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Comparison of morphological characteristics of Arabi and Turki sheep breeds in Baghlan province, Afghanistan

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ABSTRACT

Sheep products such as milk, meat, wool, and skin play an important role in ensuring food security and livelihoods of rural families. Therefore, identifying and documenting the morphological characteristics of indigenous breeds is a fundamental step toward improving breeds, preserving genetic reserves, and increasing productivity. Accordingly, this study aimed to investigate the morphological characteristics of the Arabi and Turki breeds in Baghlan province. This study was conducted from October 2025 to August 2026 by examining 10 quantitative traits such as live body weight, body length, chest girth, wither's height, head length and width, ear length and width, neck length and width, and 5 qualitative variables such as horn status and absence of horns, ear shape, tail shape, and color, classified based on age and sex from a total of 339 sheep, of which 231 were Turki and 108 were Arabi. The findings showed that ear shape, tail shape, and color indices differed significantly between the two breeds, while horn and hornlessness traits did not differ significantly. Live body weight had the highest significant correlation with chest girth ($p<0.001$), followed by body length ($p<0.01$). The lowest correlation was with ear width ($p>0.05$) and was not significant. However, in the Turki breed, the mean and standard deviation for live body weight, body length, chest girth, and wither height were 88.00±9.550 kg, 100.00±5.163, 63.00±3.882, and 98.00±7.464 cm, respectively. In contrast, the average live body weight, body length, chest girth, and wither height of the Arabi breed were recorded as 49.83±4.262 kg, 83.83±1.941, 51.50±1.761, and 82.38±4.445 cm, respectively, indicating that the Turki breed in Baghlan province is larger than the Arabi breed. The results showed that the two breeds have distinct morphological profiles, with the Turki breed showing greater body size and growth potential. Strong correlations were observed between the main body measurements.

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INTRODUCTION

Sheep farming is a cornerstone of Afghanistan's livestock sector, providing essential cash income, animal-source food, and employment for rural households (Jawahar et al., 2024). Beyond its immediate contributions to meat, milk, and wool production, the sector underpins national food security, rural livelihoods, and the broader economy. It also plays a strategic role in reducing import dependency and preserving indigenous animal genetic diversity (Thomson

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et al., 2005). Globally, cattle account for 81% of milk output, buffaloes for 15%, while sheep, goats, and camels collectively contribute the remaining 4% (Abdurrahman, 2019). In Afghanistan, sheep production historically generated nearly 90% of foreign exchange earnings before the successive conflicts and drought episodes of recent decades, highlighting its exceptional economic significance (FAO, 2008).

Notwithstanding this recognized importance, the Afghan sheep industry is constrained by multiple interconnected challenges: scarcity of improved germplasm, inadequate characterization of local breeds, insufficient knowledge of morphological traits and environmental adaptation, and weak institutional support and market infrastructure (Haidari et al., 2023). Systematic documentation of native breed morphology constitutes a prerequisite for evidence-based breeding strategies, as such data directly inform genetic improvement programs, sustainable intensification, and *in situ* conservation of genetic resources (Melesse et al., 2013).

Previous research has identified several morphometric traits of relevance to sheep breeding. Body length has been proposed as the single most important quantitative indicator for genetic selection (Yunusa et al., 2013), while sex has been shown to significantly influence live weight, body length, and wither height (Haque et al., 2020). Consistently strong positive correlations have been reported among wither height, body length, chest girth, and live weight in both sexes (Akbar et al., 2021). Among these variables, chest girth has emerged as the most accurate and practical estimator of live weight across multiple breeds and production systems (Surafel et al., 2019; Cilek & Petkova, 2016). Additionally, head width, tail length, chest circumference, and body length have demonstrated high predictive capacity for weight estimation in comparative breed studies (Ibrahim & Yakubu, 2011).

Age and sex represent additional sources of morphometric variation. Traits including wither height, body length, chest girth, and cranial dimensions increase significantly with advancing age, particularly until five years (Çilek, 2014). Significant age- and sex-related differences have been documented across indigenous populations, with direct implications for genetic improvement strategies (Bouyahiaoui et al., 2021). Reported mean values vary considerably across ecotypes: one study recorded male and female body weights of 39.76 kg and 43.02 kg, respectively, with corresponding wither heights of 81.67 cm and 84.8 cm (Khosa et al., 2023). Another investigation reported a mean live weight of 25.8 kg, a wither height of 63.6 cm, a chest girth of 70.4 cm, and a body length of 55.4 cm, with age and sex exerting significant effects on all measured parameters (Bimerow et al., 2011). Strong intercorrelations among these linear body measurements have been further corroborated (Tuncer et al., 2022).

Multivariate analytical approaches have advanced the understanding of breed differentiation. Principal component analysis has revealed that body size and morphometric indices jointly explain 65.84–72.30% of total phenotypic Variance (Putra et al., 2021), with the first two components capturing approximately 68.66% of trait variability in certain populations (Mishra et al., 2017) and up to 56.42% in others (Mishra et al., 2021). Substantial breed-specific variation has been documented: for instance, the Ouled Jallel breed exhibits wither height of 82.84 cm and chest girth of 25.13 cm, whereas the Hamra and Saidaoun breeds display smaller frames, with shoulder height of 79.63 cm and chest circumference of 43.85 cm (Imane et al.,

2024). Additional studies have reported average wither height of 68.3 cm, chest girth of 46.0 cm, and hip height of 68.8 cm (Whenua et al., 2021), alongside marked sex dimorphism in live weight, chest girth, wither height, and body length (Hailemariam et al., 2018).

The current investigation focuses specifically on the morphological characterization of two indigenous breeds: Arabi and Turki sheep. The Turki breed, originally from Turkey and subsequently distributed across Iran and Afghanistan, is distinguished by its large body size and rapid growth rate, attaining live weights of 50–55 kg. By contrast, the Arabi breed typically weighs 45–50 kg and is phenotypically characterized by a predominantly black coat with a prominent white stripe along the forehead, though brown and white color variants have occasionally been reported (Hosseini, 2024; Rahman et al., 2013).

Although previous national-level reports have provided general descriptions of these breeds, no empirical study has systematically characterized their morphological traits in Baghlan province, where distinct climatic conditions, diverse husbandry practices, and variable nutritional environments may produce significant phenotypic differences from other production regions. This knowledge gap is particularly important because Arabi and Turki sheep constitute vital genetic reservoirs and livelihood assets for local herding communities. Without location-specific morphometric data, accurate assessment of production potential and adaptive capacity remains elusive, limiting the design of targeted breeding interventions and the sustainable management of genetic diversity. To address this identified gap, the present study was conducted to document the morphological traits of Arabi and Turki sheep breeds in Baghlan province. The baseline data generated are intended to support the development of future breeding programs, increase system productivity, and contribute to the sustainable use and conservation of Afghan indigenous sheep genetic resources.

RESEARCH METHODOLOGY

Study Area

This study is a comprehensive field study to investigate the morphological characteristics of two indigenous sheep breeds (Turki and Arabi). The study was conducted in 2025 in Baghlan province of Afghanistan in six counties with the largest sheep population (Nahrin, Barka, Doshi, Khinjan, Dahana-i-Ghori and Baghlan Markazi) (Figure 1 & Table 1). Baghlan is an important and influential province in the northeast, centered in the city of Pul-e-Khumri. It covers 21,112 square kilometers, and its estimated population is 1,053,200 people. Most of its people are engaged in livestock farming, goat, and sheep breeding. (NSIA, 2022; Profile Province, 2019).

The selection criteria for data collection are shown in **Figure 1.** The study area is of particular importance in terms of the origin and availability of different sheep breeds; obtaining consent from sheep owners and their willingness to cooperate in data collection and interviews to obtain more information were key factors considered during the selection process.



Figure 1. Baghlan map shows the studied area (Source: Prepared by the authors, 2026)

Sampling Method

Due to the unlimited nature of the statistical population, a total of 339 sheep were selected as a statistical sample using the Cochran formula. This study included two breeds, Arabi and Turki, with 318 females and 21 males; of these, 108 were Arabi and 231 were Turki.

Data Collection Method

Data for quantitative and qualitative traits were recorded based on the FAO (2012) breed morphological characteristics descriptor list. In this study, ten quantitative traits were measured, including age, body weight, body length, withers height, chest circumference, ear length, ear width, head length, head width, neck length, and neck width. Measurements were made using instruments such as tape measures, scales, and locally designed frames **Table 1.** In addition, five qualitative variables horn status (presence or absence), ear shape, tail shape, and coat color were recorded through direct observation and structured questionnaires distributed in the study area. Data collection method: Measurements were taken in the early morning before feeding to minimize the influence of feed intake on the results. The management and environmental conditions in which the sheep were raised were also considered: they were kept in barns during the winter and grazed on pastures in the spring, summer, and autumn. These factors can significantly influence the morphological traits of sheep and were therefore considered in the analysis Table 2.

Table 1: *Diversity of the studied breeds by sex*

Breed		Percentage		Sex		Percentage	
Turki	Arabi	Turki	Arabi	Male	Female	Male	Female
231	108	68.1	31.9	21	318	5.5	94.5
Total	339	100.0		339		100.0	

(Source: Prepared by the authors, 2026)

Table 2: *Description of measured body indices for each animal*

Parameters	**Description**
Live Body Weight (BW)	The live weight of the animal was usually measured with a scale
Body Length (BL)	It was measured as the diagonal distance from the tip of the sternum to the base of the tail.
Wither Height (WH)	It was measured from the bottom of the front foot to the highest point of the shoulder between the withers.
Chest Girth (CG)	It was taken as the circumference of the body immediately behind the shoulder blades in a vertical plane perpendicular to the long axis of the body.
Ears Length (EL)	Distance from the base to the tip of the ear along the dorsal surface
Ears Width (EW)	Distance between the two side edges of the ear in the middle
Head Length (HL)	Distance between the top of the forehead and the mouth
Head Width (HW)	Maximum distance between the two zygomatic bones
Neck Length (NL)	Measure from the poll to the center of the withers with the sheep's head being held up at approximately 90 degrees to its body
Neck Width (NW)	Circumference of the neck in its median part

(Source: Prepared by the authors, Haddadi Imane et al.,2024; Belay Deribe et al., 2021)

Statistical Analyses

This study was quantitative-qualitative and descriptive in analytical purpose. Accordingly, first, the normality of the data was examined, the mean and rank were calculated, and the Mann-Whitney test, Pearson Correlation Coefficient (PCC), and Principal Component Analysis (PCA) were used. To further investigate significant differences in qualitative parameters, Chi-Square tests were used, and the results also confirmed significant differences. In addition, the mean and standard deviation of quantitative parameters were calculated separately for each breed and age. SPSS (27) for Windows 11 was used to perform statistical analyses.

RESULTS

The results show the mean and standard deviation of 10 body measurements by sex in centimeters for each breed. provides a comparative analysis of body indices.

Among the studied breeds, the Turki breed had the largest body size in both sexes. In the male Turki breed, the mean and standard deviation of Live Body Weight (BW) were 88.00±9.550 kg, Body Length (BL) was 100.00±5.163, Chest Girth (CG) was 63.00±3.882, and Withers Height (WH) was 98.00±7.464 cm. Head Length (HL) was 31.00±2.828, Head Width (HW) was 20.00±2.628, Ear Length (EL) was 2.828±16.00, Ear Width (EW) was 3.409±10.00, Neck Length (NL) was 38.00±7.017, and Neck Width (NW) was 23.50±3.536. Also, in the Turki female breed, the mean and standard deviation of Live body Weight (BW) was 58.38±6.564

kg, Body Length (BL) was 90.00±3.943, Chest Grith (CG) was 53.94±2.663, and Wither Height (WH) was 84.78±5.464 cm. Head Length (HL) 24.67±1.862 Head Width (HW) 16.67±1.633 Ear Length (EL)15.83±1.941 Ear Width (EW) 10.67±2.658 Neck Length (NL) 30.72±4.183 Neck Width (NW) 19.28±2.943 cm was observed

In contrast, the Arabi sheep breed had the smallest body size compared to the Turki breed. In the male Arabi breed, Live Body Weight (BW) was 4.086±46.00 kg, Body Length (BL) was 82.00±2.862 cm, Chest Girth (CG) was 3.310±50.00 cm, and Wither Height (WH) was 4.111±83.00 cm. Head Length (HL) was recorded as 22.50±1.643, Head Width (HW) as 15.17±1.329, Ear Length (EL) as 16.00±1.897, Ear Width (EW) as 8.50±1.049, Neck Length (NL) as 30.00±4.082, and Neck Width (NW) as 17.83±1.472. were recorded. Also, in the female Arabi breed, Live Body Weight (BW) was 49.83±4.262 kg, Body Length (BL) was 83.83±1.941, Chest Girth (CG) was 51.50±1.761, and Withers Height (WH) was 83.00±4.111 cm. Head Length (HL) was 23.31±1.750 cm, Head Width (HW) 16.35±1.178 cm, Ear Length (EL) 15.50±1.517 cm, Ear Width (EW) 8.54±1.127 cm, and Neck Length (NL) 28.18±2.500 cm, Neck Width (NW) 18.65±1.593 cm, as observed in Table 3.

Table 3: *Mean and standard deviation of 10 body measurements by sex for the studied breeds*

		Sex				
Parameters	Turki (N=231)	Female	Male	Arabi (N=108)	Female	Male
Body weight (Kg)	231	58.38±6.564	88.00±9.550	108	49.83±4.262	46.00±4.086
Body length (cm)	231	90.00±3.943	100.00±5.163	108	83.83±1.941	82.00±2.862
Chest girth (cm)	231	53.94±2.663	63.00±3.882	108	51.50±1.761	50.00 ±3.310
Wither height (cm)	231	84.78±5.464	98.00±7.464	108	82.38±4.445	83.00±4.111
Head length (cm)	231	24.67±1.862	31.00±2.828	108	23.31±1.750	22.50±1.643
Head width (cm)	231	16.67±1.633	20.00±2.628	108	16.35±1.178	15.17±1.329
Ear length (cm)	231	15.83±1.941	16.00±2.828	108	15.50±1.517	16.00±1.897
Ear width (cm)	231	10.67±2.658	10.00±3.409	108	8.54±1.127	8.50±1.049
Neck length (cm)	231	30.72±4.183	38.00±7.017	108	28.18±2.500	30.00±4.082
Neck width (cm)	231	19.28±2.943	23.50±3.536	108	18.65±1.593	17.83±1.472

(Source: prepared by the authors, 2026)

In this study, Arabi and Turki sheep were evaluated in six age groups (1 to 6 years). The highest mean Live body Weight (BW) at age 5 years was recorded for the Turki breed 58.38±6.564kg and the lowest for the Arabi breed 49.83±4.262 kg In most morphological characteristics such as body length (BL) 5-years Turki 90.00±3.943 cm, 6-years Arabi 83.83±1.941 cm, Chest Grith (CG)5-years Turki 53.94±2.663 cm, 6-year Arabi 51.50±1.761cm, Wither's Height (WH) 5-years Turki 84.78±5.464 cm, 5-years Arabi 82.38±4.445cm, Head Length(HL) 6-year Turki 24.67±1.862 cm, 5-years Arabi 23.31±1.750 cm, Head Width (HW) 6-years Turki 16.33±1.033 cm, 6-years Arabi 16.67±1.633 cm, Ear Length (EL) 6-years Turki 15.83±1.941 cm, 4-years Arabi 15.59±1.395 cm, Neck Length (NL) 5-years Turki 30.72±4.183 cm, 3-years Arabi

28.18±2.500 cm and Neck Width (NW) Turki 5 years 19.28±2.943 cm, Arabi 4 years 18.65±1.593 cm, This difference indicates that increasing age in both breeds was associated with improved growth indices of morphological traits, such that age had a significant effect on weight in both Arabi and Turki sheep breeds. However, the Turki breed had a significant advantage over the Arabi breed in most morphometric traits, including the additional traits mentioned in Table 4.

Table 4: *Mean and standard deviation of 10 morphological characteristics and body measurements by age for the studied breeds.*

Parameters	(N=339)	Year (Age) Breed					
		Year (1)	Years (2)	Years (3)	Years (4)	Years (5)	Years (6)
BW(Kg)	Turki	39.42±7.371	52.13±8.655	54.67±9.253	56.20±7.196	58.38±6.564	54.17±12.432
	Arabi	40.82±4.143	41.53±5.566	43.45±5.663	45.53±4.412	47.46±4.960	49.83±4.262
BL (cm)	Turki	78.27±6.677	85.65±5.857	85.23±8.850	87.06±10.769	90.00±3.943	88.00±9.654
	Arabi	78.64±3.384	79.73±4.148	80.55±3.233	81.59±2.851	83.62±2.063	83.83±1.941
CG (cm)	Turki	47.38±4.374	51.65±4.286	53.83±7.502	52.96±3.524	53.94±2.663	52.17±4.167
	Arabi	48.27±1.737	48.27±2.219	49.18±2.343	49.94±1.890	50.69±2.057	51.50±1.761
WH (cm)	Turki	75.98±5.221	81.87±5.789	81.83±6.358	84.21±5.692	84.78±5.464	83.67±8.710
	Arabi	78.00±3.578	79.53±3.777	79.41±3.875	81.21±3.641	82.38±4.445	82.33±3.882
HL (cm)	Turki	20.38±1.782	22.39±2.667	22.63±2.428	23.57±1.869	23.75±1.814	24.67±1.862
	Arabi	21.09±1.221	22.27±2.120	22.23±1.850	22.62±1.724	23.31±1.750	22.83±2.137
HW (cm)	Turki	14.79±2.143	15.77±1.521	15.73±1.617	16.24±1.564	16.22±1.845	16.67±1.633
	Arabi	15.82±1.168	15.73±1.387	16.00±1.272	16.35±1.178	16.23±1.013	16.33±1.033
EL (cm)	Turki	15.02±2.488	15.29±2.479	15.67±2.644	15.17±2.803	15.75±2.258	15.83±1.941
	Arabi	15.45±1.695	15.47±1.060	15.45±1.595	15.59±1.395	15.00±1.633	15.50±1.517
EW (cm)	Turki	7.85±1.571	8.10±1.248	8.43±1.501	8.53±1.894	8.94±0.948	10.67±2.658
	Arabi	8.09±0.944	8.20±1.474	8.41±1.182	8.53±0.992	8.54±1.127	8.33±1.211
NL (cm)	Turki	25.54±3.209	27.58±5.596	29.50±3.579	29.06±3.833	30.72±4.183	29.50±6.285
	Arabi	26.09±1.578	27.67±2.968	28.18±2.500	28.03±3.176	27.62±3.124	27.83±3.710
NW (cm)	Turki	16.00±2.423	17.58±2.433	18.77±3.159	18.44±2.764	19.28±2.943	18.67±3.011
	Arabi	16.36±1.912	17.27±1.335	18.59±1.869	18.65±1.593	18.38±1.557	18.00±2.530

(**Source**: prepared by the authors, 2026)

shows the classification and comparison of measured body traits between the two breeds, where significant differences were observed in some morphological traits of the Arabi and Turki breeds, and no differences were observed in some traits such as Body Length (BL), Live Body Weight (BW), Chest Girth (CG), and Withers Height (WH). There was a significant difference at the 1% level. However, a slightly significant difference was observed in Neck Length (NL) ($p<0.044$). Also, Head Length (HL), Head Width (HW), and Head Width (HW) showed a non-significant difference ($p<0.101$). Meanwhile, Ear Length (EL) and Ear Width (EW) did not differ significantly ($p<0.549$) Table 5.

Table 5: Mean ranking and comparison of 10 measured body traits in the studied breeds.

Parameters	Breeds		z	Sig. (p-value)
	Turki Mean rank	Arabi Mean rank		
Body weight (Kg)	196.44	113.45	-7.268	0.000
Body length (cm)	197.81	110.52	-7.661	0.000
Chest girth(cm)	192.27	122.38	-6.145	0.000
Wither height(cm)	182.93	142.34	-3.559	0.000
Head length(cm)	175.91	157.35	-1.64	0.101
Head width(cm)	166.48	177.52	-0.985	0.325
Neck width(cm)	168.48	173.25	-0.421	0.674
Neck length(cm)	177.28	154.42	-2.015	0.044
Ear width(cm)	172.11	165.49	-0.6	0.549
Ear length(cm)	171.68	166.41	-0.467	0.64

(Source: prepared by the authors, 2026)

The morphological correlation coefficient showed that, like Live Body Weight (BW), it had a strong and significant correlation with most body traits. The highest coefficients were related to Chest Girth (CG) (0.953) and Body Length (BL) (0.860), and the lowest was related to Ear Width (EL) (0.205), which was not significant at the 5% level ($p>0.05$). The correlation of weight with other traits, including Wither Height (WH) 0.645, Head Length (HL) 0.430, Head Width (HW) 0.264, Neck Length (NL) 0.344, and Neck Width (NW) 0.244, was significant at the 1% level ($p<0.01$). Also, the highest correlation between traits such as Body Length (BL) and Chest Girth (CG) was 0.729, Wither Height (WH) and Head Length (HL) was 0.470, and Head Length (HL) and Head Width (HW) was 0.472 Table 6.

Table 6: *Spearman correlation coefficient of body measurement indices in Arabi sheep breed.*

	BW	BL	CG	WH	HL	HW	EL	EW	NL	NW
BW	1.000	.860**	.953**	.645**	.430**	.264**	.116	.205*	.344**	.244*
		.000	.000	.000	.000	.006	.233	.033	.000	.011
BL		1.000	.729**	.628**	.369**	.209*	.116	.151	.260**	.145
			.000	.000	.000	.030	.231	.119	.007	.133
CG			1.000	.620**	.411**	.266**	.133	.202*	.308**	.259**
				.000	.000	.005	.169	.036	.001	.007
WH				1.000	.470**	.271**	.157	.100	.329**	.298**
					.000	.005	.105	.301	.001	.002
HL					1.000	.472**	.163	.196*	.389**	.251**
						.000	.091	.042	.000	.009
HW						1.000	.281**	.328**	.281**	.293**
							.003	.001	.003	.002
EL							1.000	.536**	.233*	.249**
								.000	.015	.009
EW								1.000	.429**	.448**
									.000	.000
NL									1.000	.471**
										.000
NW										1.000

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).BW, Body Weight, BL, Body Length, CG, Chest Girth, WH, Wither Height, HL, Head Length, HW, Head Width, EL, Ear Length, EW, Ear Width, NL, Neck Length, NW, Neck Width

Morphological correlation coefficients showed that Live body Weight (BW) had a strong and significant correlation with most measured body traits. In fact, the highest correlation was between Live body Weight (BW) and chest girth (CG) (0.931), followed by Body Length (BL) and Wither height (WH) (0.670 and 0.539, respectively). All were statistically significant at the 1% level ($p<0.01$). Also, Live Body Weight (BW) showed a positive and significant correlation with Neck Length (NL) (0.392). However, among other body indices such as Head Length (HL) with Wither Height (WH) 0.612, Neck Width (NW) with Wither Height (WH) 0.544, and Neck Width (NW), Head Length (HL), Neck Width (NW) and Head Width (HW) (0.520), all of which were statistically significant. Accordingly, some indices, such as Ear Length (EL) and Ear Width (EW), showed a weak correlation with Live Body Weight (BW) at the 5% level ($p>0.05$) and were not significant (Table 7)**.**

Table 7: *Spearman correlation coefficient of body measurement indices in Turki sheep breed.*

	BW	BL	CG	WH	HL	HW	EL	EW	NL	NW
BW	1.000	.670**	.931**	.539**	.205	.166	-.039	-.060	.392**	.262
		.000	.000	.000	.171	.270	.798	.693	.007	.078
BL		1.000	.512**	.545**	.327*	.356*	-.127	-.066	.236	.456**
			.000	.000	.026	.015	.400	.663	.114	.001
CG			1.000	.469**	.169	.105	-.041	-.028	.341*	.173
				.001	.263	.488	.787	.854	.020	.251
WH				1.000	.612**	.509**	.303*	.227	.279	.544**
					.000	.000	.040	.129	.061	.000
HL					1.000	.434**	.354*	.067	.001	.540**
						.003	.016	.659	.996	.000
HW						1.000	.158	.097	-.130	.520**
							.295	.522	.389	.000
EL							1.000	.373*	.139	.040
								.011	.358	.794
EW								1.000	.071	-.008
									.637	.959
NL									1.000	.268
										.072
NW										1.000

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed). BW, Body Weight, BL, Body Length, CG, Chest Grith, WH, Wither Height, HL, Head Length, HW, Head Width, EL, Ear Length, EW, Ear Width, NL, Neck Length, NW, Neck Width

The results of the Principal Component Analysis (PCA) for the studied traits of the Arabi sheep breed are presented in the table.

The first principal component (PC1), with an eigenvalue of 4.202, explained 42.019% of the variance; the second principal component (PC2) explained 18.683% of the variance and had an eigenvalue of 1.868. Together, these two components explained 60.702% of the variation in the measured qualities. During the rotation, the contributions of these components were more evenly distributed, with (PC1) accounting for 36.1255% and (PC2) accounting for 24.578% of the total variance, keeping the cumulative variance at 60.702%. Each of the other components accounted for less than 10% of the variance, and their eigenvalues were less than 1, indicating that their contribution to explaining the total variation is indeed negligible. The first two principal components are considered sufficient to describe the main features of variation in the studied Arabi sheep population Table 8.

Table 8: *Principal component variance analysis of body measurement traits for the Arabi sheep breed.*

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	of variance	Cumulative	Total	of variance	Cumulative
1	4.202	42.019	42.019	3.612	36.125	36.125
2	1.868	18.683	60.702	2.458	24.578	60.702
3	.937	9.366	70.068			
4	.862	8.617	78.685			
5	.623	6.231	84.916			
6	.525	5.251	90.167			
7	.393	3.929	94.096			
8	.333	3.329	97.425			
9	.245	2.454	99.879			
10	.012	.121	100.000			

(Source: prepared by the authors, 2026) Extraction Method: Principal Component Analysis.

Analysis of Variance of principal components for quantitative variables of the Turki sheep breed shows that the first principal component (PC1), with an eigenvalue of 5.464, accounted for 54.636%, and the second principal component (PC2) accounted for 14.620% with an eigenvalue of 1.462. Together, these two components accounted for 69.257% of the variation in the measured traits. During rotation, the contributions of these components were more evenly distributed, with (PC1) accounting for 51.907% and (PC2) for 17.349% of the total variance, keeping the cumulative variance at 69.257%. Each of the other components accounted for less than 10% of the variance, and their eigenvalues were less than 1, indicating that their contribution to explaining the total variation was negligible. The first principal component was considered sufficient to describe the main features of variation in the studied Turki sheep population. In the Turki breed, the first principal component (PC1) had an eigenvalue of 5.464 (54.636%), and the second component (PC2) had an eigenvalue of 1.462 (14.620%). Their combination accounted for 69.257% of the measured traits. These findings were in relative agreement with the study (Mishra et al., 2017), which showed that the PCA first component explained 36% and the second component 21%, explaining 68.66% of the total variance of body traits, which could play an important role in breeding and phenotypic selection programs (Table 9).

Table 9: *Principal component variance analysis of body measurement traits for the Arabi sheep breed.*

	Value	df	Sig. (2-sided)	Sig. (2-sided)	Sig. (1-sided)
Pearson Chi-Square	2.856[a]	1	.091		
Continuity Correction[b]	1.557	1	.212		
Likelihood Ratio	4.653	1	.031		
Fisher's Exact Test				.182	.098
N of Valid Cases	339				

a. 2 cells (50.0%) have expected counts less than 5. The minimum expected count is 1.91.
(Source: prepared by the authors, 2026)

In this study, the chi-square test was used for qualitative data, showing that the calculated value (2.856a) was obtained with 1 degree of freedom and a significance level (p-value) of 0.91. It is stated that there is no statistically significant difference between the two breeds in terms of horn characteristics Table 10 below.

Table 10: *Distribution of the relationship between horn status and breed.*

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	of variance	Cumulative	Total	Of Variance	Cumulative
1	5.464	54.636	54.636	5.191	51.907	51.907
2	1.462	14.620	69.257	1.735	17.349	69.257
3	.616	6.158	75.415			
4	.573	5.735	81.150			
5	.506	5.061	86.211			
6	.435	4.354	90.565			
7	.333	3.330	93.894			
8	.297	2.970	96.865			
9	.199	1.986	98.851			
10	.115	1.149	100.000			

Extraction Method: Principal Component Analysis.
(Source: prepared by the authors, 2026)

The chi-square test showed that the calculated value (7.643a) was obtained with a degree of freedom of 3 and a significance level (p-value) of 0.054. In terms of tail shape, there is a statistically significant difference between these two breeds **(**Table 11).

Table 11: *Distribution of the relationship between tail shape and breed*

	Value	df	Asymptotic Sig. (2-sided)
Pearson Chi-Square	7.643[a]	3	.054
Likelihood Ratio	7.781	3	.051
N of Valid Cases	339		

a. 2 cells (25.0%) have expected counts less than 5. The minimum expected count is .32.
(Source: prepared by the authors, 2026)

In contrast, the chi-square test showed that the calculated value (18.064a) was obtained with 5 degrees of freedom and a significance level (p-value) of 0.003. Regarding ear shape, there is a statistically significant difference between the two breeds (Table 12).

Table 12: *Distribution of the relationship between ear shape status and breed*

	Value	df	Sign. (2-sided)
Pearson Chi-Square	18.064[a]	5	.003
Likelihood Ratio	19.829	5	.001
N of Valid Cases	339		

a. 6 cells (50.0) have expected counts less than 5. The minimum expected count is 1.91.
(Source: prepared by the authors, 2026)

Meanwhile, the chi-square test yielded a calculated value (124.631a) with 9 degrees of freedom; the significance level (p-value) was at the 1% level. In terms of color composition, there is a statistically significant difference between the two breeds (Table 13).

Table 13: *Distribution of the relationship between ear shape status and breed*.

	Value	df	Sig. (2-sided)
Pearson Chi-Square	124.631[a]	9	.000
Likelihood Ratio	142.168	9	.000
N of Valid Cases	339		

a. 12 cells (60.0) have expected count less than 5. The minimum expected count is .32.
(Source: prepared by the authors, 2026)

DISCUSSION

Morphological characteristics are important indicators for identifying different sheep breeds. These characteristics indicate genetic differences and adaptation to environmental conditions and can provide useful information for breeding and improvement programs for local sheep breeds. In the present study, the morphological characteristics of Arabi and Turki sheep and their crosses in Baghlan Province were investigated to determine the similarities and differences among these groups. The findings provide valuable information on the body size and physical characteristics of these sheep, which can be used to improve the management, selection, and breeding of local sheep breeds. Therefore, the findings of this study were compared and discussed with those of previous studies to determine whether the morphological characteristics observed in the present study were consistent with previous findings.

According to Table 3, the average body weight of male Turki sheep was 88 kg, body length was 100 cm, chest girth was 63 cm, wither height was 98 cm, and ear length was 31 cm. In females, the average body weight was 58.38 kg, body length was 90 cm, chest girth was 53.94 cm, wither height was 84.78 cm, and ear length was 24.67 cm. These findings were not consistent with those of Imane et al. (2024), who reported that the Ouled Jalal breed had a wither height of 32.84 cm and a chest girth of 25.129 cm, while the Hamra and Sidaoun breeds had the smallest body sizes, with a wither height of 79.63 cm and a chest girth of 43.85 cm. These differences may be due to climatic and geographical factors that affect morphological characteristics. The average weight of male Arabi sheep was 46 kg, body length was 82 cm, chest girth was 50 cm, wither height was 83 cm, and head length was 22.50 cm. Meanwhile, in females, the average weight was 49.83 kg, body length was 83.83 cm, chest girth was 51.50 cm, wither height was 82.83 cm, and head length was 23.31 cm. The findings of this study were relatively consistent with those of Khosa et al. (2023), who reported average body weights of 39.76 kg for males and 43.02 kg for females, and body heights of 84.8 cm for females and 81.67 cm for males.

According to the results presented in Table 4, the body weight of five-year-old Turki sheep was 58.38 kg, while that of five-year-old Arabi sheep was 49.83 kg. The body length of five-year-old Turki sheep was 90 cm, while that of six-year-old Arabi sheep was 83.83 cm. The chest girth of five-year-old Arabi sheep was $53.6 \pm 4.51 \pm 1.761$ cm. The wither height of five-year-old Turki sheep was 84.78 ± 5.464 cm, while that of five-year-old Arabi sheep was 82.38 ± 4.445 cm. These findings were compared with those reported by Bimerow et al. (2011), who found that the average body weight was 25.8 kg, wither height was 63.6 cm, chest girth was 70.4 cm, body length was 5.4 cm, and hip width was 12.7 cm. They also found that age and gender were significant factors for all traits. In addition, this study showed relative agreement with the findings of Hailemariam et al. (2018), who reported that the average body weight was 37 kg in males and 18 kg in females, chest girth was 47 cm in males and 50 cm in females, wither height was 32 cm in males and 50 cm in females, and body length was 35 cm in males and 17 cm in females. However, the findings of this study were consistent with those of Çilek (2014), who reported that the effect of age on several measurements, such as wither height, hip height, thigh length and width, body length, chest girth and depth, tail width, and head girth, was significant, and that total body weight increased by five percent.

According to the findings presented in Table 5, live weight, body length, chest girth, and wither height differed significantly between the Arabi and Turki breeds at the 1% level. These results are consistent with those of Haque et al. (2020), who reported that body weight, body length, and wither height were significant traits and played a prominent role in breed evaluation and genetic improvement programs. The findings were also consistent with those of Akbar et al. (2021), who reported significant differences in wither height, body length, chest girth, and live weight in both males and females, indicating that these traits can be used as effective indicators in genetic improvement, breeding, and the selection of superior animals.

According to the findings presented in Table 6, in the Arabi breed, live body weight, body length, and chest girth showed the highest positive and significant correlations with other body measurements at the 1% level. In addition, body length had a positive and significant correlation with chest girth and wither height at the 1% level, while the lowest correlation was observed with neck length at the 5% significance level ($p < 0.05$). These findings did not agree with those of Yunusa et al. (2013), who reported that body length was the most important indicator for breeding, genetic improvement, and identifying different populations of indigenous sheep. These differences may be due to environmental conditions, management practices, and genetic effects in indigenous breeds. However, these findings were consistent with those of Tuncer et al. (2022), who also reported significant correlations among different body measurements, such as live weight with chest girth and chest width, and body length with wither height and live weight.

According to the results presented in Table 7, in the Turki breed, live weight, chest girth, and body length had the highest significant correlations with other body measurements at the 1% level. In addition, body weight and chest girth showed positive and significant correlations with wither height. The findings of this study were relatively consistent with those of Melaku et al. (2019), who identified chest girth as having the strongest correlation with live weight and as the best indicator for estimating weight. They attributed these differences to environmental conditions, genetics, and management practices in indigenous breeds. However, the results of this study were consistent with those of Çilek and Petkova et al. (2016), who reported the highest correlation between body weight, chest girth, and body length.

According to the findings presented in Table 8, in the Arabi breed, the first principal component (PC1) had an eigenvalue of 4.202 and explained 42.019% of the variance, while the second principal component (PC2) had an eigenvalue of 1.868 and explained 18.683% of the variance. Together, these two components accounted for 60.702% of the measured variation. These findings were relatively consistent with those of Mishra et al. (2021), who reported that the three main components explained 20.71% of the variance and that the first component (PC1) was identified as the physical measurement index, accounting for 56.42%.

CONCLUSION

This study was conducted to compare the morphological characteristics of two indigenous sheep breeds, namely the Arabi and Turki. Clear morphological differences were observed between the breeds in both quantitative and qualitative traits. Among the quantitative parameters, live body weight, body length, chest girth, and withers height exhibited highly

significant correlations ($p < 0.01$), indicating that these indices can serve as reliable predictors of body weight in indigenous sheep populations.

In terms of average live body weight, body length, withers height, chest girth, and other linear body measurements, the Turki breed demonstrated a consistent superiority over the Arabi breed. Conversely, the Arabi breed showed no advantage over the Turki breed in growth-related indices or body dimension parameters. Nevertheless, the Arabi breed still displayed significant intercorrelations among key traits, including live weight, body length, chest girth, and withers height.

Overall, the two breeds possess distinct morphological profiles, with the Turki breed exhibiting greater body size and apparent growth potential. The strong correlations observed between major body measurements, particularly chest girth and body length, and live weight support their utility as practical selection criteria in genetic improvement programs. Furthermore, principal component analysis (PCA) confirmed the structural coherence of these traits, providing a robust foundation for future breeding strategies.

Given the qualitative differences identified, further genetic and molecular investigations are recommended to elucidate the underlying genetic architecture of these traits. Such studies would also contribute to the conservation and sustainable utilization of these valuable indigenous genetic resources. Considering these findings, we propose implementing a systematic breeding program involving both Arabi and Turki breeds, which could facilitate the selection of more resilient and productive strains. Preserving native breeds as valuable genetic reservoirs, while leveraging morphological traits, may enhance productivity traits related to milk, meat, and reproduction in the studied populations. The findings of this research serve as a scientific reference for researchers, students, and future sheep breeding initiatives.

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