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Phenotypical characterization of Kababich breed in peri-urban zone of N'Djamena-Chad

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Abstract

This work was carried out on the phenotypic characteristics of the Kababich sheep exploited in the peri-urban zone of N'Djamena (Chad). This phenotypic characterization of Kababich sheep should be continued on local breeds for genetic improvement and objective optimization of productivity. The objective of this study is the characterization of phenotypically Kababich sheep exploited in the peri-urban area of N'Djamena-Chad. It was conducted in 39 farms and involved 1035 sheep aged less than one year old. Phenotypic traits were measured according to the guideline defined by FAO. A total of 12 variables were measured including five qualitative and seven quantitative. The results obtained show a positively significant correlation ($p > 0.001$) between the age of the sheep estimated by the breeder and the dentition (0.83). The ears are drooping and measure 17.90 ± 2.77 cm. The color of the brown dress (fawn) and the smooth and short coat are dominant. The females are matte and the rams of brown dress have horns in the forms of the vestiges. The Kababich is large with a height at the withers of 81.50 ± 9.40 cm, a rump height of 83.24 ± 9.42 cm and a chest circumference of 88.29 ± 9.22 cm. The body is 72.82 ± 9.63 cm long, has a basin width of 19.89 ± 2.53 cm and a chest depth of 40.68 ± 5.16 cm. These measurements show that Kababich is a meat breed by excellence. In addition, the sexual dimorphism very accentuated in this race orients towards a valorization of the young males in the fattening workshops.

Keywords: Kababich sheep; Phenotypic; Peri-urban area; N'Djamena; Chad

1. Introduction

Sheep breeding by their genetic diversity is a real national wealth. Chadian sheep breeds are exploited exclusively for the production of meat. Among these sheep, the Arab and Fulani breeds are the most exploited breeds [3]. Since the 1990s, the Kababich sheep which was mainly found in the Sahel-Saharan zone began to occupy the Sahelian zone, particularly the peri-urban area of N'Djamena. Since the 2000s, this sheep that comes from Sudan is the third most exploited breed [3]. Information on the phenotypic standard of local breeds relates to the earlier studies by Dumas [4]. In Chad, very little work on sheep breeds, varieties and populations has been devoted to its species. This is why it is necessary to describe the state of the genetic resources, particularly sheep, present in Chad in order to better understand their performance and ensure the sustainability of farms. Phenotypic characterization of animal genetic resources provides information on observed characteristics, geographical distribution, production systems and uses of these resources. This information also helps to plan the management of animal resources in local, national, regional and

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global communities [5]. The present work is part of this approach and aims to characterize phenotypically Kababich sheep exploited in the peri-urban area of N'Djamena (Chad).

2. Material and methods

2.1. Choice and presentation of the study area

The study was conducted in two main areas. This is the urban area that covers part of the municipality of N'Djamena including the 1st, 8th and 10th arrondissements, and the peri-urban area which stretches for a distance of 50 to 60 km beyond the administrative boundaries of the urban area. The choice of districts and outlying villages is justified by the importance of Kababich sheep farming. The retained climate was that of the city of N'Djamena. It is dry tropical with two seasons: a long dry season and a short rainy season. The average temperature is around 37° C, with a minimum of 18° C in January and February and a maximum of 45 ° C between April and May. The area benefits from two permanent rivers which are Logone and Chari rivers. The shrubby vegetation consists mainly of *Acacia sp.* occupies 72% of the study area and the agricultural zone 23% (Figure 1).

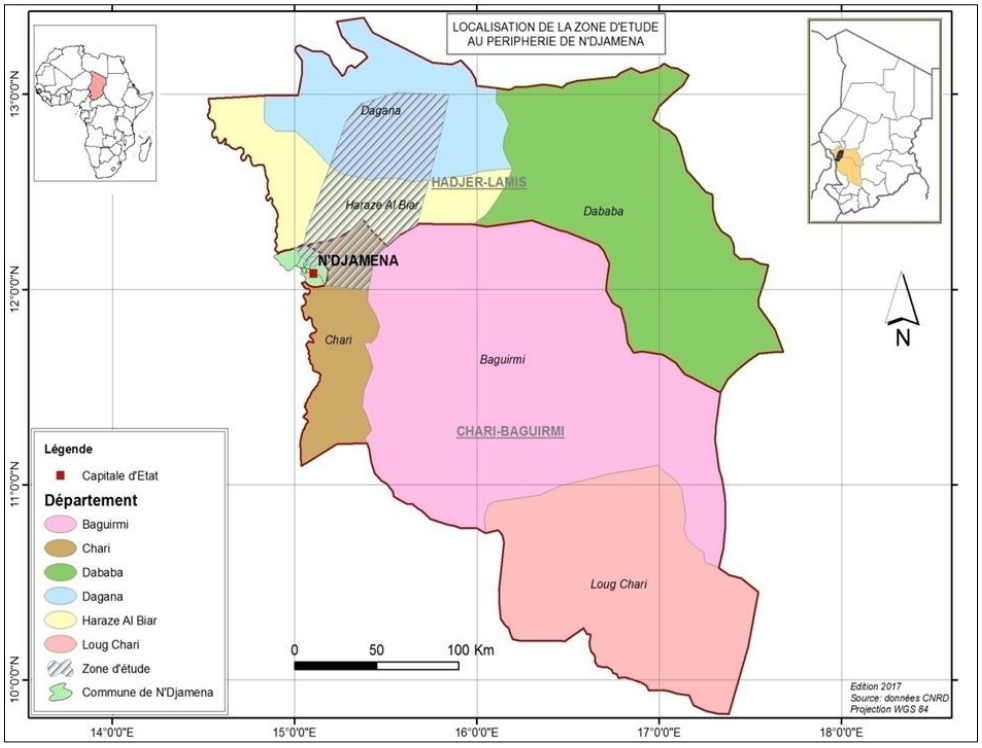

Figure 1 Area localization

2.2. Sampling and data collection

The study took place during the months of July and August. The cross-sectional survey was conducted in 39 Kababich sheep farms with at least three years of experience in breeding this breed. A total of 1,035 sheep from the 39 farms were measured. Animal data and phenotypic characteristics are recorded on an individual record.

The phenotypic descriptions were based on a selected standard sample, which is the animal most representative of the breed according to the breeders. The information provided by the breeders on the age of the animal and those obtained by the examination of the teeth of the animals defined by the directive of FAO [6]. The age interval of the animals is: very young (0-1 year old) (VYo), young (1-2 years old) (Yo), young adults (2-3 years old) (YAd) and adults (3 years old and up) (Ad). The guideline developed by FAO [6] has also been used to describe or measure phenotypic traits. The qualitative parameters assessed by individual observations were: wear and type of horns (HT) and ear (ET), coat structure (type of coat (smooth (SmC) and not smooth (NSmC)), coat length (long (LCo), mid long (MLCo) and sort (SCo)) and color of the dress (white (CDW), brown (CDBr) and white / brown (CDWBr)). Excluding the compass to measure the Width of the pelvis, the other seven body measurements (Figure 2) were performed either with a ribbon

or with the measuring rod graduated in centimeters (cm). These are: height at withers (HW), height at the rump (HR), Corp length (CL), chest circumference (CS), basin width (BW), depth of chest (CD) and the length of the ears (EL). The measurements were carried out by two persons and a third responsible for recording the data on the sheet.

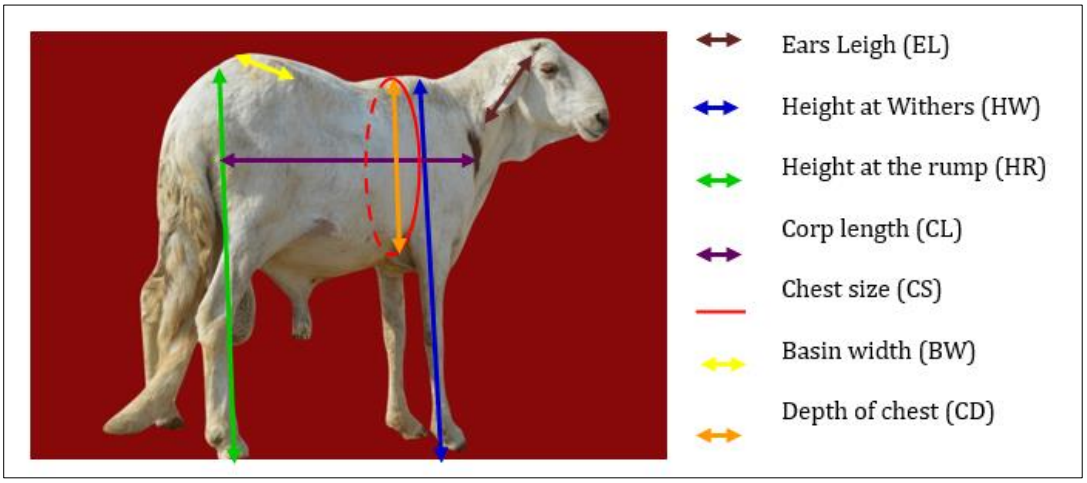

Figure 2 Phenotypic describers' measurements

2.3. Data analysis

The data was recorded on Excel 2007 and the statistical processing was done using the Statistical Package for Social Science software (SPSS version 21) and the SPAD version 5.5 software. The percentages of the qualitative and average variables with standard deviations of the different quantitative parameters were calculated and subjected to analysis of variance (ANOVA) with the Newman-keuls multiple comparison test. The significance level used for the differences in average was 5%. The Pearson correlation between the variables was calculated. The SPAD software made it possible to carry out the multidimensional analysis in particular the Principal Component Analysis (PCA).

3. Results

3.1. Phenotypic characterization

The sample consisted of 50.1% females and 49.9% males. The age of the sheep estimated by the breeder and the dentition (0.83) were positively significantly corrected (p> 0.001). Adult animals older than 3 years were more numerous (37.2%), followed by very young animals (27.3%) (Figure 3).

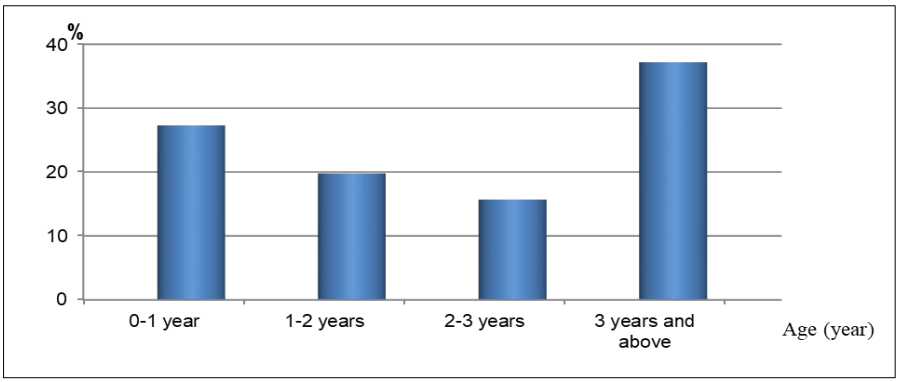

Figure 3 Animals Repartition according to age

3.2. Qualitative parameters

All sampled sheep have droopy ears. The color of the dress was dominated by brown (52.17%) followed by the color white / brown (27.15%) and white (20.67%). On the other hand, the spotted brown color was rarely observed (0.29%).

The coat was smooth (71%) and short (70%). These coats (smooth and short) were dominant in very young and adult animals (p> 0.001) (Figure 4). Peeling by age / sex of the animal and age / color of the dress showed no significant difference (p <0.05). Small horns in the form of vestiges were observed in 67.53% of adult rams of brown dress. The other rams and ewes were matte. The rest of the flock surveyed has no horn.

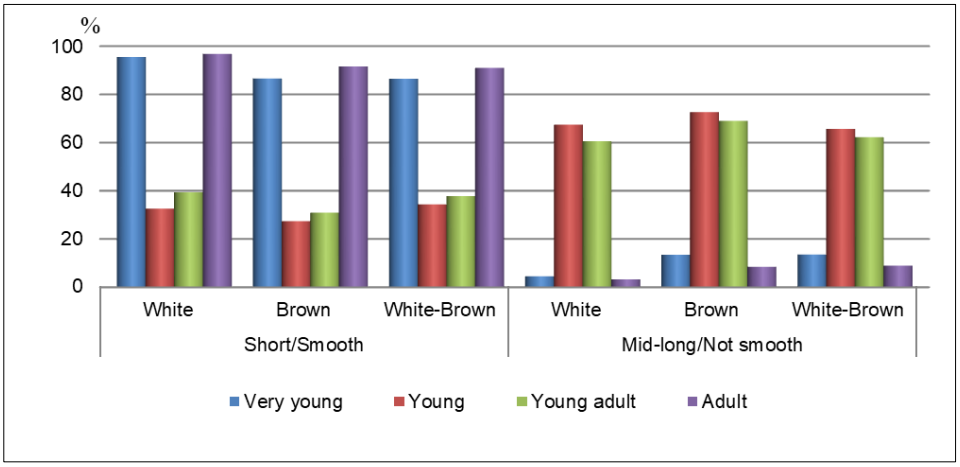

Figure 4 Type Repartition and hair length according to age and dress color

3.3. Quantitative parameters

The average of the quantitative parameters measured as a function of sex and age interval is presented in Table 1.

Table 1 Quantitative parameters of Kababich sheep according to sex and age

Age Interval	Sex	Height_withers HW (cm)	Deph_Chest CS (cm)	Corp_length CL (cm)	Basin_width BW (cm)	Heigh_rump HR (cm)	Chest_dept CD (cm)	Ears_length EL (cm)
0-1 Year (N=283)	Male (139)	43,32±3,58^a	48,55±5,04^a	35,07±4,36^a	9,89±0,79^a	45,10±3,59^a	22,34±3,34^a	11,24±1,29^a
	Female (144)	42,00±2,47^b	47,89±4,16^b	33,25±2,91^b	9,99±0,78^a	44,05±2,74^b	21,09±1,92^b	11,81±1,19^a
	Average	42,65±3,13	48,21±4,62	34,14±3,80	9,94±0,78	44,48±3,08	21,71±2,78	11,53±1,27
1-2 years (N=203)	Male (87)	57,78±5,20^a	64,38±6,05^a	48,90±5,26^a	13,23±1,20^a	59,65±5,20^a	28,37±3,04^a	14,61±1,25^a
	Female (116)	54,56±4,92^b	60,92±5,53^b	45,86±5,79^b	12,74±1,52^b	56,76±4,89^b	27,18±3,04^b	14,45±1,36^a
	Average	55,94±5,28	62,41±6,00	47,16±5,76	12,95±1,41	58,00±5,20	27,69±3,09	14,52±1,32
2-3 years (N=162)	Male (90)	67,04±5,69^a	73,34±5,85^a	57,98±5,97^a	15,68±1,85^a	68,80±5,63^a	33,61±3,40^a	16,65±1,31^a
	Female (72)	65,64±3,77^b	72,34±5,20^b	56,44±4,79^b	15,03±1,30^a	67,82±3,88^b	34,08±5,76^b	16,51±1,13^a
	Average	66,42±4,97	72,88±5,56	57,30±5,57	15,39±1,66	68,36±4,94	33,82±4,59	16,59±1,23
3 years and above (N=383)	Male (198)	89,65±5,02^a	95,73±5,64^a	80,81±5,72^a	22,03±1, 34^a	91,39±5,06^a	44,76±3,61^a	17,93±0,19^a
	Female (185)	72,74±2,62^d	80,32±4,33^d	64,27±3,93^d	17,60±1,06^d	74,47±2,70^d	36,30±2,02^d	17,85±0,34^a
	Average	81,50±9,40	88,29±9,22	72,82±9,63	19,89±2,53	83,24±9,42	40,68±5,16	17,90±2,77

^{a}: not significant (p>0,05), ^{b}: significant (p<0,05), ^{c}: highly significant (p<0,01) et ^{d}: very highly significant (p<0,001). The difference between the letters is significant on the same line and for the same variable

Quantitative parameters change very significantly with age (p <0.001). This significant difference was also observed by sex (p <0.001) except the variable length of the ears, which shows no difference (p> 0.5). The level of significance of the comparison of the means of quantitative phenotypic characteristics according to the age and sex interval was very high in adulthood (p <0.001).

The white coat animals were slightly larger compared to those of brown and white-brown dresses. However, the results of the average comparison tests did not show any significant difference (p> 0.5).

The correlation coefficient is between 0.845 and 0.996. This means that the variables have a significant positive correlation (p <0.01) (Table 2).

Table 2 Simple correlation (Pearson) of quantitative variables

Variables	IA	HW	CS	CL	BW	HR	CD	EL
IA	1							
HW	0,921**	1						
CS	0,918**	0,982**	1					
CL	0,912**	0,986**	0,976**	1				
BW	0,908**	0,965**	0,951**	0,955**	1			
HR	0,920**	0,996**	0,981**	0,985**	0,964**	1		
CD	0,884**	0,958**	0,950**	0,950**	0,930**	0,960**	1	
EL	0,920**	0,879**	0,873**	0,871**	0,874**	0,880**	0,845**	1

**: the correlation is highly significant; IA: Interval age

3.3.1. Principal Component Analysis (PCA)

The cumulative percentage of eigen values is 69.33% for the first three factorial axes:

- 1st factorial axis: it is positively correlated with the variables Adult, Height at withers (HW), Chest circumference (CS), Body length (CL), width of the basin (BW), Height at the rump (HR), Depth of the thorax (CD) and length of the ears (EL) and negatively correlated with the Very young (VYo) variable. This factorial axis gives information on the morphology of animals which, according to the results, evolves with age.
- 2nd factorial axis: it is positively correlated with type variables and not-smooth / mid-long coat length and negatively correlated with smooth /short variables. It gives information on animal peeling by distinguishing on one side sheep with not-smooth coat / mid-length and on the other sheep with smooth / short coat.
- 3rd factorial axis: it is positively correlated with the Male variable and negatively with the Female variable. It gives information on the sex of animals by distinguishing males from females (Table 3).

Table 3 Correlation with factorial axes

Active variables																	
Variables			Coordinates					Correlation Variable-factor					Old unit axes				
Code	Libeled		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
C2	Male	Male	0.25	-0.03	-0.95	0.08	-0.10	0.25	-0.03	0.95	0.08	-0.10	0.09	-0.01	0.66	0.06	-0.09
C3	Femelle	Female	-0.25	0.03	-0.95	-0.08	0.10	-0.25	0.03	-0.95	-0.08	0.10	-0.09	0.01	-0.66	-0.06	0.09
C4	Très jeune	VYo	-0.71	-0.51	0.18	0.06	-0.05	-0.71	-0.51	0.18	0.06	-0.05	-0.25	-0.24	0.13	0.05	-0.04
C5	Jeune	Yo	-0.28	0.44	-0.06	-0.16	0.07	-0.28	0.44	-0.06	-0.16	0.07	-0.10	0.21	-0.04	-0.12	0.06
C6	Jeune-Adulte	YAd	0.03	0.43	0.12	0.08	-0.14	0.03	0.43	0.12	0.08	-0.14	0.01	0.20	0.08	0.06	-0.13
C7	Adulte	Ad	0.86	-0.21	-0.21	0.01	0.09	0.86	-0.21	-0.21	0.01	0.09	0.30	-0.10	-0.14	0.01	0.08
C8	H_au_garot	HW	0.98	0.14	0.02	0.02	0.02	0.98	0.14	2	0.02	0.02	0.34	0.06	0.01	0.01	0.01
C9	Tour_poitrine	CS	0.97	0.15	0.00	-0.01	0.04	0.97	0.15	0.00	-0.01	0.04	0.34	0.07	0.00	-0.01	0.03

C10	L_corps	CL	0.97	0.13	0.02	0.01	0.01	0.97	0.13	0.02	0.01	0.01	0.34	0.06	0.01	0.00	0.01
C11	L_bassin	BW	0.97	0.08	-0.01	0.01	0.02	0.97	0.08	-0.01	-0.01	-0.02	0.34	0.04	-0.01	-0.01	-0.01
C12	H_croupe	HR	0.98	0.14	0.02	0.02	-0.02	0.98	0.14	0.02	0.02	0.02	0.34	0.07	0.01	0.01	0.01
0.45	P_thorax	CD	0.95	0.14	0.02	0.03	0.01	0.95	0.14	0.02	0.03	0.01	0.33	0.07	0.02	0.02	0.01
0.45	L_oreille	EL	0.84	0.22	-0.24	-0.02	0.03	0.84	0.22	-0.24	-0.02	0.03	0.30	0.10	-0.16	-0.02	0.03
C15	L_poils_Ras	SCo	0.27	-0.95	-0.03	-0.02	0.01	0.27	-0.95	-0.03	-0.02	0.01	0.09	-0.45	-0.02	-0.02	0.01
C16	L_poils_ML	MLCo	-0.27	0.95	0.03	0.02	-0.01	-0.27	0.95	0.03	0.02	-0.01	-0.09	0.45	0.02	0.02	-0.01
C17	Type_poils_L	SmC	0.26	-0.95	-0.03	-0.03	0.01	0.26	-0.95	-0.03	-0.03	0.01	0.09	-0.45	-0.02	-0.02	0.01
C18	Type_poils_NL	NSmC	-0.26	0.95	0.03	0.03	-0.01	-0.26	0.95	0.03	0.03	-0.01	-0.09	0.45	0.02	0.02	-0.01
C19	Couleur_robe_B	CDW	0.12	-0.02	-0.13	-0.46	-0.87	0.12	-0.02	-0.13	-0.46	-0.87	0.04	-0.01	-0.09	-0.35	-0.77
C20	Couleur_robe_BM	CDWBr	-0.07	0.04	0.23	-0.68	0.67	-0.07	0.04	0.23	-0.68	0.67	-0.02	0.02	0.16	-0.52	0.59
C21	Couleur_robe_M	CDBr	-0.03	-0.01	-0.09	0.98	0.10	-0.03	-0.01	-0.09	0.98	0.10	-0.01	-0.01	-0.07	0.76	0.09
C22	Couleur_robe_MT	CDBs	-0.04	-0.02	-0.09	-0.03	0.01	-0.04	-0.02	-0.09	-0.03	0.01	-0.01	-0.01	-0.06	-0.03	0.01

The crossing of the Morphology / Peeling factorial axes shows that the very young sheep (VYo) (orange group) and the adult sheep (Ad) (blue group) have smooth and short coat. The third green group has medium morphology and not-smooth, mid long coat (Figure 5).

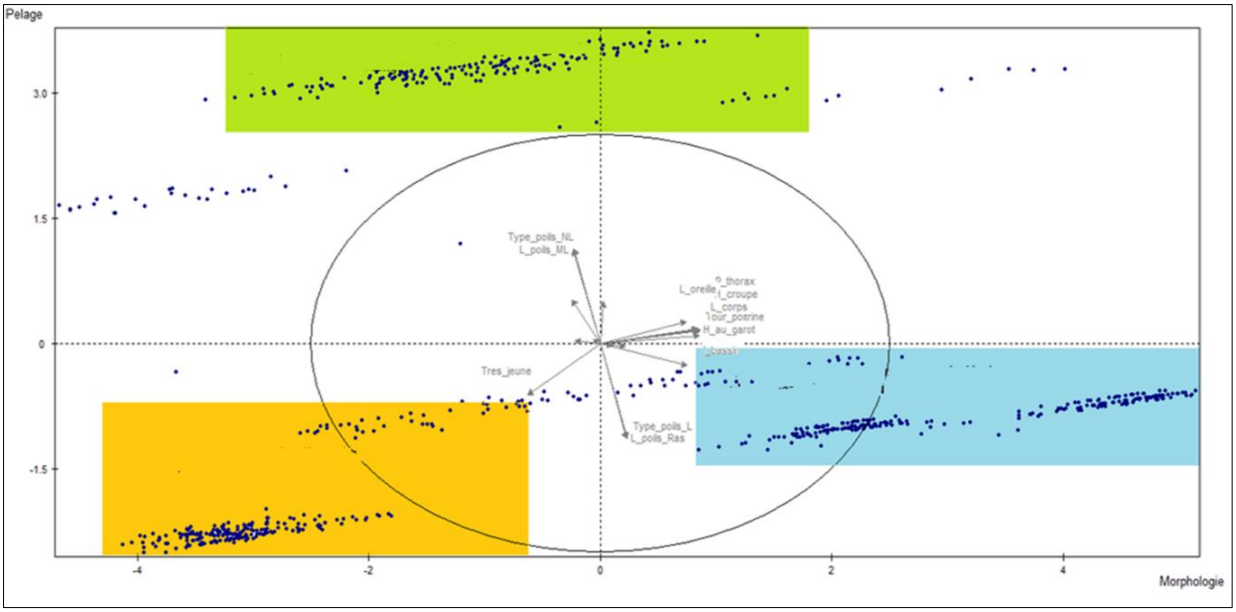

Figure 5 Croatization Morphology-Peeling

The crossing of the axes Peel (Pelage) / Sex (Sexe) gives information on the typology of the Kababich sheep's fur, which is not different according to the sex (figure 6).

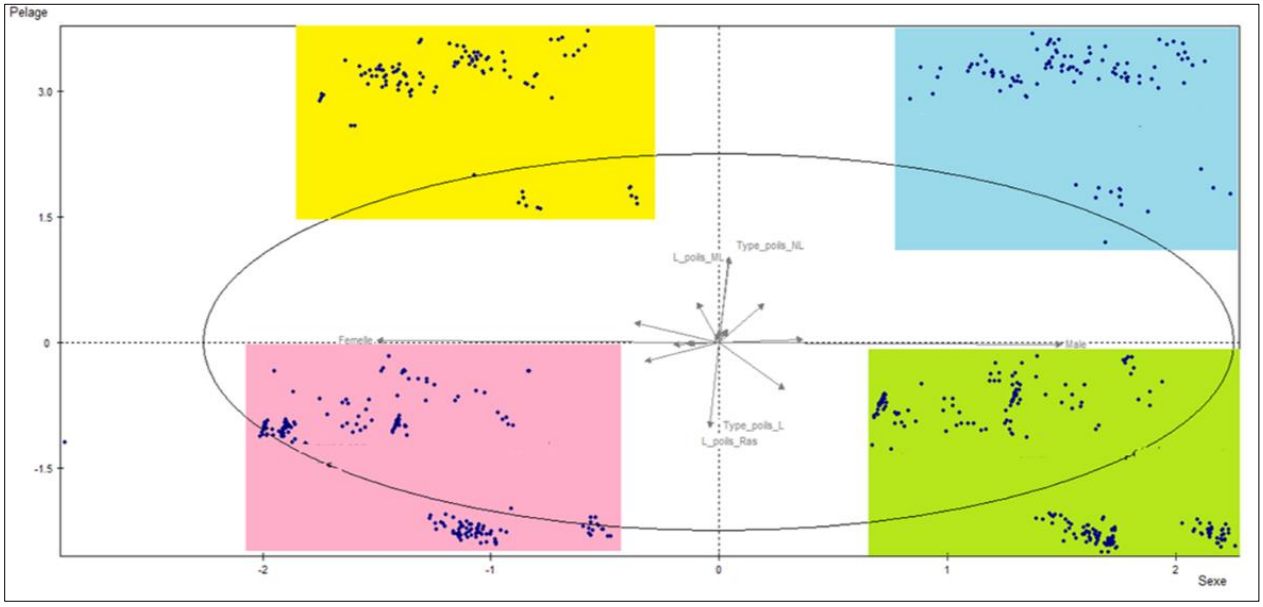

Figure 6 Crossing Peel-Sex

Finally, the crossing of the Morphology / Sex axes clearly distinguishes two groups: a group of females and a group of males. This figure has shown that the quantitative parameters are higher in males compared to females (Figure 7).

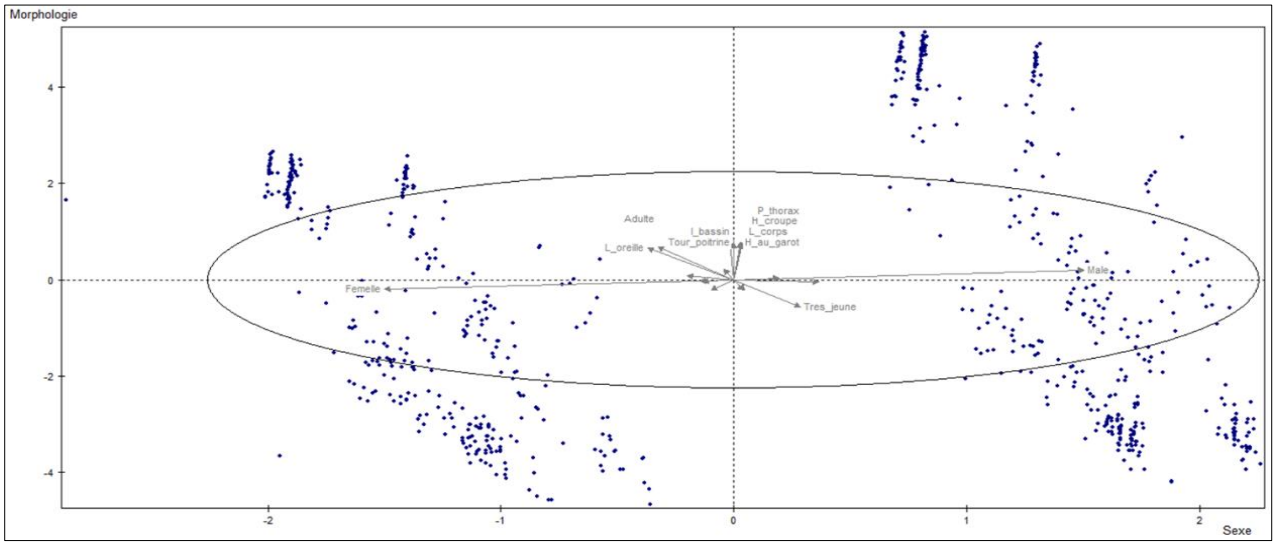

Figure 7 Morphology-Sex crossing

4. Discussion

For compliance with the FAO recommendations on the correct identification of a breed, the number of animals measured was favored, rather than the number of herds from which the measurements were taken. Adult animals aged 3 and over are more numerous followed by the very young. Measurements on young animals may be needed to assess and compare growth performance [6]. This age is obtained by examining the animal dentition defined by the FAO [6] Directive and the information provided by the breeders on the age of the animal. The positive and significant correlation coefficient between the age of the sheep given by the farmer and the dentition confirms the strong bond, which exists between age and dentition. This link makes it possible to consider the criterion of dentition as effective for easily apprehending the age of the sheep [2].

The variables characterized and measured in this breed in the peri-urban area of N'Djamena are similar to those of the Sahelian breeds described in the literature [1, 3, 4]. In contrast to Chadian Arab and Fulani sheep with horns, at 10.4% and 53.6% respectively [3], our observations on the Kababish ewe have shown that it is matte. These results are similar to the observations made by Issam and *al.* [7] in the region of Setif in Algeria, where the ewes were devoid of horns.

The Kababich sheep ears are droopy and shorter than those of the Arab and Fulani sheep (Oudah) [4]. In general, the Sahelian sheep have long, drooping ears compared to Sudanese sheep, which have short, upright ears [1, 4]. The same observations are made by Issam and *al.* [7] in the region of Setif in Algeria, where the sheep have falling ears of an average length of 17.78 cm very close to the average (17.90 cm) obtained on our animals of 3 years and more.

Proportion of Kababich with a brown (fawn) color is weak compared to that reported by Djalal [3] which was 67,7% on the same breed. The type of smooth and short fur was typical of Kababich. This type of peeling characterizes especially very young and adult animals. The type of Kababich peeling was identical to that of Arab sheep [3]. The peeling according to age/sex of the animal and the age/color of the dress do not show any significant difference($p<0,05$). However the quantitative variables studied show very significant differences by sex and age range ($p<0,001$) except for the length of the ears, which does not differ by sex. The male has a very developed format. The height at the withers and that at the rump exceed those of other Sahelians sheep as well as the sheep of Algeria [3, 4, 8]. The size of female Kababich is similar to that of the Arab sheep, but much smaller than that of Fulani [3]. Those results confirm that Kababich breed is a beef breed by excellence. Indeed, the size of the body, the length of the body and the width of the basin are consistent with those of beef breeds studied in Algeria [8, 9]. According to Yapi [11], the lambs' circumference is strongly correlated with weight. As for Sudanese sheep, they have low quantitative phenotypic parameters compared to Kababich sheep [3, 10].

The quantitative variables studied show a highly significant positive correlation. These results confirm that this is a single genetic type in Kababich studied in the peri-urban area of N'Djamena. Indeed, the size of the body, the length of the body allowed for three factorial axes, which correlate with morphology, peeling and sex. The crossing of these factorial axes between them reaffirms the results obtained. The smooth, short coatis' youth and adult friendly. In addition, the sexual dimorphism of Kababich sheep is very pronounced compared to that of Arab and Fulani sheep [3].

5. Conclusion

In view of the genetic diversity, the number of livestock and the socioeconomic and cultural role of sheep in Chad, it is necessary to define the phenotypic standard of local breeds for better exploitation. The Kababich breed is one of the most exploited local breeds. The population studied during this work carried out in the peri-urban area of N'Djamena has made it possible to define a single genetic type. The brown dress and the smooth and fluffy coat are dominant. The adult female is matte compared to the adult male, which has horns in the form of remains. There is also a large variation in the format for both sexes. The results confirmed confirm the meat potential of the Kababich breed, which must be better exploited in fattening. This preliminary work on the phenotypic characterization of Kababich sheep and the study on other local sheep breeds should be continued in order to allow a more refined characterization of the local breeds' prerequisites for genetic improvement and productivity optimization.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

There is no conflict of interest.

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