Breeding System and Multivariate Analysis of Phenotypic Variability of Arbia Goat Breed in the Ouarsenis Region (Tissemsilt and Tiaret, Algeria)

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Received: 14/05/2022; Accepted: 05/09/2022; Published: 31/10/2022

Abstract:

The objective of our study is the characterization of the breeding system followed by a phenotypic characterization of the local breed goat named Arbia. The study samples come from the local goat population of the two wilayas Tiaret and Tissemsilt, under a family breeding mode mainly. The morphometric study was carried out on the taking of body measurements, and the phenotypic description in 59 goats and representatives including 47 females and 12 males characterized as adults and unrelated. The age was determined by a dental examination and commemorative of the breeder. According to the developed questionnaire, we found that the breeders of goat farms are mostly men (76.92%) than women (23.07%), this finding can be explained by the difficulty of breeding as well as the extensive practice of breeding in pastures. The age ranges from 25 years to over 50 years, our work has allowed us to confirm that that goat rearing is secondary to sheep rearing. It has been observed that reproduction is free, uncontrolled, males are permanently in the herds and the cradle of the breed in the crossbreeding among some breeders is not respected. For milk production, the majority of the farmers surveyed practice manual milking in the morning, once a day. The average yield is between 0.5 and 1 litre depending on the feed distributed. Almost all the farms visited contain traditional buildings or sheepfolds or sometimes buildings for mixed breeding but what is remarkable among most breeders despite the simple means and traditional breeding, hygiene is respected.The results of the GLM procedure show that the measured quantitative characters are not influenced by the region effect ($P>0.05$), except for two characters Lnb (F value=5.28; ddl= 1; P=0.0156) and Lco (F value=17.41; ddl= 1; P=0.0001) whose difference is significant between the two regions with R^2 values equal to 18.16% and 33.21% respectively. The Mahalanobis distance was estimated at $D^2=11.99$ between the two regions, namely Tiaret and Tissemsilt using the PROC CANDISC procedure. This low Mahalanobis distance which does not exceed 50 ($D^2<50$) results in considerable phenotypic overlaps between individuals from the two localities.

Keywords: Local goat breed, Arbia, Tissemsilt, Tiaret, breeding system, phenotypic characterization.

Tob Regul Sci. ™ 2022 ;8(2): 902-913

DOI : doi.org/10.18001/TRS.8.2.62

1. Introduction

Sustainable agricultural development must undeniably be based on rational exploitation of biodiversity and adequate improvement of genetic resources. (Tefiel et al 2018). In the case of goats, they represent, after sheep, the most important group of ruminants in Algeria. (MADR 2021).Ruminant breeding represents a major component of Algerian agricultural systems, in which the "small ruminants" component predominates, where goat breeding is among the most traditional agricultural activities associated with sheep breeding (Belantar et al., 2018). Goat breed is characterized by its adaptation to the majority of agro-ecosystems that exist there and it constitutes a versatile supplier of noble foods, fibers and organic matter likely to improve soils. (FAO stat, 2020). Production objectives are very different depending on the location. In many countries such as Algeria, the hardiness and the ability to exploit poor plant resources make the goat a subsistence animal with a dominant objective of meat production. It has been able to demonstrate economic importance in the different breeding methods even in arid and semi-arid, very arid regions (Belkhadem et al., 2020). A production of 66671.85 quintals of red meat including a production of 7241.42 quintals of goat meat (D.S.A of Tissemsilt, 2019), and a production of 247668 quintals of red meat (D.S.A of Tiaret, 2020), which only covers the needs of the local population of the region. And despite the importation and breeding of more efficient goats such as the Saanen, the Alpine by several breeders, these tests ended in failure due to feeding problems and the adaptability of these animals to environmental conditions. (Tefiel et al. 2018). Furthermore, most of the livestock's food is provided by natural environments (steppes, rangelands, and scrubland) and artificial environments (fallow land, meadows), particularly in winter and spring. Knowledge of the production potential of our goat populations is insufficient in terms of both their characteristics and their performance, particularly with regard to: feeding, skills, resistance to some diseases and to climatic and food adversities, and reproductive performance (Belkhadem et al., 2019). For several years, the selection and classification of animal species and breeds has been based mainly on a set of criteria based mainly on the morphology and size of the animals. Phenotypic characterization is therefore an important step in a conservation program, for the identification and classification of breeds so that agricultural communities can be linked (Tefiel et al 2018, 2020). The objective of our study is the characterization of the breeding system first followed by a phenotypic characterization of the local breed goat named Arbia, and which is of capital importance to contribute to remedying the problem of lack of information on genetic resources which plagues goat breeding throughout the country, particularly in the west in the two wilayas (Tissemsilt and Tiaret) where the Arbia goat breed is very widespread.

2. Materials and Methods

2.1. Study areas

Our research is conducted on Arbia goat breed farms in western Algeria. The main reason that determines the choice of Tissemsilt and Tiaret as study locations is dictated by the absence of a characterization of this species, the importance of these goat population and the accessibility to the farms.

2.2. Animal material

The study samples come from the local goat population of the two wilayas Tiaret and Tissemsilt, under a family breeding mode mainly. The morphometric study was carried out on the taking of body measurements, and the phenotypic description in 59 goats and representatives including 47 females and 12 males characterized as adults and unrelated. The age was determined by a dental examination and commemorative of the breeder.The choice of 13 farms belonging to the two wilayas was made and which are visited during the study period, well away from each other in order to eliminate family ties. a qualitative and quantitative measurement sheet as well as a questionnaire relating to zootechnical performance and animal welfare in these farms was established to facilitate the collection of information. General data on the herds (numbers, location, categories of animals and breeding conditions, etc.) were noted on survey questionnaires.

2.3. Data collection

2.3.1. Measurements

Seventeen different body measurements were measured for each animal: head length (LT), ear length (LO), neck length (LO), body length (LCr), pelvic length (LnB), ischial width (LI), chest circumference (TP), chest depth (PP), flank depth (PF), neck circumference (TCO), height at withers (HG), height at back (HD), height at sacrum (HS), abdominal circumference (TAB), hair length (Lpi), front cannon circumference (TCA), and tail length (LQ) (Figure 01).

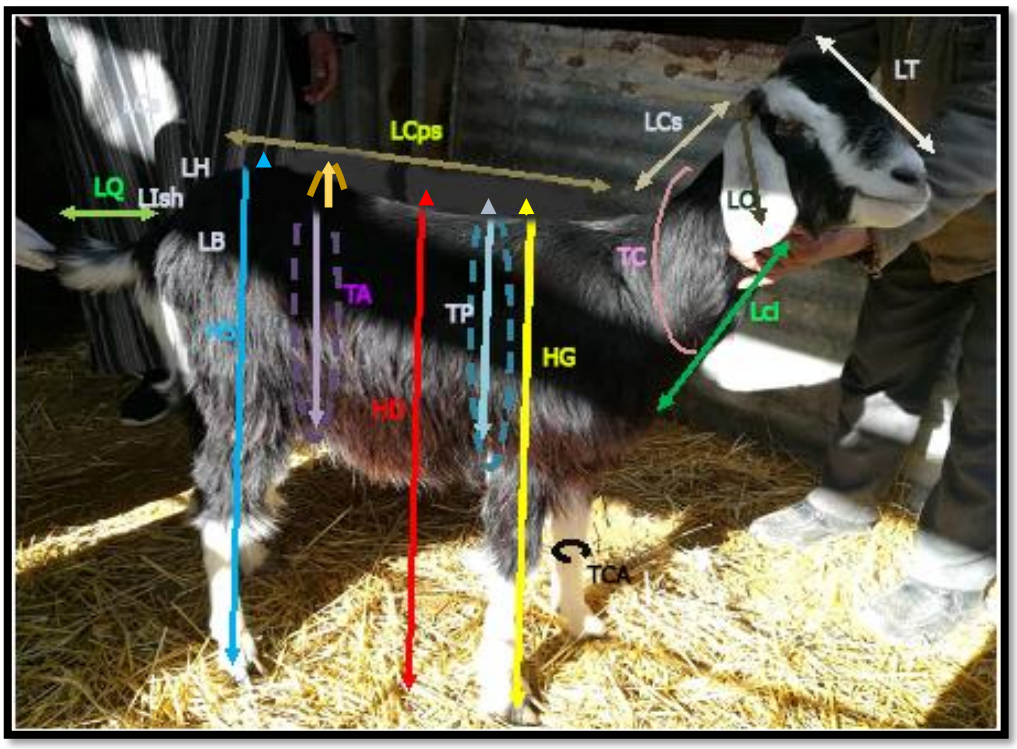

Figure 01: Body measurements taken

2.3.2. Qualitative traits

On the other hand, 15 phenotypic variables were studied: Coat pattern (MR), Head pattern (MT), Head color (CT), Coat color (CR), Leg color (CP), Presence of horns (PC), Horn shape (FC), Horn orientation (OC), Ear length (LO), Ear orientation (OR), Facial profile (head) (PF), Pendants (PEN), Beard (Bar), Back line profile (PLD) and udder (MA).

2.4. Statistical analysis

Data of the survey were organized in Excel 2016 software. All statistical analysis were conducted under SAS version 9 for Windows. The model of statistics type 3 was used. The statistical significance level was defined as $p \leq 0.05$. PROC GLM procedure was used to adjust the generalized linear model. Regions and the sex were considered as fixed variables to determine the effects of fixed factors on the variable factors. Additionally, the PROC Means was used to estimate the means and standard deviations for each parameter. The Pearson's parametric test was utilized to assess the correlation between all quantitative characters.

3. Results and discussion

3.1. Survey results

3.1.1. Gender of breeders

According to the questionnaire that was developed, we found that the breeders of goat farms are mostly men (76.92%) than women (23.07%), this finding can be explained by the difficulty of breeding as well as the extensive practice of breeding in pastures. These results are similar to those found by ADDOUCHE F.Z. and MAIRECHE S. (2021) with 100% of breeders being men in the same region. This would be due to the custom that imposes poultry and rabbit breeding on women (backyard breeding) while reserving that of small ruminants for men; but also without neglecting the share of women who own even small numbers of large livestock.

3.1.2. Age of breeders

The age ranges from 25 years to over 50 years; the age of breeders is represented mainly by adults than by young people, indicated by the tendency of young people towards other occupations except the profession of their grandparents. ADDOUCHE F.Z. and MAIRECHE S. (2021), report that the average age of breeders was divided into three categories, 47.4% of those surveyed have an age that varies between 25-50 years and the same proportion for breeders over 50 years old and a very low percentage of young people recorded as practicing goat farming 5.3%.

3.1.3. Intellectual level

The intellectual level of breeders varies from one region to another; according to our study, it ranges from breeders who are illiterate (07 breeders) to breeders who are qualified and trained through short and long-term training programs developed by state organizations (ITELV, DSA, institutes, etc.) who number 03

breeders, and others with a primary level (03 breeders).ADDOUCHE F.Z. and MAIRECHE S. (2021), report that the level of education of the respondents is generally admissible; 42.1% have an average level, 36.8% have benefited from primary education, 10.5% have a secondary level 10.5% have not followed any studies at all (No level).Despite the lack of education, breeders have a good command of herd management, thanks to their experience and the teachings of their parents. In addition, in both wilayas, almost all breeders do not have agricultural training due to the lack of agricultural training programs adapted to their mentality and the distance of breeders from specialized training centers.

3.1.4. Type of breeding

Goat breeding is of the traditional type with family labor. The extensive system is largely dominant. Breeding is primarily oriented towards meat production. Our visits to the farms selected for this study revealed that the breeding system is of the traditional type, this is noted by the absence of identification tags, the absence of adequate equipment for breeding. ADDOUCHE F.Z. and MAIRECHE S. (2021), report that interviews with breeders in the study region revealed that goat farming is traditional. The semi-extensive and extensive systems are largely dominant. The animals do not have ear tags or identification marks, but the breeder has the ability to identify these animals by different criteria specific to him, such as coat color.

3.1.5. Animal health

Concerning health; the breeder calls on veterinarians in the event of a serious illness affecting a significant part of the livestock and for periodic vaccinations of animals against certain diseases. Most breeders take advantage of the arrival of the state veterinarian at the time of vaccinations to expose the sick animal to him. When an animal is ill, the breeder only uses traditional treatments. Regarding health, ADDOUCHE F.Z. and MAIRECHE S. (2021) found that 89.5% is the proportion of farmers who call on the veterinarian when a pathology appears and for periodic vaccinations of animals against certain diseases such as enterotoximia, sheep pox, most breeders take advantage of the arrival of the veterinarian at the time of vaccinations to dispose of the sick animal, outside these periods and in the event of an animal's illness, the breeder uses traditional treatment practices or slaughters the animal directly.

3.1.6. Place of goat farming

Our work has allowed us to confirm that goat livestock is secondary, managed with sheep. The size of the herds varies from 5 to 50 goats (Figure 2), which reflects the importance of sheep farming and the important place it occupies in relation to goat farming. The results are similar to those found by ADDOUCHE F.Z. and MAIRECHE S. (2021) who state that all the farms visited had mixed goat and sheep farming, sheep is the main objective of the farming for purely economic purposes (wool and meat). Goats are not used for commercial purposes but are sold in case of financial difficulties and farmers do not consider them as an investment.Farmers specified that they use goats to drive the flock of sheep to the pasture, according to them; goats travel longer distances than sheep in search of food. (Belanter et al., 2018).

Figure 02: Goat farming is always associated with sheep farming

3.1.7. Reproduction

It has been observed that reproduction is free, uncontrolled, males are permanently in the herds and the cradle of the breed in the crossbreeding among some breeders is not respected, although there are breeders who are aware of the conservation value of the breed and the effect of mixing between breeds but there are not really projects or selection attempts. ADDOUCHE F.Z. and MAIRECHE S. (2021), report that for reproduction, it is left completely to chance among all the breeders surveyed, natural mating and the presence of bucks permanently with the goats are the characteristics of all the farms, this is the case of the study carried out by Belantar et al., (2018) whose breeders confirmed that reproduction is uncontrolled. For mating, breeders take into account the weight and age of females for breeding. Artificial insemination of goats for genetic improvement is not practiced. The sex ratio is not applied for the farms because the breeders do not separate the males from the females. The kids are always with their mothers, the goats give birth to twins in most pregnancies.

3.1.8. Milk production

For milk production, the majority of the farmers surveyed practice manual milking in the morning, once a day. It is an average of 0.5L to 1L depending on the feed distributed. According to our study, the milk produced is mainly intended for feeding young animals. Milk production is intended for self-consumption for 52.63% of farmers and the rest for suckling kids, i.e. 47.36% of farmers. ADDOUCHE F.Z. and MAIRECHE S. (2021). These same authors state that milk production varies from 0.5 to 3 liters/day/goat, for 47.36% of farmers the milk produced is 1L, and 26.31% of farmers whose quantity of milk produced is around 0.5L; 21.05% of farmers whose production is around 1.50 L of milk.

3.1.9. Feeding management

We knew that to allow the animal to have better productivity and reproduction, it must be in perfect health; this necessarily involves a good diet but according to our survey and questionnaire established with the breeders, the feed management is not in accordance with the needs of the animals; the feed used by the breeder is based on the availability of the latter provided by natural pasture which guarantees the majority of their food; The rest of the ration is provided by concentrates (barley) as well as by straw, wheat bran; also bread is used by some breeders. The distribution of these different products is done in different quantities from one breeder to another. Concerning the watering method; most of the respondents give water freely to their herds. ADDOUCHE F.Z. and MAIRECHE S. (2021) state that the feeding of the herds is essentially based on grazing throughout the year with spontaneous vegetation and green fodder to which is added a supplement at the trough based on a concentrate (brans, corn and barley) in the winter season since the intensity of use of the rangelands decreases because access becomes more or less difficult.

2.1.10. Building

Almost all the farms visited contain traditional buildings or sheepfolds or sometimes buildings for mixed breeding (figure 03). The goats are sheltered in Zimermane (Zeriba) wire mesh sheepfolds or buildings that do not meet standards, the litter is made of straw or beaten earth. The feeding and watering equipment is traditional feeders and waterers; these observations allowed us to explain the lack of investment in this species which is placed in a secondary position compared to the priority of other breeding. The roof plays a very important role in regulating temperatures, most of the farms use sheet metal as roofing, and more than half of the buildings on the farms visited are in the form of simple sheet metal sheds. All the breeders have traditional sheepfold type buildings 73.3% and 26.7% of traditional buildings built in beaten earth in the form of zribba and stables and old disused houses they do not have any facilities. The feeding and watering equipment are traditional feeders and waterers the litter used is straw. The results show that the condition of the litter is sometimes damp with 52.6% of most of the farms visited and 47.4% of the litter is always dry. ADDOUCHE F.Z. and MAIRECHE S. (2021).

Figure 03: Sheepfolds, traditional and modern buildings

3.1.11. Hygiene

What is remarkable among most breeders despite the simple means and traditional breeding, hygiene is respected (figure 04) since the majority of the breeding is located next to the breeders' homes. The work of ADDOUCHE F.Z. and MAIRECHE S. (2021) reports that the cleaning of buildings is generally done manually by "regular sweeping", 15.8% of breeders have clean buildings, the rest of the buildings visited have intermediate to bad hygiene which reflects poor hygiene and non-compliance with prophylaxis and cleanliness measures access to the building is generally free, without footbath. In order to avoid diseases and infections, the breeders visited disinfect their building, and this is done with bleach or liming.

Figure 04: Hygiene respected in goat breeding

3.2. Statistical description of quantitative parameters

Descriptive analyses of quantitative characteristics (PROC MEANS) are mentioned in Table 01.

Table 01: **Effect of geographical location and sexes on biometric traits of goats**

				Sexe				Region			
Traits	Sexe	Tissemsilt	Tiaret	Valeur de F	ddl	P value	R^2	Valeur de F	ddl	P value	R^2
LCr	Male	77,50±6,35	67,75±3,96	1,13	1	0,2938	29,64	1,05	1	0,3116	29,64
	femelle	70,28±9,23	67,98±11,48								
HG	Male	74,50±6,46	65,38±2,56	0,30	1	0,5845	23,28	0,36	1	0,5508	23,28
	femelle	69,43±7,18	70,98±5,77								

HD	Male	72,25±4,92	65,75±2,49	0,21	1	0,6492	26,51	0,01	1	0,9105	26,51
	femelle	68,71±6,05	70,58±5,54								
HS	Male	72±6,06	65,38±2,50	2,99	1	0,0903	30,06	0,01	1	0,9131	30,06
	femelle	70,14±5,76	72±5,63								
LO	Male	1±0	1,12±0,35	0,93	1	0,3406	12,53	0,01	1	0,9109	12,53
	femelle	1,24±0,38	1,10±0,30								
LQ	Male	14,50±1	13,25±1,04	1,10	1	0,3002	09,54	0,64	1	0,4266	09,54
	femelle	12,14±2,91	13,40±2,68								
TP	Male	78,50±7,68	71,38±5,78	0,21	1	0,6491	10,86	0,94	1	0,3365	10,86
	femelle	70,57±8,20	76,80±7,25								
PP	Male	35,75±1,26	10,50±2,39	0,00	1	0,99	16,11	0,44	1	0,5126	16,11
	femelle	32,86±3,44	32,65±5,97								
LnB	Male	18,50±0,58	21,25±4,03	2,19	1	0,1450	18,16	6,28	1	0,0156	18,16
	femelle	16,43±1,01	19,48±3,50								
Lco	Male	27,50±1,73	27,25±4,27	0,09	1	0,7662	33,21	17,41	1	0,0001	33,21
	femelle	34,14±0,90	25,68±3,74								
LT	Male	27,75±2,63	21,38±5,53	1,34	1	0,2522	25,95	0,49	1	0,4860	25,95
	femelle	22±6,06	22,05±5,72								
TCA	Male	9,25±0,96	8,88±0,83	19,74	1	<0,0001	37,78	1,17	1	0,2855	37,78
	femelle	8,14±1,07	7,85±0,62								
Lpi	Male	12,75±1,26	12,63±1,41	8,04	1	0,0066	33,08	2,94	1	0,0927	33,08
	femelle	12,57±1,40	10,13±2,88								
LI	Male	19,50±1,91	29,63±1,30	0,03	1	0,8687	20,79	0,03	1	0,8687	20,79
	femelle	21±2,16	19,90±2,48								
PF	Male	34,75±3,30	28,13±3,83	0,03	1	0,8600	22,30	1,13	1	0,2931	22,30
	femelle	31±3,37	30,78±5,87								
TAB	Male	81±6,87	76,63±6,14	0,61	1	0,1792	20,50	1,86	1	0,1792	20,50

	femelle	74,43±5,06	80,73±8,67								
TCO	Male	38,75±5,19	34,38±6,19	2,51	1	0,2247	13	1,51	1	0,2247	13
	femelle	34,57±6,35	32,80±5,74								

The results of the GLM procedure show that the measured quantitative characters are not influenced by the region effect (P>0.05), except for two characters Lnb (F value=5.28; ddl= 1; P=0.0156) and Lco (F value=17.41; ddl= 1; P=0.0001) whose difference is significant between the two regions with R2 values equal to 18.16% and 33.21% respectively. However, these characters are not influenced by sex except for TCA (F value=19.74; ddl= 1; P<0.0001) and Lpi (F value=8.04; ddl= 1; P=0.0066) with R2=37.78% and R2=33.08% respectively. This sexual dimorphism is in favor of males (Table 1), and this for individuals from both regions.

3.3. Frequency distribution of qualitative traits and sex

All individuals from the two studied regions are characterized by a diversity of colors either unique or associated with other colors. The dominant color of the head in both sexes is "The mixture", with percentages of 65.95% and 58.33% for females and males, respectively. For the frequency of uniform colors of the head, the highest rate is noted for the white color 23.40% and 25% in males and females / Followed by black with rates of 10.63% and 16.66% in females and males respectively. Also, the same color is dominant for the coat "The mixture", with 53.19% in females and 75% in males. On the other hand, the uniform color of the coat, black, white or gray, is less frequent in both sexes, 46.80% for females and 25% for males.

3.4. Mahalanobis distance

The Mahalanobis distance was estimated at D^2=11.99 between the two regions, namely Tiaret and Tissemsilt using the PROC CANDISC procedure. This low Mahalanobis distance which does not exceed 50 (D^2<50) results in considerable phenotypic overlaps between individuals from the two localities. And this taking into account all the quantitative and qualitative characters that were estimated in this study (17 quantitative characters and 15 qualitative characters).

3.5. Correlations between quantitative variables

The Pearson correlation results (Table 2) between quantitative variables show that the strongest positive correlation was recorded between HD and HG (r=0.92; p <.0001), followed by the correlation between HD and HS (r=0.91; p <.0001). Then, the two characters HS and HG presented a considerable correlation (r=0.89; p <.0001) and which is almost the same with those noted between PP and PF (r=0.88; p <.0001), LT and LCr (r=0.84; p <.0001) and PP and LCr (r=0.83; p <.0001). Also LT and PF have a very highly significant strong correlation (r=0.79; p <.0001). However, the strongest negative correlation was noted between LO and HG with (r=-0.27; p=0.0378).

Table 2: Pearson correlation of quantitative variables

Varia	LC	HG	HD	HS	LO	LQ	TP	PP	LnB	Lco	LT	TCA	Lpi	LI	PF	TAB	TCO
LCr	1	0,61	0,62	0.62	-0.09	0.36	0.49	0.83	0.14	0,24	0,84	0,39	0,50	0,29	0,76	0,52	-0,13
HG		1	0,92	0,89	-0,27	0,28	0,77	0,65	0,18	0,07	0,62	0,21	0,40	0,29	0,64	0,66	0,16
HD			1	0,91	-0,23	0,18	0,65	0,66	0,20	0,04	0,65	0,20	0,39	0,24	0,66	0,63	0,03
HS				1	-0,21	0,17	0,72	0,66	0,20	0,11	0,64	0,06	0,28	0,28	0,68	0,64	0,01
LO					1	-0,02	-0,16	0,01	-0,25	0,10	-0,08	-0,04	-0,21	-0,06	0,07	0,02	-0,22
LQ						1	0,28	0,42	-0,12	-0,20	0,21	0,17	0,03	0,12	0,30	0,30	-0,07
TP							1	0,51	0,42	0,07	0,48	0,20	0,27	0,38	0,50	0,72	0,27
PP								1	-0,04	0,07	0,74	0,18	0,34	0,14	0,88	0,53	-0,33
LnB									1	0,16	0,16	0,18	0,19	0,35	-0,15	0,18	0,35
Lco										1	0,14	0,10	0,29	0,26	0,06	-0,10	0,18
LT											1	0,45	0,49	0,28	0,79	0,52	-0,01
TCA												1	0,50	0,18	0,19	0,27	0,32
Lpi													1	0,28	0,30	0,28	0,13
LI														1	0,16	0,26	0,34
PF															1	0,56	-0,20
TAB																1	0,01

ns: Not significant *Significant difference **Highly significant difference
***Very highly significant difference

4. Conclusion

Our work contributed to the morphometric characterization of the local goat species in western Algeria and the characteristics of breeding practices. The farms consist of local goats with a few heads of imported breeds, the numbers of the herds fluctuate between 5 and 50 heads, mainly made up of females that are kept for reproduction and the production of milk intended for the suckling of the kids mainly and self-consumption secondarily, the bucks are in the minority (3 to 5 maximum) this explains the tendency of breeders to reduce the number of bucks in order to reduce expenses in food, care and keep the goats for their productivity and benefit. Livestock farming is characterized by the absence of herds consisting exclusively of goats. This association is perhaps due to the similarity of the diets of the two species and the same livestock management. So it has been disproved that goat farming is secondary after sheep farming. The owners of these farms are men by majority 76.92% while women are in the minority 23.08%. Our visits to the farms revealed that the livestock system is of the traditional type this is indicated by the absence of identification tags, the absence of adequate equipment for breeding ....etc. the shelter of the goats takes place in (Zeriba) or buildings that do not meet the standards. The feed used by the breeder is based on the availability provided by natural pasture which guarantees the majority of their diet; the rest of the ration is provided by concentrates (barley) as well as by straw, bran also bread is used by some breeders. Poorly organized breeding and no effort of selection or preservation of breeds has been noted by ignorance, this despite good knowledge noted among breeders on the methods of crossing and selection.

5. References

[1] **Addouche F.Z. And Maireche S. 2021.** Phenotypic characterization, typology of goat farming in western Algeria. Master's Dissertation University of Tissemsilt.147p.

[2] **FAO 2020**. Available at: http://www.fao.org/faostat/en/#data/QA/visualize, (Accessed 02/04/2022).

[3] **Belantar I. Tefiel H. Gaouar S.B.S. 2018.** Phenotypic characterization of local goat population in western Algeria (Wilaya of Relizane) with morphometric measurements and milk analysis. Genet. Biodiv. J. GABJ 2, 55-66–66

[4] **Belkhadem S. Tefiel H. Belantar I. Chahbar M. Gaouar S.B.S. 2019.** Discriminant analysis on the morphometry of local goats breed in the western of Algeria. Genet. Biodiv. J. GABJ 3(2): 49-56

[5] **D.S.A 2020.** Directorate of Agricultural Services of the wilaya of Tiaret.

[6] **D.S.A 2020.** Agricultural Services Department of the wilaya of Tissemsilt.

[7] **MADR., 2021.** Agricultural Statistics Series B. Ministry of Agriculture and Rural Development/ Directorate of Agricultural Statistics and Information Systems, Algiers, Algeria.

[8] **Tefiel H, Ata N, Chahbar M, Benyarou M, Fantazi K, Yilmaz O, Cemal I, Karaca O, Boudouma D, Gaouar S BS.** Genetic characterization of four Algerian goat breeds assessed by microsatellite markers. Small Ruminant Res. 2018; 160: 65–71.

[9] **Tefiel H, Ata N, Fantazi K, Yilmaz O, Cemal I, Karaca O, Chahbar M, Ameur Ameur A. Gaouar S B S.** Microsatellite based genetic diversity in indigenous goat breeds reared in algeria and turkey. The Journal of Animal & Plant Sciences 2020; 30(5): 1115-1122.