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Original Research Paper

Morphometric assessment and physico-chemical description of the milk of Arbiagoat breed in province of Tlemcen

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Abstract

As part of the genetic resources' biodiversity study of Arbiagoats, we conducted a morphometric assessment in the wilaya of Tlemcen using a phenotypic approach and physicochemical analysis of this breed's milk. The barometric approach addresses the characterization of the Arbia breed by the use of body measurements on 40 individuals (34 goats and 6 bucks), these measurements: HL, HW, EL, EW, WH, BH, SH, CP, HG, CD, SW, NL, BL, TBL, SIL, TL, PL, RW, IW and TW are respectively : 23.16 ± 1.53 cm, 11.51 ± 2.13 cm, 16.47 ± 2.40cm, 7.30 ± 0.63cm, 69.79 ± 4.46 cm, 71.40 ± 4.74 cm, 72.28 ± 4.67cm, 8.58 ± 1.11cm, 79.36 ± 6.44 cm, 28.71 ± 3.17cm, 16.65 ± 2.80cm, 23.18 ± 2.19cm, 72.57 ± 7.14cm, 109.96 ± 7.55cm, 64.24 ± 5.26 cm, 12.30 ± 2.42cm, 15.59 ± 1.36 cm, 15.59±1.36cm, 21.28 ± 1.84cm, 11.97 ± 1.81cm and 16.77 ± 2.75cm. This characterization revealed a phenotypic dimorphism between males and females, with very highly significant differences ($p<0.001$) for some body measurements. The results of the PCA yielded 03 classes (n = 34, n = 05 and n = 01, respectively). While the performance aspect is carried out by physicochemical analyzes of 29 milk samples belonging to the individuals characterized, the analyzes F, D, C, S, P, L, T, S1 are respectively 56.90 ± 20, 24 g / l; 3.086 ± 3.62; 4.96 ± 0.41; 7.73 ± 1.78%; 27.35 ± 4.01 g / l; 4.21 ± 0.61g / 100ml; 19.18 ± 2.77C °; 0.70 ± 0.09%. These characteristics give good milk quality. This work encourages us to move forward toward the large-scale exploitation of goat herds, focusing on the steppe regions where cattle experience production difficulties.

Keywords: Characterization;Barymetry;Breed; Goat;Milk.

الملخص

كجزء من دراسة التنوع البيولوجي للموارد الوراثية للماعز ، تستند دراستنا إلى نهج النمط الظاهري للسلالة العربية على مستوى ولاية تلمسان من جهة ، وعلى التحليل الفيزيائي الكيميائي لحليب هذه السلالة على من جهة أخرى. تتناول المقاربة الباريومترية لتوصيف سلالة العربية من خلال استخدام قياسات الجسم على 40 فردًا (34 ماعزًا و 6 دولارات) ، وهذه القياسات: HL, HW, EL ,EW ,WH ,BH ,SH ,CP ,HG ,CD ,SW ,NL ,BL ,TBL, SIL ,TL ,PL ,RW ,IW و TW على التوالي : 1.53 ± 23.16 سم , 2.13 ± 11.51سم , 2.40 ± 16.47 سم , 0.63 ± 7.30 سم , 4.46 ± 69.79 سم , 4.74 ± 71.40 سم , 4.67 ± 72.28 سم , 1.11 ± 8.58 سم , 6.44 ± 79.36 سم , 3.17 ± 28.71 سم , 2.80 ± 16.65 سم , 2.19 ± 23.18 سم , 7.14 ± 72.57 سم , 7.55 ± 109.96 سم , 5.26 ± 64.24 سم , 2.42 ± 12.30 سم , 1.36 ± 15.59 سم , 1.36±15.59 سم , 1.84 ± 21.28 سم , 1.81 ± 11.97 سم و 2.75 ± 16.77 سم . اظهر هذا التوصيف اختلاف الشكل المظهرى بين الذكور والإناث ، مع وجود فروق ذات دلالة إحصائية عالية ($P<0.001$) لبعض قياسات الجسم المستخدمة. أسفرت نتائج PCA عن 03 فئات (n = 34، n = 05 و n = 01 على التوالي). في حين التحاليل الفيزيائية والكيميائية لـ 29 عينة حليب تنتمي إلى الأفراد الموصوفة ، تظهرالنتائج التالية حسب المعايير التالية : F، D، C، S، P، L، T، S1 هي على التوالي 56.90 ± 20 ، 24 جم / لتر ؛ 3.086 ± 3.62 ؛ 4.96 ± 0.41 ؛ 7.73 ± 1.78٪ ؛ 27.35 ± 4.01 جم / لتر ؛ 4.21 ± 0.61 جم / 100 مل ؛ 19.18 ± 2.77 درجة مئوية ؛ 0.70 ± 0.09٪. تعطي هذه الخصائص جودة حليب جيدة ، ويشجعنا هذا العمل على المضي قدمًا نحو الاستغلال الواسع النطاق لقطعان الماعز مع التركيز على مستوى السهوب حيث تواجه الماشية صعوبات في الإنتاج.

الكلمات المفتاحية : التوصيف , قياس , ماعز, لبن

Introduction

Identifying the characteristics of local genetic resources is a primordial and essential step for any program or strategy in the selection, performance improvement, and genetic conservation (Nesamvuniet al., 2000; Delgado et al., 2001; Gaouar, 2002; Mwacharoet al., 2006; Gizawet al., 2007; Martins et al., 2009; Gaouar, 2009).

Animal farming is one of the most important activities in Algeria. However, a great part of the territory is under dry climate pressure where cattle cannot express their best zootechnical potential, especially for milk production. Fortunately, sheep and goats are the species that could, most probably, replace cattle milk production through their long adaptation and fewer consumption indices, especially in dry areas.

Goat farming in Algeria is one of the most widespread agricultural activities in harsh regions. It allows their pastoral resources to be transformed into quality products; goat milk and goat meat are indeed interesting nutritional sources, but also contribute to the income of rural populations (Sahraouiet al., 2016; Fantaziet al., 2017; Belantaret al., 2018; Belkhadem et al., 2019).

The total number of goats in Algeria was estimated in 2017 at 5,007,894 heads (FAO STAT 2017). This herd was made of a mixture of local breeds (Arabia, M'zab, Kabyle, and Makatia) and imported breeds (Alpine, Saanen) (Tefielet al., 2018; Tefielet al., 2020). The national production of goat's milk is 228,981 tonnes (FAO 2018).

The "Arbia" goat is one of the largest populations in terms of numbers and distribution, especially in the dry regions of Algeria. However, it has not benefited from any extensive study to guide its use and improve its production. Thus, we have contributed to the morphological characterization of this breed that exists in the Wilaya of Tlemcen and presented an approach to the quality of its milk.

Materials and methods

Presentation of the study area

Most of the data collected were recorded during a field survey based on a questionnaire to make a preliminary study of the morphological characterization of the Arbia breed and the quality of its milk. The herds studied are located with private breeders at the level of seven municipalities in the wilaya of Tlemcen (Maghnia, El Fehoul, Sebdou, Chetouane, Nedroma, Tounane, Tlemcen).

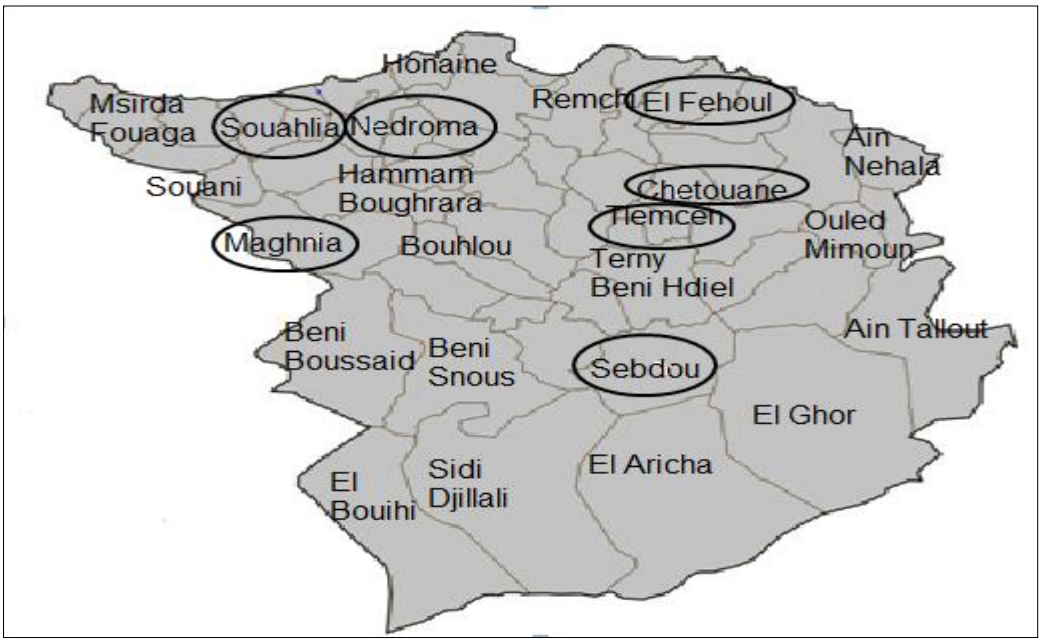

Figure 1. Map of Tlemcen (study area).

Climate

The wilaya of Tlemcen is characterized by a Mediterranean climate. It is based on the opposition between cold oceanic winter, where the wilaya is open to maritime depressions, and a hot and dry desert summer which causes the rise and the parking of a persistent heat throughout the season. Rainfall remains irregular and varies between 200 to 500 mm/year (Table1).

Table 1. Climatic condition for each study region (Climate-Data.org).

Wilaya	Region	Climate
Tlemcen	**Maaziz**	Steppe climate. There is little precipitation. The Köppen-Geiger classification is of Csa type. The average temperature is 18.6°C. It falls on average 464 mm per year.
	Maghnia	Steppe climate. There is little precipitation. The Köppen-Geiger classification is of the BSk type. The average temperature is 17.1°C. It falls on average 365 mm per year.
	Tounane	The climate map of Köppen-Geiger classifies the climate there as being of type Csa. The average annual temperature is 17.0°C, the average precipitation is 379 mm.
	Nedroma	This location is classified as Csa by Köppen-Geiger. The average temperature is 16.9°C. The average annual rainfall reaches 399 mm.
	Sebdou	Sebdou has a local steppe climate. The climate map of Köppen-Geiger classifies the climate there as being of type Csa. The average annual temperature is 15.1 °C, the average precipitation is 463 mm.
	Chetouane	The climate map of Köppen-Geiger classifies the climate there as being of type Csa. The average annual temperature is 16.6 °C. Over the year, the average precipitation is 477 mm.
	El Fehoul	Rain in El Fehoul mostly falls in winter, with Köppen-Geiger classification Csa. The average temperature is 18.0 °C. The average annual precipitation is 478 mm.
	Oujlida	Steppe climate. This location is classified as Csa by Köppen and Geiger. 16.0 °C average temperature throughout the year. It falls on average 484 mm of rain per year.

Animals studied

Forty (40) unrelated adult goats of the Arbia breed; 34 goats (figure 2), and 6 billy goats (figure 3) were included in this study (Table 2).

Figure 2. Goat of the Arbiabreed

Figure 3. Billy goat of the Arbia breed

Table 2. Distribution of the goat population studied according to region and sex.

Breed	Number	Study area		Sex		Total
		Wilaya	Area	Females	Males	
Arbia	8	Tlemcen	Maghnia	6	2	8
	12		Souahlia	11	1	12
	2		Nedroma	2	0	2
	2		Sebdou	1	1	2
	7		Chetouane	6	1	7
	4		El Fehoul	3	1	4
	5		Oujlida	5	0	5
Total				**34**	**6**	**40**

Milk sampling

The milk samples analyzed are fresh, from herds of healthy goats characterized as adults and located in the wilaya of Tlemcen in four regions (Maghnia, Chetouane, Souahlia and Oujlida) (Table3).

Table 3. Date and place of milk collection

Breed	Wilaya	Study areas	Sampling date	Total samples
Arbia	Tlemcen	Maghnia	05/05/2018	11
		Chetouane	27/05/2018	4
		Souahlia	30/05/2018	3
		Souahlia	02/06/2018	7
		Oujlida	03/06/2018	4
		Total		**29**

Variables studied

Body measurements

Twenty quantitative variables were measured for each animal: Head length (HL), Head width (HW), ear length (EL), Ear width (EW), Withers Height (WH), Back Height back (BH), Sacrum Height (SH), Cannon Perimeter (CP), Heart girth (HG), Chest depth (CD), Shoulder width (SW), Neck Length (NL), Body Length (BL), Total Body Length (TBL), Scapulo-ischial Length (SIL), Tail length (TL), Pelvis length (PL), Rump width (RW), Ischions width (IW), Trochanter width (TW). These measurements were taken using a double pole rod and a tape measure.

Physico-chemical analysis of goat's milk

For the analysis of the milk's quality, we used the Lactoscan device (Table 4)

Table 4. The different parameters measured by the Lactoscan analyzer.

Parameters	Abbreviation
Fat	F
Density	D
Conductivity	C
Dey Extract	S
Proteins	P
Lactose	L
Temperature	T

Statistical analyzes

Descriptive statistics and the effect of gender (compared using the Student test) were analyzed using SPSS software (version 19).

A principal component analysis (PCA) was carried out to group together homogeneous individuals who have the same body measurements to differentiate goats according to these criteria, define a classification of animals, and build a typology to identify individuals similar to each other. Finally, to obtain the optimal number of groups, an ascending hierarchical classification (CHA) was used. These tests were processed also by SPSS software (version 19).

Results

Body measurements

Descriptive analysis

The total goat population studied has an average withers height (WH) of 69.79 ± 4.96 cm; an average back height (BH) of 71.40 ± 4.74 cm; an average height at the sacrum (SH) of 72.28 ± 4.64 cm; an average heart girth (HG) of 79.36 ± 6.44 cm; an average body length (BL) of 72.57 ± 7.14 cm; an average total body length (TBL) of 109.96 ± 7.55 cm and an average scapulo-ischial length (SIL) of 64.24 ± 5.26 cm. These measures have very high variance values, which explains the variability in the population (Table 5).
The other measures: (HL), (WH), (EL), (EW), (CP), (NL), (TL), (BL), (HL), (IW), (CD), (SW) and (TW) have very low variance values (Table 5).

Table 5. Descriptive analysis of body measurements in the Arbia breed.

	Mean	SD	Std Error	Variance	Minimum	Maximum
HL(cm)	23.16	1.53	0.24	2.35	20.50	28.00
HW(cm)	11.51	2.13	0.34	4.55	7.50	16.00
EL(cm)	16.47	2.40	0.38	5.78	13.50	27.80
EW(cm)	7.30	0.63	0.10	0.40	6.40	9.00
WH(cm)	69.79	4.96	0.78	24.61	57.00	80.00
BH(cm)	71.40	4.74	0.75	22.49	65.00	85.00
SH(cm)	72.28	4.67	0.74	21.82	64.00	87.00
CP(cm)	8.58	1.11	0.18	1.24	7.00	13.00
HG(cm)	79.36	6.44	1.02	41.41	68.00	98.00
CD(cm)	28.71	3.17	0.50	10.05	22.50	34.50
SW(cm)	16.65	2.80	0.44	7.82	11.00	22.00
NL(cm)	23.18	2.19	0.35	4.79	19.50	28.00
BL(cm)	72.57	7.14	1.13	51.04	56.00	87.00
TBL(cm)	109.96	7.55	1.19	57.01	95.00	130.00
SIL(cm)	64.24	5.26	0.83	27.62	52.00	72.50
TL(cm)	12.30	2.42	0.38	5.88	8.00	16.90
PL(cm)	15.59	1.36	0.21	1.84	13.00	18.00
RW(cm)	21.28	1.84	0.29	3.37	17.80	27.00
IW(cm)	11.97	1.81	0.29	3.26	9.50	18.00
TW(cm)	16.77	2.75	0.43	7.54	12.00	23.00

Head length (HL), Head width (HW), Ear length (EL), Ear width (EW), Withers Height (WH), Back Height back (BH), Sacrum Height (SH), Cannon Perimeter (CP), Heart girth (HG), Chest depth (CD), Shoulder width (SW), Neck Length (NL), Body Length (BL), Total Body Length (TBL), Scapulo-ischial Length (SIL), Tail length (TL), Pelvis length (PL), Rump width (RW), Ischions width (IW), Trochanter width (TW).

Variation of parameters studied according to sex

The body measurements studied in both sexes (males and females) of the Arbia breed are presented in Table 6.

Table 6. Variation of variable according to sex

	Male	**Female**	**P**
N	6	34	
HL(cm)	24.13±2.60	22.99±1.25	***
HW(cm)	12.82±1.09	11.27±2.20	ns
EL(cm)	18.45±4.61	16.12±1.66	***
EW(cm)	7.67±0.93	7.24±0.56	ns
WH(cm)	73.80±6.25	69.09±4.44	***
BH(cm)	77.20±6.07	70.37±3.71	*
SH(cm)	77.58±7.69	71.35±3.29	***
CP(cm)	9.22±0.95	8.46±1.11	ns
HG(cm)	83.42±9.38	78.64±5.66	***
CD(cm)	30.18±3.40	28.45±3.11	ns
SW(cm)	16.97±2.05	16.60±2.93	ns
NL(cm)	23.83±2.29	23.06±2.18	ns
BL(cm)	73.42±10.48	72.42±6.60	ns
TBL(cm)	113.50±13.19	109.34±96.19	ns
SIL(cm)	65.77±8.85	63.96±4.50	ns
TL(cm)	15.67±1.29	11.71±2.07	*
PL(cm)	16.67±1.97	15.40±1.16	***
RW(cm)	22.17±2.58	21.12±1.67	ns
IW(cm)	11.47±1.48	12.06±1.86	ns
TW(cm)	15.87±2.44	16.93±2.80	ns

** Significant at 0.05, *** significant at 0.001, Ns: not significant. Head length (HL), Head width (HW), Ear length (EL), Ear width (EW), Withers Height (WH), Back Height back (BH), Sacrum Height (SH), Cannon Perimeter (CP), Heart girth (HG), Chest depth (CD), Shoulder width (SW), Neck Length (NL), Body Length (BL), Total Body Length (TBL), Scapulo-ischial Length (SIL), Tail length (TL), Pelvis length (PL), Rump width (RW), Ischions width (IW), Trochanter width (TW).*

The biometric measurements of the goat breeds studied vary with sex. There are significant differences at 0.001 between males and females for the traits: (HL), (EL), (WH), (BH), (SH), (HG), (TL), and (PL). That is to say that there is phenotypic heterogeneity between the two sexes.

On the other hand, the sex of the animals does not have a discriminating effect (P> 0.05) on (HW), (EW), (CP), (CD), (SW), (NL), (BL), (TBL), (SIL), (RW), (IW), and (TW).

It was noticed that the males have a longer head and ear (HL: 24.13 ± 2.60 cm; EL: 18.45 ± 4.61 cm), they are higher (WH: 73.80 ± 6.25 cm; BH: 77.20 ± 6.07 cm; SH: 77.58 ± 7.69 cm) with a very developed chest (HG: 83.42 ± 9.38 cm; CH: 30.18 ± 3.40 cm) and long pelvis (PL: 16.67±1.97cm) compared to females. Also, the tail of the male is taller (15.67±1.29cm).

Baryometric variation of individuals of the Arbia breed

Analysis of variables

A principal component analysis (PCA) was used by retaining the following variables: HL, HW, EL, EW, WH, BH, SH, CP, HG, CD, SW, NL, BL, TBL, SIL, TL, PL, RW, IW, and TW. The cumulative share of the information returned in this case is 61.423% (Table 7).

Table 7. Initial eigenvalues

Component	Total	% of variance	Cumulative %
1	8.459	42.293	42.293
2	3.826	19.130	61.423
		61.423	**103.716**

The analysis of the studied parameters shows that the two axes present respectively 42.293% and 19.130%.

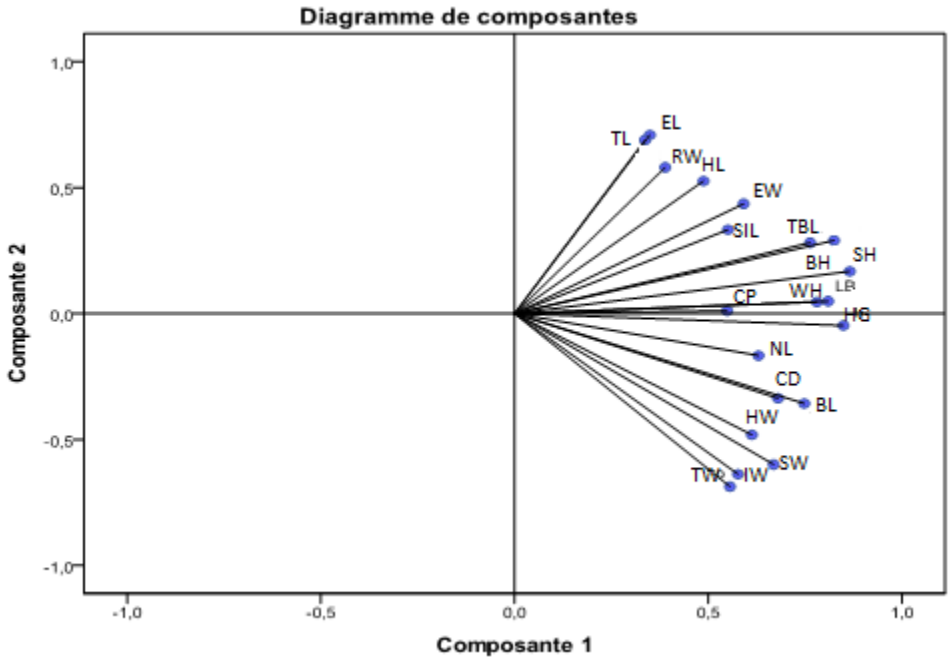

Figure 4. Presentation of the variables by PCA in Arbia goat breed. .

Analysis of individuals

The principal component analysis (PCA) and the hierarchical ascending classification made it possible to determine three classes (Figures5 and 6 and table8).

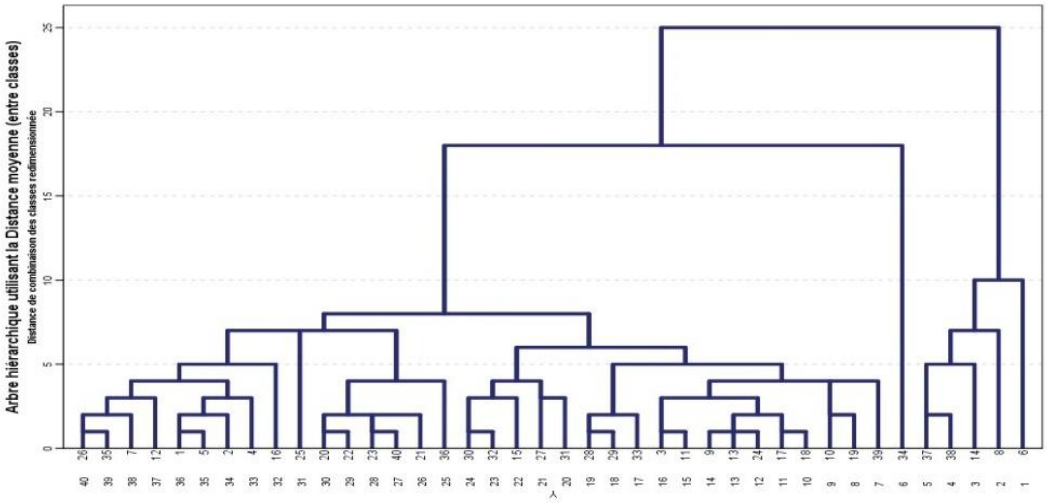

Figure 5. Hierarchical tree using the average distance (between classes) in the Arbia breed according to barymetric traits.

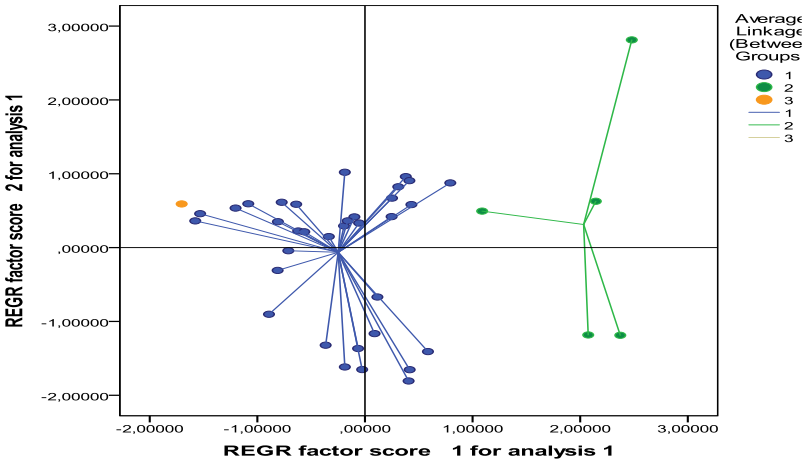

Figure 6. Presentation of individuals of the Arbia breed.

Class 01: The animals of this class (34 individuals) constitute the majority of the studied population. They have a shorter and less broad head compared to the other class (HL: 22.94 ± 1.20 cm; HW: 11.20 ± 2.07 cm) with shorter and narrower ears (EL: 16.13 ± 1.66 cm; EW: 7.20 ±, 55 cm), they are less elongated (SIL: 63.84 ± 4.69 cm), have a very short tail (TL: 11.85 ± 2.20 cm), and they are less developed behind (TW: 16.54 ± 2.36 cm) (table 8).

Table 8. Classification of the Arbia breed by PCA

	Class 1	**Class 2**	**Class 3**
N	34	5	1
HL(cm)	22.94±1.20	24.72±2.74	22.90
HW(cm)	11.20±2.07	13.68±1.46	11.00
EL(cm)	16.13±1.66	18.60±5.17	17.20
EW(cm)	7.20±.55	8.10±.65	6.80
WH(cm)	68.96±4.31	76.90±2.01	62.50
BH(cm)	70.12±3.22	80.54±3.74	69.00
SH(cm)	71.14±2.98	81.30±4.13	66.00
CP(cm)	8.38±1.02	9.82±1.09	9.00
HG(cm)	77.90±4.27	91.20±5.99	69.50
CD(cm)	28.16±2.80	33.18±1.60	25.00
SW(cm)	16.33±2.65	19.40±2.45	14.00
NL(cm)	22.85±1.98	25.90±1.56	20.50
BL(cm)	71.48±5.66	83.30±3.27	56.00
TBL(cm)	108.54±5.66	122.60±4.34	95.00
SIL(cm)	63.84±4.69	69.38±4.00	52.00
TL(cm)	11.85±2.20	14.82±2.43	15.00
PL(cm)	15.37±1.10	17.60±.89	13.00
RW(cm)	21.04±1.60	23.30±2.33	19.50
IW(cm)	11.75±1.29	13.96±3.35	9.50
TW(cm)	16.54±2.36	19.26±3.67	12.00

Head length (HL), Head width (HW), Ear length (EL), Ear width (EW), Withers Height (WH), Back Height back (BH), Sacrum Height (SH), Cannon Perimeter (CP), Heart girth (HG), Chest depth (CD), Shoulder width (SW), Neck Length (NL), Body Length (BL), Total Body Length (TBL), Scapulo-ischial Length (SIL), Tail length (TL), Pelvis length (PL), Rump width (RW), Ischions width (IW), Trochanter width (TW).

Class 02: The animals of this class (5 individuals) are very developed compared to others; these five are the most efficient, they have a longer and wider head (HL: 24.72 ± 2.74 cm; HW: 13.68 ± 1.46 cm) with larger and longer ears (EW: 8.10 ±0.65 cm; EL: 18.60 ± 5.17 cm), are the highest (WH: 76.90 ± 2.01 cm; BH: 80.54 ± 3.74 cm; SH: 81.30 ± 4.13 cm) and the longest (TBL: 122.60 ± 4.34 cm). The thoracic perimeter of these

animals is more developed (HG: 91.20 ± 5.99 cm; CD: 33.18 ± 1.60 cm). The pelvis is longer and wider (PL: 17.60 ±0.89 cm; RW: 23.30 ± 2.33 cm), are longer (SIL: 69.38 ± 4 cm), while these animals are highly developed posteriorly (TW: 19.26 ± 3.67 cm), also anteriorly (SW: 19.40 ± 2.45 cm) and have a developed bone structure (PC: 9.82 ± 1.09 cm) (table 8).

Class 03: The animal of this class is less tall compared to the animals of two other classes (WH: 62.50 cm; SH: 66.00 cm), it has a lower HG and CD (HG: 69, 50 cm; CH: 25.00 cm) and it is less developed back and forward (TW: 12.00 cm; SW: 14.00 cm; RW: 19.50 cm) compared to animals of class 01 and 02 (Table 8).

The quality of the milk

Descriptive analysis

The Physico-chemical analyzes of studied milk are: fat (F), density (D), conductivity (C), dry extract (S), proteins (P), lactose (L), temperature (T) and mineral salts (S1) (table 9).

Table 9. Descriptive analysis of milk from the Arbia breed

	Mean	**SD**	**Std Error**	**Variance**	**Minimum**	**Maximum**
F (g/l)	56.90	20.24	3.76	409.47	18.25	99.99
D	3.086	3.62	0.67	13.13	24.64	39.63
C	4.96	0.41	0.08	0.16	4.13	6.25
DE (%)	7.73	1.78	0.33	3.17	0.24	10.32
P (g/l)	27.35	4.01	0.74	16.07	18.16	35.35
L (g/100 ml)	4.21	0.61	0.11	0.37	2.89	5.46
T(C°)	19.18	2.77	0.51	7.68	13.70	23.30
S1 (%)	0.70	0.09	0.02	0.01	0.54	0.90

Fat (F), density (D), conductivity (C), dry extract (DE), proteins (P), lactose (L), temperature (T) and mineral salts (S1).

Variation of the studied parameters

Analysis of variables

A principal component analysis (PCA) was used by retaining the following variables: F, D, C, S, P, L, T, S1. The cumulative share of the information returned in this case is 73.98%.

The Physico-chemical analysis of goat's milk shows that the two axes show 59.23% and 14.75% respectively (Table 10).

Table 10. Milk variation in the Arbia breed.

Component	**Total**	**% of variance**	**Cumulative %**
1	4.74	59.23	59.23
2	1.18	14.75	73.98
		73.98	133.21

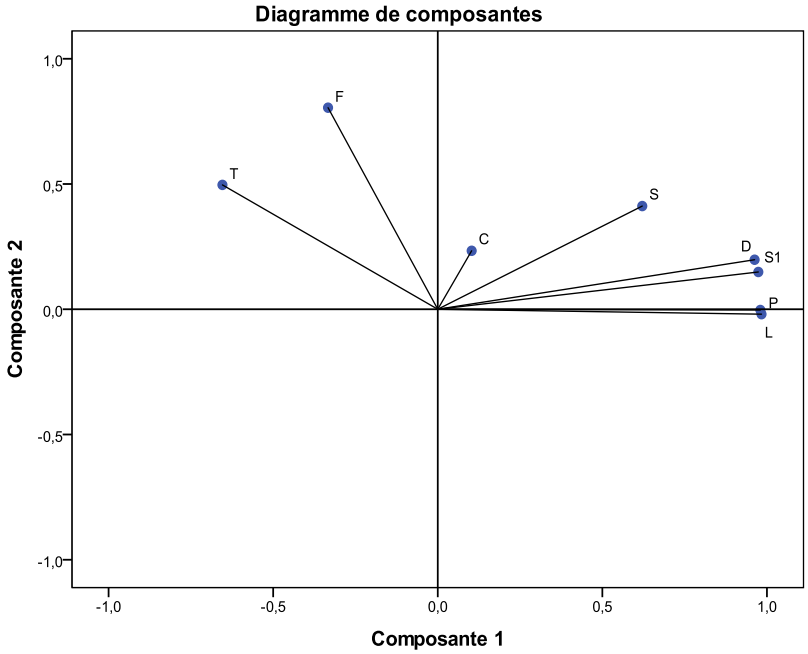

Figure 7. Presentation of milk variables by PCA in Arbia breed

Analysis of individuals

The principal component analysis: PCA and the ascending hierarchical classification made it possible to determine three classes (Figures8 and 9 and table 11).

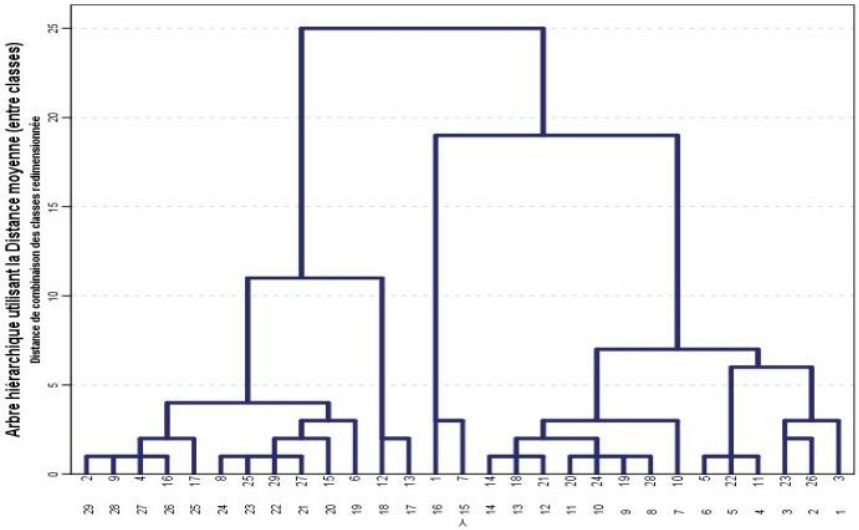

Figure 8. Hierarchical tree using the average distance (between classes) in the Arbia breed according to the physico-chemical analysis of milk.

Class 01: The samples of this class (2 Goats) contain more fat than the other classes (F: 96.83±4.48g/l) and less protein than class 02 and 03 (P: 21.51±4.74g/l). The temperature of these samples is high (T: 21.25±1.77C°).

Class 02: This class is made up of 13 samples that contain more protein (P: 28.54±3.05 g/l) and less fat (F: 38.81±10.35g/l). Compared to other samples, the conductivity of these samples is (C: 4.99±0.31).

Class 03: The samples in this class (14 Goats) have a high dry extract content (S: 8.00±1.17mg/l) and an equally high lactose composition (L: 4.17±0.66g/ 100ml). The mineral salts of these samples are (S1: 0.70±0.10 percentage).

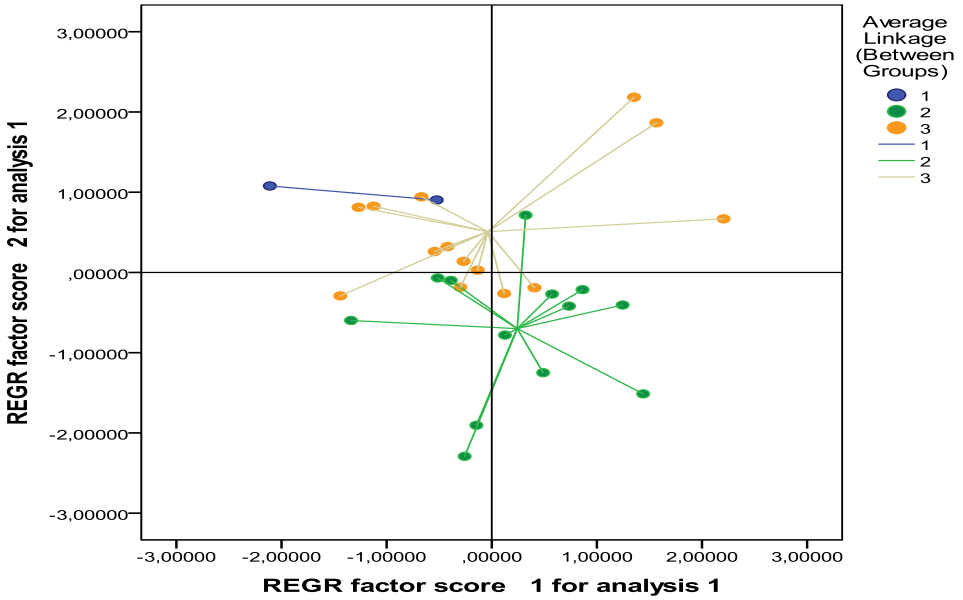

Figure 9. Presentation of physico-chemical analyzes of milk from the Arbia breed.

Table 11. Classification of milk samples from the Arbia breed by PCA.

	Class 01	**Class 02**	**Class 03**
N	2	13	14
F (g/l)	96.83±4.48	38.81±10.35	67.99±8.75
D	2.759±4.17	31.05±2.72	31.14±2.29
C	4.51±0.54	4.99±0.31	4.98±0.46
DE (%)	6.73±1.23	7.60±2.35	8.00±1.17
P (g/l)	2.151±4.74	28.54±3.05	27.09±4.19
L (g/100ml)	3.39±0.71	4.39±0.46	4.17±0.66
T(C°)	21.25±1.77	18.52±2.95	19.50±2.66
S1(%)	0.61±0.10	0.71±0.06	0.70±0.10

Fat (F), density (D), conductivity (C), dry extract (DE), proteins (P), lactose (L), temperature (T) and mineral salts (S1).

Discussion

Body measurements

External body measurements are important sources of data that reflect breed standards (Riva *et al.*, 2004). Our study was carried out to describe the Arbia breed in different regions in the wilaya of Tlemcen and to know if any biometric differences exist between the two sexes.

According to the National Commission AnGR, (2003) and Madani*et al.*, (2003), the Arbia breed is divided into two named subtypes: sedentary (lightweight, elongated body, short hair...) and transhumant (heavy, tall format, long hairs, etc.).

The average body length (BL) is 72.57±7.14 cm, and the average total body length (TBL) is 109.96± 7.55 cm. These animals are slender compared to goats studied in western Algeria (Belkhadem, 2017), the region of OuedRigh (Ouargla) (Ghechoua and Ghettas 2015), and South-West Nigeria (Samuel Fajemilehin and Salako, 2008) and the BeniArrous population in Morocco (Hilal*et al.*, 2014).

For head length (HL: 23.16 ± 1.53 cm), our study presents animals with long heads compared to those of the Sétif region (Manallah and Dekhili, 2011), India (Verma*et al.*, 2010), and the red goat from Niger (Marichatou*et al.*, 2012), but they have short heads compared to those of Ghardaïa (Habbi, 2014) and Biskra (Djouza and Chehma, 2018).

For the length of the ears (EL: 16.47 ± 2.40 cm) and their width (EW: 7.30± 0.63 cm), they are lower than those of the Arbia population of Biskra (Djouza and Chehma, 2018), which are characteristic features of this population. Syrian goats are characterized by long ears (Hassen*et al.,* 2016).

According to Vacca*et al.,* (2016), native Sardinian short-eared goats were characterized by more favorable milk quality (rich in fat, protein, and energy) than Maltese long-eared goats.

The height at the withers (WH) is part of the skeletal measurements (Blackmore and Dow, 1958). If the height at the withers of a population does not exceed 60cm, it is considered dwarf (Mason, 1984).

Our results show that the Arbia breed in the wilaya of Tlemcen is smaller (WH: 69.79±4.96 cm; BH: 71.40±4.74 cm; SH: 72.28± 4.67 cm) than the ones raised in southeastern Algeria (Djouza and Chehma, 2018), and taller than goats raised in the wilaya of Setif (Manallah and Dekhili, 2011) and Niger's redhead goat (Marichatou*et al.,* 2012).

The goats studied have a very developed chest (HG: 79.36 ± 6.44 cm) and deeper (CD: 28.71 ± 3.17 cm) compared to that of goats reported by Sahi*et al* (2018) in northeastern Algeria, Aziz (2015) in the Hadjira area, Habbi (2014) in the Ghardaïa region, and Marichatou*et al* (2012) in the red goat of Niger. The girth heart in the Arbia goat studied is greater than that of the goat of the Pare breed (72.3 ± 0.51 cm) according to Nguluma*et al* (2016) and that of the Kılkeçisi breed (86.8 cm) by Nguluma*et al.,* (2016).

The tail of the animals is short (TL: 12.30 ± 2.42cm) compared with that of animals in the OuedRigh region (Ghechoua and Ghettas, 2015) and that of goats in northeastern Algeria (Sahi*et al.,* 2018).

In our study, the sex presents highly significant differences (P<0.05) in some measurements (HL, EL, HG, WH, BH, SH, PL, and TL) with a preference for males. It was noticed that female goats of the Arbia breed in the wilaya of Tlemcen are smaller, and have a less developed chest than billy goats (P<0.05). These results are compatible with Fanazi and *al's study* (2017) in Arbia, Naine de Kabylie, Mekatia, and M'zabite breeds in north-central Algeria and Sahi*et al* (2018) in the local goat breed of Northeastern Algeria.

Milk quality

Goat's milk is a valuable source of nutrients compared to cow's milk (Singh *et al.,* 2014). It is a potential resource that should be exploited. The quality of goat's milk varies depending on various factors; lactation stage (Jenness, 1980; Shingfield*et al.,* 2008; Noutfia*et al.,* 2014), litter size (Chentouf*et al.,* 2006), and season kidding (Midau*et al.,* 2010; Ishag*et al.,* 2012).

Goat's milk contains higher levels of butterfat than cow's and camel's, and buffalo's milk, this results in higher cheese yield. Cheese curd contains mainly fat and casein (Storry*et al.,* 1983), lactose content, and protein content. The water content and dry matter are lower compared to the milk of other species. This makes the goat an animal that should be valued, particularly in the steppe and Saharan regions.

Fat: Analysis of Arbia goat's milk shows higher fat content (56.90 ± 20.24 g/l) compared to Draa goat (4.16%) and Alpine goat (3.4%) (Noutfia*et al.,* 2011), but it is close to that reported by Matallah*et al.,* (2020) with 5.4±0.3% and by Arroum*et al.,* (2016) with 5.9 g/l for the local breed in intensive farming in Tunisia and Benyoub, (2016) with values of 5.4% and 5.25% for the local breed of Tlemcen.

Salt: The salt rate is 0.7% for our study; it is close to the Draa goat (0.728%) and that of the Alpine (0.709%) (Noutfia*et al.,* 2011) but it is higher than that of DjouzaandChehma, (2018) in the breed Arbia in Biskra.

Proteins: The average values of the total proteins of the milk studied (27.35 ± 4.01 g/l) are lower than those of Matallah*et al.,* (2020) which have a value of 3.8 ± 0.08%.

Lactose: 5.70±0.11% is the lactose content for the type studied by Matallah*et al.,* (2020) and is higher than ours (4.21±0.61%).

Density: The density is estimated at 3.086 ± 3.62, this is considered denser compared to goat milk analyzed by Mekri*et al.,* (2017) which was 1.034, and by Benyoub, (2016) and Djouza and Chehma, (2018) in the breed Arbia.

Conclusion

The study of body measurements made it possible to determine the phenotypic variability of the Arbia goat breed reared in the wilaya of Tlemcen (North West of Algeria). A clear superiority in the males of this breed over the females for the parameters studied appeared. Goat breeding practices are still traditional and this species is less important than the sheep species. The Arbia breed is higher in the wilaya of Tlemcen. The breeders prefer to breed this specie because of its performance and its adaptation to the environment. Thus, it deserves to be preserved against the anarchic crossings, which present a significant risk of losing these qualities and will make the identification and characterization of populations very difficult. Further research will be needed to guide its use and improve its production through work that completes the characterization stage. Arbia goat milk deserves to be valued and exploited, especially in an area where cattle find it difficult to express their zootechnical potential. This study on the morphological characterization of the Arbia breed can serve as a basis for other more precise studies of the genetic characterization of this species.

References

Arroum S. Zmouli K. Gaddour A. Fguiri I. Naziha A. Khorchani T 2016. Étude comparative des caractéristiques physico-chimiques et microbiologiques du lait caprin en fonction du mode d'élevage. Options Méditerranéennes : Série A. Séminaires Méditerranéens., 115 : 429-433.

Belantar I. Tefiel H. Gaouar SBS 2018. Phenotypic characterization of local goat population in western Algeria (Wilaya of Relizane) with morphometric measurements and milk analysis. Genetics and Biodiversity Journal, 2(2): 55-56. DOI: https://doi.org/10.46325/gabj.v2i2.123

Belkhadem S. 2017. Caractérisation morpho métrique et zootechnique des caprins locales dans l'ouest Algérien. Thèse Master, Université Abou Bekr Belkaid, Tlemcen, Algérie.

Belkhadem S. Tefiel H. Belantar I. Chahbar M. Gaouar SBS 2019. Discriminant analysis on the morphometry of local goats breed in the Western of Algeria.Genetics and Biodiversity Journal, 3(2) : 49-56. DOI: https://doi.org/10.46325/gabj.v3i2.56

Benyoub K. 2016. Caractérisation phénotypique des populations locales caprines dans le Nord-Ouest Algérien. Analyse morphométrique et qualité du lait. Thèse Master. Université Abou Bekr Belkaid, Tlemcen, Algérie.

Blackmore J and Dow R.P. 1958. Differential feeding of Celuxtarsalison nestling and adults birds. Mosq News., 18 (1) : 15-17.

Chentouf M. Boulanouar B. Bister J.L. Zantar S. 2006. Evaluation des performances de production de la chèvre locale du Nord du Maroc. Al Awamia, 118/119 : 137-153.

Delgado J.V. Barba C. Camacho M.E. Sereno F.T.P.S.MartinezA.Vegapla J.L. 2001. Caracterization de los animalsdomesticos en Espana. Agri., 29 , p: 7–18.

Djouza L and Chahma A. 2018. Productioncharacteristics of Arbiagoats in Biskrawilayah. Algeria. Livestockresearchfor rural Development, 30. (7).

FantaziK.Tolone M. Amato B.Sahraoui H. Vincenzo di Marco L.P. La Giglia M.Gaouar S.B.S. Vitale M. 2017. Characterization of morphological traits in algerian indigenous goats by multivariate analysis. Genetics and Biodiversity Journal, 1(2) : 20-30. DOI: https://doi.org/10.46325/gabj.v1i2.93

Gaouar S.B.S. 2002. Contribution à l'étude de la variabilité génétique des races ovines par l'utilisation des microsatellites : Caractérisation de deux races ovine algériennes Hamra et Ouled-Djellal. Thèse de Magistère. Laboratoire de biologie moléculaire et génétique, Institut des sciences de la nature, Université d'Es-Sénia, Oran, Algérie.

Gaouar SBS 2009. Etude de la biodiversité : Analyse de la variabilité génétique des races ovines algériennes et de leurs relations phylogénétiques par l'utilisation de microsatellites. Thèse de Doctorat. Laboratoire de biologie moléculaire et génétique, Institut des sciences de la nature, Université d'Es-Sénia, Oran, Algérie.

Ghechoua K and Ghettas S. 2015. Caractérisation phénotypique des populations caprines dans la région de Oud Righ (Cas de la daira Témacine). Mémoire de Master, Université Kasdi Merbah, Ouargla, Algérie.

Gizaw S. Van Arendonk J.A.M. Komen H. Windig J.J. Hanotte O. 2007. Population structure, genetic variation and morphological diversity in indigenous sheep of Ethiopia. Anim. Genet., 38 : 621-628.

Habbi W. 2014. Caractérisation phénotypique de la population caprine de la région de Ghardaia. Mémoire d'ingénieur d'état. Université Kasdi Merbah, Ouargla, Algérie.

Hassen H. Rischkowsky B. Termanini A. Jessry G. Haile A. Baum M. Lababidi S. 2016. Morphological and molecular genetic diversity of Syrian indigenous goat populations. African Journal of Biotechnology, 15(18) : 745-758. DO: https://doi.org/10.5897/AJB2015.15062

Hilal B. El Otmani S. Chentouf M. Boujenane I. 2014. Morphological characterization of the local goat population "Beni Arrous". Options Méditerranéennes : Série A. Séminaires Méditerranéens; 108 : 433-437

Ishag I.A. Abdalla S.A. Ahmed M.K.A. 2012. Factorsaffectingmilk production traits of Saanen goatraisedunderSudan – Semi Arid conditions. Online J. Anim. FeedRes., 1 (5) : 435-438.

Madani T. Yakhlef H. Abbache N. 2003. Les races bovines, ovines, caprines et camelines. Evaluation des besoins en matière de renforcement des capacités nécessaires à la conservation et l'utilisation durable de la biodiversité importante pour l'agriculture en Algérie. Recueil des communications, Atelier N°3 «Biodiversité Importante pour l'Agriculture». MATE-GEF/PNUD Projet ALG/97/G31, Alger 22-23/01/2003, pp 44-51.

Manallah I and Dekhili M. 2011. Caractérisation morphologique des caprins dans les zones des hautes plaines de Sétif . Agriculture 2 : 7-13.

Marichatou H. Karimou B. Issa M. Chaibou M. Banoin M. Yénikoye A. Falké D.I. Ayatundé A. 2012. Caractéristique morphologique de la chèvre rousse du Niger. Anim. Genet. Resour., 51 : 89-97.

Martins C.E.N. Quadros S.A.F. Trindade J.P.P. Quadros F.L.F. Costa J.H.C. Raduenz G. 2009. Shape and function in Braford cows: The body shape as anindicative of performance and temperament. Archiv. Zootec., 58 : 425–433.

Mason I.L. 1984. Goat In: Evolution of Domesticated Animals. Ed. Longman, London, pp86-93.

Matallah S. Matallah F. Gadi T. 2020. Effet de la race sur la composition physico-chimique de laits de chèvres du Sud-Est algérien. Livestock Research for Rural Development. 32.

Mekri M. Bboulariah K. Sahraoui A.B. Boudriche L. 2017. Comparative study of the physico-chemical, microbiological and nutritional characteristics of different milks from Algeria. 3ème MGIBR Workshop International "Le lait: Production, conservation et Valorisation " Projet international ARIMNET2 « CA.RA.VA.N » 20 Novembre 2017, ISTA, Université de Tlemcen, Algérie. p 26.

Midau A. Kibon A. Morumpa S.M. Augustine C. 2010. Influence of season on milk yield and milk composition of Red Sokoto goats in Mubi area of Adamawa state, Nigeria. J. Dairy Sci., 5 : 135-141. DOI: 10.3923/ijds.2010.135.141

Mwacharo J.M. Okeyo A.M. Kamande G.K. Rege J.E.O. 2006. The small East African shorthorn zebu cows in Kenya. 1: Linear body measurements. Trop. Anim. Health Prod., 38 : 65-76.

Nesamvuni A.E. Mulaudzi J. Ramanyimi N.D. Taylor G.J. 2000. Estimation of body weight in Nguni-type cattle under communal management conditions. South African J of Animal Science., 30 : 97-98. DOI: 10.4314/sajas.v30i4.3927

Nguluma A.S. Msalya G. Chenyambuga S.W. 2016. Phenotypic variation among four populations of small East African goats of Tanzania. Livestock Research for Rural Development 28 (8).

Noutfia Y. Zantar S. Ibnelbachyr M. 2011. Caractéristiques physicochimiques du lait et du fromage des chèvres Draa et Alpine. Conference paper. L'élevage caprin : Acquis de recherche, Stratégie et Perspectives de développement, pp: 163-168.

Noutfia Y. Zantar S. Ibnelbachyr M. Abdelouahab S. Ounas S. 2014. Effect of stage of lactation on the physical and chemical composition of Drâa goat milk. African Journal of Food, Agriculture, Nutrition and Development, 14 : 9181-9191. DOI: 10.18697/ajfand.64.11230

Riva J. Rizzi R. Marelli S. Cavalchini L.G. 2004. Body measurements in Bergamasca sheep. Small Ruminant Res., 55 : 221-227.

Sahi S. Afri-Bouzebda F. Bouzebda Z. Djaout A. 2018. Étude des mensurations corporelles de caprins dans le Nord-Est algérien. Livestock Research for Rural Development 30 (8).

Samuel Fajemilehin O.K. Salako A.E. 2008. Body measurement characteristics of the West African Dwarf (WAD) Goat in deciduous forest zone of Southwestern Nigeria. African Journal of Biotechnology., 7 (14) : 2521-2526.

Shingfield K.J. Chilliard Y. Toivonen V. Kairenius P. Givens D.I. 2008. Trans fatty acids and bioactive lipids in milk. *Adv. Exp. Med. Biol.*, 606 : 3-65. DOI: 10.1007/978-0-387-74087-4

Singh G. Sharma R.B. Kumar A. Chauhan A. 2014. Effect of Stages of Lactation on Goat Milk Composition under Field and Farm Rearing Condition. J. Anim. Vet. Adv., 2 : 287-291.

Storry J.E. Grandison A.S. Millard D. Owen A.J. 1983. Chemical composition and coagulating properties of renneted milks from different breeds and species from ruminant. Journal of Dairy Research, 50 (2) : 215–229.

Tefiel H. Ata N. Chahbar M. Benyarou M. Fantazi K. Yilmaz O. Cemal I. Karaca O. Boudouma D. Gaouar S.B.S. 2018. Genetic characterization of four Algerian goat breeds assessed by microsatellite markers. Rumin, 160 : 65-71.

Tefiel H. Ata N.Fantazi K.Chahbar M. Benyarou M. Yilmaz O. Cemal I. Karaca O. Boudouma D. Gaouar S.B.S. 2020. Microsatellite based genetic diversity in indigenous goat breeds reared in Algeria and Turkey. Journal of Animal and Plant Sciences, 30 (5) : 1115-1122. DOI: 10.36899/JAPS.2020.5.0127

Vacca G.M. Paschino P. Dettori M.L. Bergamaschi M. Cipolat Gotet C. Bittante G. Pazzola M. 2016. Environmental, morphological, and productive characterization of Sardinian goats and use of latent explanatory factors for population analysis. J. Anim. Sci. 94 : 3947–3957.