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Morphological and seminal quality evaluation of mestizo male sheep of the Pelibuey and Backbelly breed of the Pastaza Experimental Station

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Abstract

The production of sheep hair in the Amazon Region of Ecuador has great potential as a contribution of protein of animal origin for food security, as well as for the generation of family economic resources; However, due to unplanned crossbreeding, racial characteristics are lost as well as the productive and reproductive parameters of their races are diminishing; therefore, in the Pastaza Experimental Station belonging to the Polytechnic School of Chimborazo, located in the Amazon Region of Ecuador, the morphological characteristics and seminal quality of mestizo male sheep of the Pelibuey and Blackbelly breed were evaluated in order to select rams that serve as breeders for the sheep of the project: Amazonian Haired Sheep Program (PROPEA). For this, two males of each breed were studied, data were taken with a biweekly frequency, both for seminal quality, as well as for morphological measurements. The data obtained were processed with the Microsot Excel and statistically the variables were analyzed with the Student's t Test of comparison of two independent means for each race. The results of the morphological characteristics determined that the animals under study present characteristics similar to the racial standard; while in seminal quality there is a slight difference between animals. It is concluded that the male mixed breed number II of the Blackbelly breed and the male I of the Pelibuey breed should be selected for reproduction.

Keywords: sheep hair, seminal quality, morphology, reproduction.

1. Introduction

Haired sheep are widely distributed throughout the world, thanks to their cosmopolitan characteristic, accompanied by their good adaptability, convenient reproductive behavior, high survival and good possibilities of adapting to various agricultural systems such as silvopastoral (Ganzábal, 2014). Hairy sheep thanks to their innate characteristics have the ability to take advantage of pastures of low nutritional value and to adapt well to tropical and subtropical conditions, which has persuaded their introduction in Ecuador.

In Ecuador, sheep production is mainly developed in the inter-Andean region, it is managed in an extensive system and under traditional management. The sheep production of hair dates its beginning in the nineties, the Blackbelly breed also called Black Belly and the Pelibuey called Sudan, are representative breeds of the butcher biotype and of high prolificacy (Claus et al., 2014), which is confirmed by (Moyano et al, 2017) who state that these breeds are benefiting the families of the Ecuadorian Amazon Region (RAE) as a source of economic income and also being a form of Environmentally friendly livestock.

The population of the RAE presents high percentages of malnutrition and poverty, this percentage triples with respect to the rest of the country (García, 2012); approximately 17.5% of the SAR have skills for the development of agricultural and related activities (Filhoo et al, 2014); The region has an area of 21,325 hectares of natural pastures and 472,872 ha of cultivated pastures for livestock. A large part of its population develops agricultural activities for family economic sustenance, among them are activities aimed at the production of beef cattle and sheep (GADPP, 20218). In the Amazon region there are approximately 1598 sheep (ESPAC, 2018). Several producers consider that the production of hair sheep has great potential for the agricultural population of the SAR as the main source of animal protein that will contribute to food security and the generation of economic resources for family sustenance.

In recent decades the Pelibuey and Blackbelly breeds have been genetically improved with the main objective of increasing weight gain, feed efficiency and carcass yield. However, due to the use of crossing systems erroneously proposed with the use of imported breeds (mainly Katahdin) and animals that have not been well selected, they have caused effects such as genetic variability and the decrease of phenotypical, productive and reproductive characteristics of the two races (Macedo et al., 2016).

The technique of morphometric characterization of sheep allows to determine biotypes and to know how close or far the animals of the racial standard are (Macedo et al., 2016). On the other hand, the determination of the macroscopic and microscopic quality of sheep

semen (Núñez et al., 2006) allows the selection of animals for natural breeding or for the extraction, processing and cryopreservation of semen; consequently, the sheep that present better results in seminal quality, as well as morphometric characteristics according to their racial standard, should be selected for reproductive purposes to contribute to the improvement of the herd (Yotov et al., 2011).

The objective of this study was to evaluate the morphological characteristics and seminal quality of the mestizo male sheep of the Pelibuey and Blackbelly breed of the Pastaza Experimental Station to be selected and used as stallions in the project: Amazonian Hair Sheep Program (PROPEA).

2. Materials and methods

In the Pastaza Experimental Station of the ESPOCH (EEP), located in the Ecuadorian Amazon Region (RAE), at km 32 of the Puyo-Macas road, belonging to the Vencedores community of the Simón Bolívar parish of the Pastaza canton, Province of Pastaza, Ecuador. Four haired mixed-breed sheep were studied, of which two were of the Blackbelly breed and two of the Pelibuey breed. The EEP is located at an altitude of 1031 m.a.s.l., with an average temperature of 21.2 ºC; average annual rainfall of 2000 mm, relative humidity of 85% (Campaign, 2008).

The sheep were handled in a semi-intensive system, from 8:00 a.m. to 4:00 p.m. they grazed in a controlled manner in paddocks of Brachiaria decumbens and Brachiaria brizantha, the rest of the day they remained stabled in a sheepfold built with materials from the area, they received chopped grass, water at will and approximately 500 grams of concentrate; sanitary management consists mainly of deworming and vitaminization every three months.

The following morphological variables were studied: Testicular perimeter (cm), Body condition (points), Head width (cm), Face length (cm), Head length (cm) Skull length (cm), Height at withers (cm), Rump height (cm), Longitudinal diameter (cm), Dorsum sternal diameter (cm), Chest width (cm), Croup width (cm), Rump length (cm), thoracic perimeter (cm), cane perimeter (cm) and live weight (kg).

For the evaluation of semen quality, the following macroscopic variables were analyzed: Volume (ml/ejaculate), Color, Odor and pH; and the microscopic variables: Mass motility (points), Individual motility (%), Vitality (%), Sperm concentration (million spz/ml) and Morphology (%), each with its own methodology; For this, data were recorded every fortnight. Statistically, the variables were analyzed with the Student's t test comparing two independent means for each race.

3. Results and discussion

3.1. Morphological measurements of haired sheep.

The determination of morphometric measurements is of vital importance for breeders within their herds (Alderson, 1999), as well as other selection parameters constitute an important basis for establishing genetic improvement programs (Riva et al., 2004).

Table 1 shows the values of the mean, statistical variance T, statistics T, probability and significance of the variables analyzed.

Table 1: T-student test of zoometric measurements among Blackbelly and Pelibuey mixed-race male sheep (p ≤ 0.05).

Variable	Race	Media	Statistical variance T	T-Statistic	Probability	Significance
P.V (kg)	Blackbelly	67.95	8.01	-0.19990	0.42471	NS
	Pelibuey	68.45	11.17			
Pm. Test (cm)	Blackbelly	33.91	0.04	0.34921	0.37057	NS
	Pelibuey	33.86	0.05			
Body condition (1-5 points)	Blackbelly	2.2	0.31	-2.2	0.03954	*
	Pelibuey	2.75	0.04			
Face width (cm)	Blackbelly	13.15	0.43	-3.50823	0.00856	**
	Pelibuey	14.21	0.06			
Lng de cara (cm)	Blackbelly	27.33	1.26	1.02175	0.17688	NS
	Pelibuey	26.16	3.64			
Lng cabeza (cm)	Blackbelly	38.83	0.16	1.15673	0.14982	NS
	Pelibuey	37.25	10.17			
Skull length (cm)	Blackbelly	17.83	5.36	3.15296	0.01264	**
	Pelibuey	16.533	3.54			
Ear width (cm)	Blackbelly	6.53	0.26	2.21006	0.03904	*
	Pelibuey	6.31	0.56			
Ear length (cm)	Blackbelly	11.21	0.40	3.79628	0.00633	**
	Pelibuey	10.05	0.97			
Alz. Cruz (cm)	Blackbelly	74.85	2.11	0.26827	0.39960	NS
	Pelibuey	74.63	1.37			
Alz. Grup (cm)	Blackbelly	75.93	0.79	-2.81488	0.01866	**
	Pelibuey	79.90	6.85			
Diameter. Longitudinal (cm)	Blackbelly	83.33	1.86	3.31212	0.01059	**
	Pelibuey	79.83	11.76			
Dm. Dorso. East (cm)	Blackbelly	38.06	1.75	-4.83788	0.00236	**

	Pelibuey	41.23	0.32			
Chest width (cm)	Blackbelly	3	0.17	-1.42815	0.10630	NS
	Pelibuey	3.61	0.47			
Rump width (cm)	Blackbelly	20.33	5.06	-3.16227	0.01251	**
	Pelibuey	21.00	3.2			
Long group (cm)	Blackbelly	19	10	0	0.5	NS
	Pelibuey	19	10			
Thoracic circumference (cm)	Blackbelly	96.33	3.86	-1.72555	0.07255	NS
	Pelibuey	98.70	6.7			
Cane perimeter (cm)	Blackbelly	10.21	0.40	0.24253	0.40899	NS
	Pelibuey	10.16	0.16			
Dm biscostal (cm)	Blackbelly	25.93	2.3	-1.85519	0.06136	NS
	Pelibuey	29.95	0.41			

The table above shows that the variables of body condition, ear width, face width, skull length, ear length, rump height, longitudinal diameter, sternal dorsum diameter and croup width showed statistically significant and highly significant differences ($p \leq 0.05$) respectively; whereas, the variables live weight, testicular circumference, Face length, head length, height at withers, chest width, croup length, thoracic circumference, cane circumference and bicostal diameter did not present statistically significant differences ($p \leq 0.05$).

For the skull length variable (Macedo et al., 2016), it records values of 8.83 cm for Pelibuey sheep and 8.60 cm in Blackbelly sheep; Values that do not resemble those found in the present investigation, because in the previous investigation the measurement was made up to the middle of the skull, while in the present investigation the measurements taken were from the forehead to the base of the skull, that is, the entire contour of the skull. Similarly, Pelibuey sheep have a smaller size than Blackbelly; This allows us to indicate that there is a clear differentiation between the two races, however, these different values may be due to the fact that there is a higher degree of purity of the animals of the present study in relation to the high miscegenation of the animals of the previous study.

The ear width in the Pelibuey breed registers a value of 6.09 cm and in the Blackbelly breed a value of 6.10 cm (Macedo et al., 2016); while for the ear length (Vilaboa et al., 2010), it registers values of 10.85 ± 0.90 cm for the Pelibuey breed; on the other hand (Macedo et al., 2016) reports 10.95 ± 0.08 cm. These values are similar to that of the present research emphasizing that the length and width of the ear could be in relation to the length of the skull.

(Vilaboa et al., 2010) records a rump elevation in Pelibuey sheep of 64.55 ± 3.05 cm; on the other hand (Dzib et al., 2011) reports values of

69.2 ± 7.4 cm in their research carried out on Blackbelly sheep; values that are lower than those recorded in the present investigation, possibly due to the favourable influence of genetic and environmental factors in the sheep of the EEP.

The longitudinal diameter found in the present research was higher than the 65.53 cm recorded by (Hernández et al., 2019), for the Pelibuey breed; however, it is lower than the 88.7 cm found by (Moreno et al., 2013) in hairy sheep. Between the two breeds of the present study, the Blackbelly breed has a longitudinal diameter greater than the Pelibuey, which demonstrates a harmony in the body conformation of the Blackbelly breed. On the other hand (Hernández et al., 2019), it registers a dorso-sternal diameter of 26.18 cm, likewise (Arredondo et al., 2017), it registers values of 29.2 ± 1.8cm. On the other hand (Dzib et al., 2011), it registers values of 33.3 ± 4.1 cm in Blackbelly sheep; values that are lower than 38.06 and 41.23 cm for Blackbelly and Pelibuey breeds respectively; However, in accordance with the longitudinal diameter it will allow to obtain good size of channels.

In the variable croup width (Vilaboa et al., 2010) it registers ranges of 21 and 12.5 cm in Pelibuey sheep; likewise (Arredondo et al., 2017), it registers values of 17.3 ± 1.8 cm in sheep of hair, values that are similar and lower respectively to those found in the present investigation. It is concluded that the sheep under study have morphometric characteristics very close to the standard of each of the races, and that due to the great adaptation to the environmental conditions of the area it is feasible and very useful to use them for reproductive purposes.

3.2. Macroscopic and microscopic characteristics of semen

The evaluation of the seminal quality is a very important contribution for the selection of breeders, which together with good feeding, health and management will allow to obtain a greater number of pregnant sheep in the flock.

Table 2 reports the analysis of seminal quality where the macroscopic and microscopic characteristics were determined by the T-student test.

Table 2: T-student test of seminal quality between Blackbelly and Pelibuey sheep (p ≤ 0.05).

Variable	Race	Media	Statistical variance T	T-Statistic	Probability	Significance
Volume (ml)	Blackbelly	0.91	0.01	1.23358	0.13608	NS
	Pelibuey	0.80	0.06			
Ph	Blackbelly	6.71	0.02	-1.59719	0.08555	NS
	Pelibuey	6.96	0.13			
Mass motility (points)	Blackbelly	3.83	0.46	6.32455	0.00072	**
	Pelibuey	2.50	0.40			

Progressive individual motility (%)	Blackbelly	75	14	5.59016	0.00126	**
	Pelibuey	50	50			
Sperm concentration (million spz/ml)	Blackbelly	1813.66	609910.6	2.44014	0.02932	*
	Pelibuey	1057.50	2777.5			
Morfoanomalías (%)	Blackbelly	11.66	6.66	-1	0.18160	NS
	Pelibuey	13.33	16.66			
Sperm viability (%)	Blackbelly	89.16	14.16	3.37099	0.00993	**
	Pelibuey	80.83	54.16			

The variables: mass motility, progressive individual motility, sperm viability and sperm concentration presented highly significant and significant statistical differences ($p \leq 0.05$) respectively; while the variables: volume, pH and morphoanomalies did not present significant differences ($p \leq 0.05$).

Regarding mass motility (Hernández et al., 2021) they report values of 3.9 ± 0.99 to 4.1 ± 0.10 points in the Pelibuey race; likewise (Aké et al., 2016) they register values of 4.75 ± 0.11; values that are higher than those found in the present study are probably due to environmental factors, the method of extraction and the general management of males for reproductive purposes influenced the results.

While (Aké et al., 2016) recorded a progressive individual motility of 88.0 ± 0.86% in their research conducted on Pelibuey sheep, on the other hand (Ramírez et al., 2020), they reported values of 30.79 ± 2.64%, which are lower than those found in the present study.

In the Blackbelly breed (Cabrera et al., 2010) they registered values of 62.33 ± 2.31%, while (Castro et al., 2017), they found a progressive individual motility of 83.30 ± 4.92%. These two values are in the range of those found in the present research, demonstrating equality in the seminal characteristics of both races.

On the other hand (Hernández et al., 2021) they record in their research a sperm concentration of 4350 million spz/ml, values that are high compared to those found in the present study, while (Aké et al., 2016), they reported values of 2535 ± 60.7 million spz/ml. According to (Cabrera et al., 2010), in his research with sheep of the Blackbelly breed he found a sperm concentration of 2108.3 ± 661.4 spz / ml, likewise (Castro et al., 2017), he registers values of 2459 ± 904 million spz / ml; The values previously reported are not so far from those obtained in the present study, however, the variability of the data is possibly due to the genetic and environmental factors in which the sheep are found.

Hernández et al., (2021) record a sperm viability of 82.3 ± 10.31% in Pelibuey sheep, values that are similar to those found in the present study. On the other hand (Cabrera et al., 2010) they also register a

viability of 83.4 ± 5.6 % in Blackbelly sheep and that agree with the values obtained in the present study.

4. Conclusion

The four sheep studied have morphometric characteristics close to the racial standard, in terms of semen quality were recorded almost similar values for the two races; however, sheep I of the Pelibuey breed and sheep II of the Blackbelly breed are recommended to be selected for use as breeding animals for the PROPAE project, due to a slight superiority in terms of seminal quality.

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