IJAS Iranian Journal of Applied Animal Science

# Morphological Characterization and Study of Zootechnical Indices of Tazegzawt Sheep Population in Eastern Algeria

Research Article

**R. El-Bouyahiaoui[1], B. Belkheir[2], F. Moulla[1], H. Mansouri[1], M. Benidir[3*] and A. Djaout[3]**

[1] National Institute of Agronomic Research of Algeria (INRAA), El Harrach, Algiers, Algeria
[2] Algeria's National Institute for Agricultural Research (INRAA), Bejaia, Algeria
[3] Algeria's National Institute for Agricultural Research (INRAA), Setif, Algeria

Received on: 3 Nov 2020
Revised on: 11 Apr 2021
Accepted on: 1 May 2021
Online Published on: Dec 2021

*Correspondence E-mail: moh19ina@yahoo.fr

Online version is available on: www.ijas.ir

## ABSTRACT

The phenotypic study of the Tazegzawt sheep in Bejaia. A total of 54 adult sheep (16 rams and 38 ewes) with the average age 3.72 ± 1.20 years, were used for 20 barymetric measurements and 9 zootechnical indices were computed with qualitative characteristics to determine an ethnic and functional classification of this sheep. Significant differences (P<0.05) in several body measurements were detected between sex groups and age groups. The presence of wattles (80%), bluish spots in the tongue (74%), and the head (63%) are the dominant qualitative traits of this sheep, 44.4% of have black-legg spot at different points; the black color exists at the hock (25.9%), the pastern (44.4%) or the knee (22.2%). Zootechnical indices show that this race is elongate (LI: 1.05±0.08), tall on legs (depth of thorax (DT): 0.44±0.04), well developed forward (width slope (WS): 1.15±0.12) with a straight dorsal line (body ratio (BR): 1.00±0.03), a highly developed breast (thoracic development (TD): 1.29±0.08), a dolichocephalic head (cephalic index (CI): 0.58±0.16) and a better conformation for meat (body index (BI): 0.81±0.06).

KEY WORDS body measurements, characterization, Tazegzawt, zootechnical indices.

## INTRODUCTION

The Algerian sheep population is characterized by the presence of several breeds including Ouled Djellal, Rembi, Hamra, Berber, Barbarine, D'man, Sidaou, Taadmit, Tazegzawt, Srandi, and Daraa whose most dominant race is the Ouled Djellal breed (Djaout *et al.* 2017). However, the Blue Kabylie, commonly called by the breeders "Tazegzawt", which means the blue color in Berber language (El Bouyahiaoui *et al.* 2015; El Bouyahiaoui, 2017) and known as Ham in the region of Mechria (Nâama) (Djaout *et al.* 2017) is also found in Algeria. It has bluish black pigmentations in the eyes, lobes of the ears, muzzle, and lower jaw. This sheep is high on legs with a slender body having a white and semi-invasive wool. The rams have massive horns spirally wound. Wattles exist in most animals (El Bouyahiaoui *et al.* 2015; Djaout *et al.* 2017). It remained not characterized and did not even appear in the official nomenclature of the Algerian sheep breeds, or the FAO's database (El Bouyahiaoui *et al.* 2015). It is a large local sheep with a low number, considered among the endangered breeds in Algeria (El Bouyahiaoui *et al.* 2015). According to Djaout *et al.* (2017) and El Bouyahiaoui (2017), the Tazegzawt sheep is more frequent at the level of the Kabylie mountains (some regions of Tizi Ouzou and Bejaia, whose bioclimatic level is between 250 and 1000 meters above sea level) where it has only a very small number (about 300 heads). The current investigation consists of studying the phenotypic and barymetric characteristics of Tazegzawt sheep breed, based on body measurements, phenotypic

characteristics and zootechnical indices. This work was carried out in INRAA (National Institute of Agronomic Research of Algeria) station of Bejaia, eastern Algeria, on Tazegzawt sheep and with some breeders of the region of Akbou (Bejaia).

## MATERIALS AND METHODS

The study was carried out at the INRAA experimental station "Oued Ghir", located in the (southwest of the Bejaia Department located in Northern East of Algeria), at 36˚ 42' 37" latitude North and 4˚ 58' 38" longitude East and elevation 66 meters from sea level. The region is characterized by a Mediterranean climate with average annual temperatures ranging from 12.9 ˚C to 22.1 ˚C and an average annual rainfall of 767 mm.

### Animals studied

The study examined and calculated zootechnical indices based on body measurements and phenotypic description in 54 Tazegzawt sheep (16 rams and 38 ewes) aging on average of 3.72 ± 1.20 years (between November 2016 and May 2017) at the INRAA Oued Ghir station in Bejaia.

### Body measurements and zootechnical indices

The different body measurements (cm) were recorded by the same operator in the morning, 20 measurements were taken for each animal: total body length (TBL), body length or scapular-ischial length (SIL), withers height (WH), back height (BH) rump height (RH), heart girth (HG), chest depth (CD), shoulder width (SW), rump width (RW), trochanter width (TW), Ischial width (IW), pelvis length (PL), head length (HL), head width (HW), ear length (EL), ear width (EW), cannon perimeter (CP), fore leg length (FL), tail length (TL) and muzzle diameter (MD) (Esquivelzeta *et al.* 2011; Khaldi *et al.* 2011; Ravimurugan *et al.* 2012; FAO, 2013; Yakubu, 2013). These measurements were taken through the sheep measuring scale (tape) and a homemade measuring rod with a double bracket.

From these measurements, 9 zootechnical indices were calculated according to some authors (Miller *et al.* 1964; Sotillo and Serrano, 1985; Santos *et al.* 1995; Alderson, 1999; Salako, 2006; Sarma, 2006; Chacón *et al.* 2011). The calculation and analysis of the various zootechnical indices made it possible to classify the ethnology of the Tazegzawt breed.

### Qualitative traits

Other phenotypic variables studied were: head color, leg color, wool color, color of the skin, color of the hock, color of the pastern, color of the knee, presence or absence of the horns, presence or absence of the wattles and the presence or absence of blue spots in the tongue, fleece cover, fleece density, ear shape, cephalic profile according to Degois (1970), Cesbron *et al.* (1972) and Denis *et al.* (1980).

The color of the wool is entirely white in all the studied populations as well as all the animals have long and hanging ears.

### Statistical analysis

Body measurements were analyzed according to the following linear model (Payne *et al.* 2010):

$$Y_{ij} = \mu + Age_i + Sex_j + e_{ij}$$

Where:

$Y_{ij}$: dependent barymetric characters.

$\mu$: general mean of the population.

$Age_i$: effect of the $i^{th}$ age.

$Sex_j$: effect of the $j^{th}$ sex.

$e_{ij}$: residual error of mean = 0 and of constant variance.

The effect of age and sex were compared by the one-way ANOVA test followed by the Student Newman-Keuls multiple comparison test. All these data were analyzed using the statistical analysis software SPSS (2011).

A principal component analysis (PCA) was performed based on the body measurements. Multiple factorial analysis (MCA) was used for the qualitative variables to differentiate the sheep according to the body measurements used for the classification of the animals and to construct a typology that consists of identifying individuals who were fairly similar to one another to present common qualitative characteristics.

Finally, to obtain the optimal number of classes, an ascending hierarchical classification (CHA) was used. These tests were processed by the SPSS.19 software (IBM Corporation, 2010).

## RESULTS AND DISCUSSION

Means, standard deviations, minimum, maximum, and coefficients of variation of body measurements, and zootechnical indices of Tazegzawt sheep are shown in Tables 1.

Cephalic measurements were used for the identification of breed, origin, and species relationship (Jewel, 1963). The heads of the Tazegzawt animals are dolichocephalic because they are longer than wide (twice the width), their width is half of their length (17.27±3.27 *vs.* 30.23±3.14 cm) with a cephalic index (CI) of 0.58 ± 0.16. The ears were long and pendulous (21.69±2.15 cm) and wide (10.11±0.59 cm). This character is identical to that of the breed Ouled Djellal (Djaout *et al.* 2017) and the Rembi breed (Djaout *et al.* 2015).

**Table 1** Descriptive analysis of body measurements in Tazegzawt breed

| Body measurement | Mean | SD | SE | Var | CV | Min | Max |
|---|---|---|---|---|---|---|---|
| TBL | 108.67 | 8.61 | 1.17 | 74.20 | 7.93 | 90.00 | 126.00 |
| SIL | 87.73 | 8.23 | 1.12 | 67.68 | 9.38 | 71.00 | 108.00 |
| WH | 83.60 | 4.72 | 0.64 | 22.29 | 5.65 | 73.00 | 96.00 |
| BH | 81.75 | 4.31 | 0.59 | 18.61 | 5.28 | 71.00 | 89.00 |
| RH | 83.97 | 3.87 | 0.53 | 14.99 | 4.62 | 76.00 | 92.00 |
| HG | 108.12 | 7.13 | 0.97 | 50.87 | 6.59 | 93.00 | 129.00 |
| CD | 37.19 | 3.70 | 0.50 | 13.69 | 9.97 | 24.00 | 46.00 |
| SW | 24.30 | 3.27 | 0.44 | 10.67 | 13.44 | 18.00 | 34.00 |
| RW | 27.55 | 2.40 | 0.33 | 5.76 | 8.71 | 22.00 | 37.00 |
| TW | 26.18 | 2.83 | 0.39 | 8.03 | 10.80 | 19.00 | 32.00 |
| IW | 14.87 | 2.60 | 0.35 | 6.75 | 17.48 | 12.00 | 24.00 |
| PL | 31.43 | 3.65 | 0.50 | 13.34 | 11.61 | 19.00 | 41.00 |
| HL | 30.23 | 3.14 | 0.43 | 9.88 | 10.42 | 20.00 | 37.00 |
| HW | 16,90 | 2,34 | 0,32 | 5,49 | 13.86 | 14.00 | 25.00 |
| EL | 21.69 | 2.15 | 0.29 | 4.62 | 9.89 | 16.00 | 27.00 |
| EW | 10.11 | 0.59 | 0.08 | 0.34 | 5.80 | 9.00 | 11.00 |
| CP | 9.64 | 2.06 | 0.28 | 4.26 | 21.37 | 7.00 | 23.00 |
| FL | 24.93 | 3.11 | 0.42 | 9.70 | 12.49 | 11.00 | 32.00 |
| TL | 39.54 | 5.68 | 0.77 | 32.21 | 14.36 | 30.00 | 56.00 |
| MD | 31.51 | 2.87 | 0.39 | 8.26 | 9.12 | 25.00 | 41.00 |

TBL: total body length; SIL: body length or scapular-ischial length; WH: withers height; BH: back height; RH: rump height; HG: heart girth; CD: chest depth; SW: shoulder width; RW: rump width; TW: trochanter width; IW: ischia width; PL: pelvis length; HL: head length; HW: head width; EL: ear length; EW: ear width; CP: cannon perimeter; FL: fore leg length; TL: tail length and MD: muzzle diameter.
SD: standard deviation; SE: standard error and CV: coefficient of variation.

The total length of the body is 108.67 ± 8.61 cm and the scapulo-ischial length or length of the body (SIL) that is taken from the tip of the shoulder to the tip of the ischium and reported as 87.73 ± 8.23 cm, the two variables of the length have the highest variances (74.20 and 67.68, respectively). These measurements showed that the Tazegzawt animals are more elongated, (length index of 1.05±0.08) which showed that length is greater than height. This index is lower than that of the Rembi breed (Laoun *et al.* 2015) and the Ouled Djellal breed (Harkat *et al.* 2015).

The Body Index averaged 0.81 ± 0.06; lower values of IB indicated that animal is closer to being of rectangular shape which is an indicator of a better conformation for meat (Cerqueira *et al.* 2011). This value is lower than that of the Rembi breed (Djaout *et al.* 2015).

Withers height (WH), back height (BH), and rump height (RH) were found as 83.60 ± 4.72 cm, 81.75 ± 4.31 cm, and 83.97 ± 3.87 cm respectively. The relative depth of thorax (DT) 0.44 ± 0.04 showed that animals are leggy because thoracic depth is less than the average withers height. This index is similar to that of the Rembi breed (Laoun *et al.* 2015) and the Ouled Djellal breed (Harkat *et al.* 2015). The body ratio (BR) is 1.00 ± 0.03; it presents a straight dorsal line following the equality between the withers height and the rump height.

The animals had a fairly developed thoracic cavity; the chest depth (CD) was 37.19 ± 3.70 cm and the heart girth (HG) was 108.12 ± 7.13cm with a fairly high variance which was 50.87. The thoracic development (TD) confirmed thoracic development index of 1.29 ± 0.08. The dactylo-thoracic index (DTI) was 8.90 ± 1.67 that indicates thoracic development.

The shoulders width (SW), the rump width (RW), and width slope (WS) are 24.30 ± 3.27 cm, 27.55 ± 2.40 cm and 1.15 ± 0.12 cm respectively. This value is higher than that of the Rembi breed (Laoun *et al.* 2015) and the Ouled Djellal breed (Harkat *et al.* 2015).

The distance between the two points of the rump (ilions) (RW) is 27.55 ± 2.40 cm, while the distance between the tip of the ilium and the tip of the ischium (PL) is 31.43 ± 3.65 cm. The animal basin is longer than width, longer and wider than the Rembi breed (Djaout *et al.* 2015). In addition, the trochanter width was observed as 26.18 ± 2.83 cm, this measurement is very important, to determine the quality of the carcass because it expresses the greatest width of the carcass (Laville *et al.* 2002).

The perimeter of the upper 1/3 of the canon bone (CP) is 9.64 ± 2.06 cm. The dactylo-costal index (DCI) is 0.40 ± 0.06 and this index shows that the animals have a small skeleton. It indicates the degree of skeletal fineness; it allows us to establish a correlation between the individual mass of the animal and its members, to determine if the body volume corresponds to the bone development (Cerqueira *et al.* 2011).

Tazegzawt sheep with other Algerian recognized sheep, was found to be less elongate than the Ouled Djellal breed

(Harkat *et al.* 2015; Afri-Bouzebda *et al.* 2018) and the Rembi breed studied by Laoun *et al.* (2015), and more elongate than the Rembi breed reported by Djaout *et al.* (2015), Srandi, Tazegzawt of Naama, Daraa, Ouled Djellal, Barbaarin, Hamra, Berber (Belharfi *et al.* 2017; Afri-Bouzebda *et al.* 2018).

These sheep are more in height than Hamra, Berber, Barbarine breeds (Belharfi *et al.* 2017; Afri-Bouzebda *et al.* 2018) and Rembi studied by (Djaout *et al.* 2015), and lower than the breed. Ouled Djellal and Daraa sheep breeds (Belhrfi *et al.* 2017; Afri-Bouzebda *et al.* 2018) but they are quite close in height to that of Hamra, Srandi, and Tazegzawt of Naama (Belharfi *et al.* 2017) and the Rembi breed reported by (Laoun *et al.* 2015).

These animals (Tazegzawt) are larger than other breeds like Rembi, Tazegzawt of Nâama, Daraa, Srandi and Ouled Djellal, Hamra, Berber, Baabarin (Djaout *et al.* 2015; Laoun *et al.* 2015; Belharfi *et al.* 2017; Afri-Bouzebda *et al.* 2018), but they are quite similar in width to that of the Ouled Djellal breed (Belharfi *et al.* 2017; Afri-Bouzebda *et al.* 2018).

The chest of the Tazegzawt sheep is more developed than other breeds viz. Rembi, Srandi, Daraa, Naama's Tazegzawt, Barbarine, Hamra, Berber and Ouled Djellal (Djaout *et al.* 2015; Harkat *et al.* 2015; Laounet *et al.* 2015; Belharfi *et al.* 2017; Afri-Bouzebda *et al.* 2018). However, the Ouled Djellal breed reported by Afri-Bouzebda *et al.* (2018) presented a higher heart girth, while the Ouled Djellal breed studied by Belharfi *et al.* (2017) presented heart girth close to the race studied.

While the Tazegzawt chest depth is greater and identical to that of the Ouled Dejellal breed (Afri-Bouzebda *et al.* 2018), it is higher than that of the other breeds: Rembi, Srandi, Daraa, Tazegzawt de Naama, Barbarine, Hamra, and Berber (Djaout *et al.* 2015; Laoun *et al.* 2015; Afri-Bouzebda *et al.* 2018).

The head of the animals studied is longer than the Rembi, Barbarine, Ouled Djellal, Srandi, Daraa, Tazegzawt of Naama, Hamra, Barbarine and Berber breeds (Djaout *et al.* 2015; Laoun *et al.* 2015; Belharfi *et al.* 2017; Afri-Bouzebda *et al.* 2018) and wider than the Rembi and Barbarine breed (Djaout *et al.* 2015; Laoun *et al.* 2015; Afri-Bouzebda *et al.* 2018) but it is quite wide close to that of the Srandi breed, Daraa, Tazegzawt of Nâama, Ouled Djellal, Hamra, and Berber (Belharfi *et al.* 2017; Afri-Bouzebda *et al.* 2018). This breed is characterized by very long and large ears compared to the Rembi, Ouled Djellal, Srandi, Daraa, Tazegzawt of Naama, Hamra, Barbarine, and Berber breeds (Djaout *et al.* 2015; Laoun *et al.* 2015; Belharfi *et al.* 2017; Afri-Bouzebda *et al.* 2018), but it has the same length and width of the ears as the Ouled Djellal breed reported by Afri-Bouzebda *et al.* (2018).

The perimeter of the canon is greater than that of the Rembi, Srandi, Barbarine, Hamra, and Berber breeds (Djaout *et al.* 2015; Belharfi *et al.* 2017; Afri-Bouzebda *et al.* 2018) while it is below than that of Ouled Djellal breed (Afri-Bouzebda *et al.* 2018) but it is similar to that of the Tazegzawt breed of Naama, Daraa, Ouled Djellal (Belhrfi *et al.* 2017) and the Rembi breed reported by Laoun *et al.* (2015).

The chamfer is hooked (53.7%) or slightly hooked (42.6%). The presence of wattles and blue spots in the tongue is the main character in the Tazegzawt breed (El Bouyahiaoui *et al.* 2015), they are present in 80% and 74% of the population respectively. Twenty-four percent of the animals have forward-spiraling horns (Figure 1), which are males with an average horn length of 44.09 ± 8.60 cm, whereas all females are clods (7%).

The color of the Tazegzawt head is tricolor in 63% of the animals, it is white impregnated with beige with bluish black reflections in the eyes, lower lobes of the ears, muzzle, and lower jaw which is different from the Sardi or Srandi breed that has black glasses around the eyes (Djaout *et al.* 2017). The rest of the animals (37%) do not show the impregnation of the beige color with the white color of the head which gives a black pie color.

The color of the members is white in 55.6% of the animals (the black-legged members (44.4%) have the color black either at the hock (25.9%) or at the pastern (44.4%) or the knee (22.2%) or at the three places at the same time. While the skin of animals is white with the existence of pigmentations in 38.9% of animals and included the udder (Figure 2).

The head and limbs are partly covered with wool in 38.9% of the animals (invasive wool), in the same percentage of the animals, the head and the distal part of the members are shed of wool (semi-invasive wool) with a semi-closed fleece in most animals (85.2%) and an average tail of 39.54 ± 5.68 cm.

These results are comparable to those reported by (Hambli and Tazarat, 2003; El Bouyahiaoui *et al.* 2015; Moula, 2018).

In addition, the males in this study have horns, while, half of the males are clods as reported by El Bouyahiaoui *et al.* (2015).

Despite the existence of a very high variance in body length (SIL) and chest depth (CD), these two measures showed no significant differences by age. While the total body length (TBL), withers height (WH), back height (BH), rump height (RH), chest depth (CD), ischia width (IW), pelvis length (PL), head length (HL) and head width showed significant differences ($P<0.05$) with superiority of animals aged 4 years. Cilek (2015) reported animals age 1 year to animals aged 4 years.

**Figure 1** Tazegzawt ram (coiled spiral horns)

**Figure 2** Skin and pigmented udders

Animals in 4-year class are the most elongated (P<0.05) and the highest on feet (P<0.01) with the most developed chest depth (P<0.001) and the largest head (P<0.05) and longer head (P<0.001). These results are almost similar to those reported by Djaout *et al.* (2018a) for Berber breed.

Tazegzawt rams are significantly (P<0.05) higher leg length, and wider head than females with very large chest depths, longer heads, and very long tails, snouts diameter rather large than that of females (Table 3).

This superiority of males against females has been observed in the Sardi breed (Chikhi and Boujenane, 2003), Ouled Djellal, Hamra, Barbarine, and Rembi (Djaout *et al.* 2015; Belharfi *et al.* 2017; Djaout *et al.* 2018a; Afri-Bouzebda *et al.* 2018) unlike the Berber breed where sex has no significant influence on these measurements (Djaout *et al.* 2018b).

No difference in the framework was noted between males and females (CP, P>0.05), in addition, the size of the pelvis is not influenced by sex, whereas the trochanter width (TW) is significantly greater in males compared to females (P<0.001), these results agree with those reported by Boubekeur *et al.* (2013) in D'man breed and Harkat *et al.* (2015) in Ouled Djellal breed.

This explains that males have a large carcass width which is one of the criteria for the selection of animals for meat (Laville *et al.* 2002).

**Table 2** Descriptive analysis of qualitative characters in Tazegzawt breed

| | |
|---|---|
| Color of the head | Black magpie (37%); tricolor (63%) |
| Color of the legs | White (55.6%); black magpie (44.4%) |
| Color of the skin | White (61.1%); pigmented (38.9%) |
| Color of the hock | White (74.1%); black (25.9%) |
| Color of the pastern | White (55.6%); black (44.4%) |
| Color of the knee | White (77.8%); black (22.2%) |
| Horns | Present (24%); absent (76%) |
| Wattles | Present (79.6%); absent (20.4%) |
| Blue spots in the tongue | Present (74.1%); absent (25.9%) |
| Fleece cover | Invasive (38.9%); semi invasive (38.9%); non-invasive (18.5%); shell (3.7%) |
| Fleece density | Closed (9.3%); semi closed (85.2%); semi open (5.6%) |
| Cephalic profile | Hooked (53.7%); slightlyhooked (42.6%); rectilinear (3.7%) |

**Table 3** Body measurements of Tazegzawt sheep according to age and sex

| **Traits** | **Age** | | | | | **Sex** | | |
|---|---|---|---|---|---|---|---|---|
| | 02 years | 03 years | 04 years | > 05 years | P-value | Male | Female | P-value |
| N | 09 | 15 | 18 | 12 | | 16 | 38 | |
| TBL | 101.00±8.86$^{a}$ | 108.47±8.12$^{b}$ | 111.83±7.06$^{a}$ | 109.93±8.54$^{a}$ | < 0.05 | 114.31±6.71 | 106.29±8.27 | < 0.01 |
| SIL | 85.22±8.89 | 87.00±7.35 | 88.28±9.14 | 89.72±7.75 | NS | 91.44±11.06 | 86.18±6.24 | < 0.05 |
| WH | 79.89±5.67$^{c}$ | 82.13±3.93$^{bc}$ | 86.33±3.53$^{a}$ | 84.10±4.30$^{ab}$ | < 0.01 | 87.88±3.40 | 81.79±4.00 | < 0.001 |
| BH | 78.22±6.00$^{c}$ | 80.73±3.06$^{bc}$ | 84.33±3.73$^{a}$ | 81.81±2.77$^{ab}$ | < 0.01 | 85.63±2.50 | 80.12±3.86 | < 0.001 |
| RH | 81.00±5.15$^{b}$ | 83.07±2.69$^{b}$ | 86.72±3.20$^{a}$ | 83.19±2.57$^{b}$ | < 0.001 | 87.94±2.14 | 82.30±3.15 | < 0.001 |
| HG | 104.00±9.27 | 108.20±6.19 | 108.44±5.06 | 110.64±8.56 | NS | 112.38±7.79 | 106.33±6.10 | < 0.01 |
| CD | 33.00±4.74$^{b}$ | 37.27±2.34$^{a}$ | 38.56±2.45$^{a}$ | 38.20±3.84$^{a}$ | 0.001 | 40.38±2.78 | 35.85±3.20 | < 0.001 |
| SW | 24.22±4.76 | 23.87±2.83 | 24.06±2.62 | 25.25±3.58 | NS | 26.06±4.12 | 23.55±2.55 | < 0.01 |
| RW | 26.56±3.09 | 27.47±1.68 | 27.44±2.25 | 28.57±2.72 | NS | 28.13±3.26 | 27.31±1.93 | NS |
| TW | 24.67±4.06 | 26.20±2.21 | 26.67±2.52 | 26.55±2.87 | NS | 28.19±2.40 | 25.33±2.59 | < 0.001 |
| IW | 17.22±3.11$^{a}$ | 14.93±2.71$^{b}$ | 14.17±1.72$^{b}$ | 14.09±2.35$^{b}$ | < 0.05 | 14.63±1.67 | 14.98±2.92 | NS |
| PL | 27.78±4.44$^{b}$ | 32.40±2.50$^{a}$ | 31.83±3.38$^{a}$ | 32.36±3.30$^{a}$ | < 0.01 | 32.88±2.63 | 30.82±3.88 | NS |
| HL | 26.89±3.37$^{b}$ | 29.80±1.42$^{a}$ | 31.19±3.30$^{a}$ | 31.85±2.50$^{a}$ | < 0.001 | 32.03±3.68 | 29.48±2.58 | < 0.01 |
| HW | 15.44±2.01$^{b}$ | 16.07±1.28$^{b}$ | 17.69±2.08$^{a}$ | 17.85±3.17$^{a}$ | < 0.05 | 19.28±2.38 | 15.90±1.44 | < 0.001 |
| EL | 21.22±3.83 | 22.27±1.67 | 21.56±1.76 | 21.52±1.61 | NS | 21.81±2.20 | 21.64±2.16 | NS |
| EW | 10.22±0.67 | 10.13±0.58 | 10.11±0.68 | 9.98±0.41 | NS | 10.13±0.56 | 10.10±0.60 | NS |
| CP | 10.17±5.02 | 9.33±0.56 | 9.69±0.77 | 9.53±0.68 | NS | 9.94±0.87 | 9.51±2.39 | NS |
| FL | 25.44±5.79 | 25.13±2.95 | 24.89±2.05 | 24.36±2.03 | NS | 24.94±1.29 | 24.93±3.64 | NS |
| TL | 38.44±4.45 | 39.27±4.57 | 39.17±6.71 | 41.26±6.34 | NS | 43.00±6.23 | 38.08±4.80 | < 0.01 |
| MD | 31.00±4.30 | 30.73±2.60 | 31.69±2.50 | 32.60±2.39 | NS | 33.25±3.59 | 30.78±2.18 | < 0.01 |

N: number; TBL: total body length; SIL: body length or scapular-ischial length; WH: withers height; BH: back height; RH: rump height; HG: heart girth; CD: chest depth; SW: shoulder width; RW: rump width; TW: trochanter width; IW: ischia width; PL: pelvis length; HL: head length; HW: head width; EL: ear length; EW: ear width; CP: cannon perimeter; FL: fore leg length; TL: tail length and MD: muzzle diameter.

While in the Rembi breed, sex has a very highly significant influence on all dimensions of the pelvis where males have a developed pelvis compared to that of females (Djaout *et al*. 2015).

The qualitative characteristics which have been studied for the description of the animals are Fleece cover, fleece density, cephalic profile, color of the head, legs, skin, hock, paturon and knee, presence or absence of horns, wattles, and blue spots at the tongue.

The analysis carried out on 54 Tazegzawt animals showed that the first two factorial axes 1 and 2 respectively expressed 32.34% and 21.20% of the inertia, of which the total inertia is 53.54%.

Axis 1 (32.34%) is presented by the following variables: the color of the head, the color of the legs, the color of the hock, the color of the pastern, the color of the knee, skin color, fleece cover and, presence or absence of wattles.

Axis 2 (21.20%) is presented by the following variables: fleece density, presence or absence of horns, cephalic profile, and presence or absence of blue spots at the tongue.

The analysis identified four classes:

**Class 01:** this class includes 23 of the animals of the sample, they have white skin and entirely white members (100%), ahead either black magpie (47.83%) or tricolor (52.17%). The absence of horns is the dominant character

istic in 69.57% of this class.

**Class 02:** this class consists of 10 animals, they have white skin (100%) and black legs (100%) that have black spots on the pastern (90%) and hocks are either black (50%) or white (50%) with white knees (80%). The head is black in the majority (60%) or tricolor (40%) with a head profile hooked (70%). Horns are present in 50% of this class. The fleece is invasive (70%) and semi closed (80%).

**Class 03:** 14 animals make up this class; they have a tricolor head (92.86%), a pigmented skin (100%) and black legs (100%) that have black spots at the pastern (92.86%), hock (64.29%) and knee (64.29%). These animals are clods (100%).

**Class 04:** this class presents 07 animals that have a tricolor head (71.43%), pigmented skin (100%) and entirely white (100%), and a semi-closed fleece (100%). The horns are absent in 85.71% of this class.

## CONCLUSION

The study of body measurements and zootechnical ethnological and functional indices in the Tazegzawt sheep have defined this breed as an elongated, tall breed, well developed forward with a straight dorsal line, a highly developed chest, and a better conformation for the meat. The presence of wattles, bluish spots in the tongue, and bluish highlights in the snout, lower lobe of the ear, and above the eyes are the dominant criteria of this breed. The presence of black spots in the limbs (knee, hock, and paturon) are variable in individuals. These animals have a dolichocephalic, long, large head with long, large, drooping ears. The skin is usually white sometimes pigmented; wool is white, invasive or semi-invasive and semi-closed in most animals. The ewes of this breed are clods, while the rams are horned, the horns are voluminous spiral (annulated and spirally wound horns). This lesser known sheep requires extensive phenotypic, genotypic, and zootechnical characterization on higher numbers to establish a breed standard.

## ACKNOWLEDGEMENT

We would like to express our thanks with deep gratitude to all the people who have contributed to its realization.

## REFERENCES

Afri-Bouzebda F., Djaout A., Bouzebdaand Z. and Belkhiri Y. (2018). Description barymétrique de cinq races ovines algériennes. *Livest. Res. Rural Dev*. **30,** 62-70.

Alderson G.L.H. (1999). The development of a system of linear measurements to provide an assessment of type and function of beef cattle. *Anim. Genet. Resour.* **25,** 45-55.

Belharfi F.Z., Djaout A., Ameur-Ameur A. and Gaouar S.B.S. (2017). Barymetric characterization of Algerian sheep breeds in Western Algeria. *Genet. Biodivers. J.* **1,** 31-41.

Boubekeur A., Benyoucef M.T., Lounassi M. and Slimani A. (2013). Caractérisation morphologique de la race ovine D'man dans les oasis du Sud-ouest algérien. Pp. 23-28 Proc. 11th Anim. Gen. Genet. Resour., Algeria, North Africa.

Cerqueira J.O.L., Feas X.I.A., Pacheco L.F. and Araujo J.P.P. (2011). Morphological traits in portuguese bordaleira de entre douro e Minho sheep: Divergence of the breed. *Anim. Prod. Sci*. **51,** 635-641.

Cesbron J., Lambert M. and Pelekhine P. (1972). Zootechnie. Brevet de technicien agricole, Paris, France.

Chacón E., Macedo F., Velázquez F., Paiva S.R., Pineda E. and McManus C. (2011). Morphological measurements and body indices for Cuban Creole goats and their crossbreds. *Rev. Bras. Zootec*. **40,** 1671-1679.

Chikhi Aet Boujenane I. (2003). Caractérisation zootechnique des ovins de race Sardi au Maroc. *Rev. Élev. Méd. vét. Pays Trop*. **56(3),** 187-192.

Cilek S. (2015). Effects of age and sex on some body measurements and body weight in malya sheep. *Indian J. Anim. Sci*. **85(9),** 979-984.

Degois E. (1970). Le bon Moutonnier : Guide des Bergers et des Propriétaires de Mouton. La Maison Rustique, Paris, France.

Denis B., Seegers H. and Malher X. (1980). Ethnologie. Ecole nationale vétérinaire, Nante, France.

Djaout A., Afri-Bouzebda F., Bouzebda Z., Routel D., Benidir M. and Belkhiri Y. (2015). Morphological characterization of the Rembi sheep population in the Tiaret area (West of Algeria). *Indian J. Anim. Sci*. **85,** 386-391.

Djaout A., Afri-Bouzebda F., Chekal F., El-Bouyahiaoui R., Rabhi A., Boubekeur A., Benidir M., Ameur-Ameur A. and Gaouar S.B.S. (2017). Biodiversity state of Algerian sheep breeds. *Genet. Biodivers. J.* **1,** 1-18.

Djaout A., Afri-Bouzebda F., Bouzebda Z., Benidir M. and Belkhiri Y. (2018a). Application of linear body measurements for predicting live weight in Ouled Djellal breed. *Indian J. Anim. Sci*. **88(8),** 966-971.

Djaout A., Afri-Bouzebda F., Bouzebda Z. and Benidir M. (2018b). Morphological characterization and study of zootechnical indexes of Berbere sheep in Eastern Algeria. *Indian J. Anim. Sci*. **88(6),** 706-713.

El-Bouyahiaoui R. (2017). Caractéristiques morphogénétiques et performances zootechniques de la race ovine «Tazegzawt» endémique de la Kabylie. Ph D. Thesis. Algeria Univ., Algeria, North Africa.

El-Bouyahiaoui R., Arbouche F., Ghozlane F., Moulla F., Belkheir B., Bentrioua A., Hidra H., Mansouri H., Iguer-Ouada M., Bellahreche A. and Djaout A. (2015). Répartition et phénotype

de la race ovine Bleue de Kabylie ou Tazegzawt (Algérie). *Livest. Res. Rural Dev.* **27,** 214-224.

Esquivelzeta C., Fina M., Bach R., Madruga C., Caja G., Casellas J. and Piedrafita J. (2011). Morphological analysis and subpopulation characterization of Ripollesa sheep breed. *Anim. Genet. Resour.* **49,** 9-17.

FAO. (2013). Caractérisation phénotypique des ressources génétiques animales. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

Hambli S. and Tazarat H. (2003). Caractérisation d'une race ovine (race bleue) dans la wilaya de Bejaïa. MS. Thesis. University Abderrahmane Mira, Algeria, North Africa.

Harkat S., Laoun A., Benali R., Outayeb D., Ferrouk M., Maftah A., Da Silva A. and Lafri M. (2015). Phenotypic characterization of the major sheep breed in Algeria. *Rev. Med. Vet.* **166,** 138-147.

IBM Corporation. (2010). IBM SPSS Statistics 19. IBM Corporation, Armonk, New York.

Jewel P.A. (1963). Cattle from British archaeological sites. Pp. 45-76 in Man and Cattle. A.E. Mourant and F.E. Zeuner, Eds. Royal Anthropological Institute, London, United Kingdom.

Khaldi Z., Haddad B., Souid S., Rouissi H., Ben Gara A. and Rekik B. (2011). Phenotypic characterization of the ovine population of West Tunisia. *Anim. Genet. Resour.* **49,** 1-8.

Laoun A., Harkat S., Benali R., Yabrir B., Hakem A., Ranebi D., Maftah A., Madani T., Da Silva A. and Lafri M. (2015). Caractérisation phénotypique de la race ovine Rembi d'Algérie. *Rev. Élev. Méd. vét. Pays Trop.* **68,** 19-26.

Laville E., Boiux J., Sayd T., Eychenne F., Marcq F., Leroy P.L., Elsen J.M. and Bibe B. (2002). La conformation bouchère des agneaux, étude d'après la variabilité génétique entre races. *INRA Prod. Anim.* **15,** 53-66.

Miller M.S., Christensen G.V. and Evans H.E. (1964). Anatomy of Dog. W.B. Saunders Co., Philadelphia, Pennsylvania.

Moula N. (2018). Caractérisation de la race ovine algérienne Tazegzawth. *Tropicultura.* **36,** 43-53.

Payne R.W., Harding S.A., Murray D.A., Soutar D.M., Baird D.B., Glaser A.I., Channing I.C., Welham S.J., Gilmour A.R., Thompson R. and Webster R. (2010). The guide to GenStat release 13. VSN International, Hemel Hempstead, United Kingdom.

Ravimurugan T., Thiruvenkadan A.K., Krovvidi S., Elango A. and Panneerselvam S. (2012). Breed characteristics of Pattanam sheep of Tamil Nadu, India. *Anim. Genet. Resour*. **51,** 99-104.

Salako A.E. (2006). Application of morphological indexes in the assessment of type and function in sheep. *Int. J. Morphol.* **24,** 13-18.

Santos S.A., Mazza M.C.M., Sereno J.R.B., De Abreu U.G.P. and Da Silva J.A. (1995). Evaluation and Conservation of the Pantaneiro Horse. EMBRAPA-CPAC, Corumbá, Brazil.

Sarma K. (2006). Morphological and Craniometrical studies on the Skull of Kagani goat (*Capra hircus*) of Jammu region. *Int. J. Morphol.* **24,** 449-455.

Sotillo J.L. and Serrano V. (1985). Producción Animal. I: Etnología Zootécnica. Tebar Flores, Madrid, Spain.

SPSS Inc. (2011). Statistical Package for Social Sciences Study. SPSS for Windows, Version 20. Chicago SPSS Inc., USA.

Yakubu A. (2013). Principal component analysis of the conformation traits of Yankasa sheep. *Biotechnol. Anim. Husb*. **29,** 65-74.