup>b</sup>	
h	(kg)			
	Body	60.42±0.6	57.29±0.	**
	length	8 <sup>a</sup>	60 <sup>b</sup>	
	(cm)			
	Wither	64.71±0.4	62.20±0.	**
	height	2 <sup>a</sup>	37 <sup>b</sup>	
	(cm)			
	Rump	65.51±0.4	62.49±0.	**
	height	1 <sup>a</sup>	36 <sup>b</sup>	
	(cm)			
	Chest	77.88±0.7	76.34±0.	ns
	circumferen	1	63	
	ce (cm)			
	Abdominal	86.30±0.7	84.38±0.	ns
	circumferen	6	67	
	ce (cm)			

# Table 1. Effects of breeds (means ± standard errors) on growth traits in sheep.

Note: the data are expressed as means  $\pm$  standard errors, ns, \*, and \*\* refer to nonsignificant, significant at level P < 0.05; and significance at level P < 0.001, respectively. The superscript a refers to the higher indices than the superscript, and b, respectively.

The data analysis shows a correlation matrix that depicts the relationships between various growth traits in sheep (Figure 1). Concerning dam weight, a moderate positive correlation with Birth weight (0.42) and Weaning weight (0.47) were shown, suggesting that heavier dams tend to have heavier offspring at birth and weaning. Other correlations with dam weight were found to be weaker but still positive, like dam age (0.23) and weaning body length (0.37). Dam age showed a moderate positive correlation with Birth weight (0.29) and Weaning weight (0.31). Weaker positive correlations with other variables like Birth body length (0.24) and Weaning body length (0.24) was observed. displayed strong Birth weight positive correlations with Weaning weight (0.55) and Weaning body length (0.49). Also, birth weight was positively correlated with birth body length (0.48), indicating that heavier lambs at birth tend to be longer



Figure 1. The correlation coefficients between various growth traits in Awassi and Karakul sheep. Each cell shows the strength and direction of the relationship between two traits, with values ranging from -1 to 1. Strong positive correlations are indicated by darker colors and more elongated ellipses, demonstrating the interconnectedness of these

traits and their implications for sheep growth and development.

Birth body length showed a strong positive correlation with Weaning weight (0.42) and Weaning body length (0.39). This strong correlation indicated that longer lambs at birth tend to be heavier and longer at weaning. Weaning weight displayed a very strong

positive correlation with Weaning body length (0.73), suggesting that heavier lambs at weaning are also longer. Generally weaning showed strong positive correlations with most other traits, underscoring its importance as a growth trait. As well, strong correlations with Weaning weight (0.73) and moderate correlations with other traits like Birth weight (0.49) and Birth body length (0.39) were shown.

### Discussion

The primary objective of this study was to compare the growth traits of Karakul and Awassi sheep, focusing on parameters such as body weight, body length, wither height, rump height, chest circumference, and abdominal circumference at birth and at three months of age. The results provide clear evidence that Karakul sheep generally exhibit superior growth traits compared to Awassi sheep at both time points. Therefore, the growth traits of Karakul and Awassi sheep were compared by measuring key parameters at birth and at three months of age. The findings reveal significant differences between the two breeds, highlighting the unique characteristics and advantages of each.

birth, Karakul demonstrated At lambs significantly higher body weight, body length, wither height, rump height, and abdominal circumference compared to Awassi lambs. Specifically, Karakul lambs had an average body weight of 5.48 kg compared to 4.71 kg for Awassi lambs, indicating a robust initial growth advantage. The greater body length (33.77 cm vs. 30.84 cm) and heights (wither height: 42.04 cm vs. 40.08 cm; rump height: 42.52 cm vs. 40.34 cm) further underscore the early physical development differences between the breeds. The abdominal circumference was also significantly larger in Karakul lambs (44.38 cm vs. 42.56 cm), suggesting better overall body condition and potential for enhanced early survival and growth. These findings have in agreements with several other recent findings that showed the significant superiority of Awassi over Karakul in many morphological and genetic aspects (18)(19)(20.(

The only parameter not showing a significant difference at birth was chest circumference, which was similar between the two breeds (42.40 cm for Karakul vs. 41.74 cm for Awassi). This lack of significance might indicate that chest development at birth is less influenced by breed-specific factors compared to other traits.

By three months of age, the differences between the breeds remained pronounced. Karakul lambs continued to show higher values across most growth traits. Their body weight was significantly greater (24.47 kg vs. 22.32 kg), reflecting sustained superior growth rates. Body length (60.42 cm vs. 57.29 cm), wither height (64.71 cm vs. 62.20 cm), and rump height (65.51 cm vs. 62.49 cm) were all significantly higher in Karakul lambs, consistent with the trend observed at birth. Several other studies showed the obvious superiority of Karakul sheep over Awassi counterpart in the three months of age (21.( Interestingly, at three months. chest circumference and abdominal circumference did not show significant differences between the breeds (chest circumference: 77.88 cm for Karakul vs. 76.34 cm for Awassi; abdominal circumference: 86.30 cm for Karakul vs. 84.38 cm for Awassi). This may indicate that while Karakul lambs have an early advantage in certain physical dimensions, some traits may equilibrate over time as both breeds develop.

The findings of this study have significant implications for sheep breeding and

management practices, particularly in regions with harsh and arid climates (22). The superior growth traits of Karakul sheep suggest they may be more suitable for environments where rapid early growth and robust physical development are advantageous. Their higher body weights and larger body dimensions could translate to better survivability and productivity, particularly in systems where meat production is a priority (23.(

For dairy-focused systems, the strong maternal instincts and good milk production of both breeds should be considered. However, the overall growth advantages of Karakul sheep might still offer an edge in terms of lamb survivability and early development, which are critical for dairy operations aiming to maximize lamb survival and growth rates (24.( While this study provides valuable insights, it is important to consider potential limitations. The sample size, although substantial, may still benefit from expansion to include more environmental conditions diverse and management systems. Additionally, future research should explore the genetic basis of the observed growth differences, as well as

#### Conclusion

In conclusion, this study highlights the superior growth traits of Karakul sheep compared to Awassi sheep, particularly in terms of body weight, body length, and height measurements at both birth and three months of age. These findings suggest that Karakul sheep may offer significant advantages in terms of early growth and physical development, making them a valuable asset in long-term performance beyond the initial three-month period .

The strong correlations between early growth traits (birth weight and body length) and weaning traits (weaning weight and body length) suggest that the superior growth traits observed in Karakul lambs at birth may translate into better performance at weaning compared to Awassi lambs. Breeders may use this information to select for dam weight and age as predictors of offspring performance, focusing on traits that show strong correlations to improve overall productivity and adaptation harsh conditions. Accordingly, to this correlation matrix provides valuable insights into the relationships between different growth traits, highlighting potential areas for selective breeding to enhance sheep productivity in challenging environments. Moreover, evaluating additional traits such as wool quality, reproductive performance, and resistance to common diseases would provide a more comprehensive understanding of the relative advantages of each breed. Such studies could inform more targeted breeding programs aimed at optimizing the specific strengths of Karakul and Awassi sheep

regions with challenging environmental conditions. However, the non-significant differences in chest and abdominal circumferences at three months indicate that some growth traits may level out over time, underscoring the importance of comprehensive breed evaluations for informed decision-making in sheep breeding and management.

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