

Intergenerational Morphostructural Stability and Harmony of Marin Magellan Meat Merino Ewes

Estabilidad y Armonía Intergeneracional Morfoestructural de Ovejas Marin Magellan Meat Merino

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SUMMARY: The aim of this study was to evaluate the stability and harmony of the morphostructural format of the Marin Magellan Meat Merino breed in order to contribute to knowledge about the differentiation of sheep populations. In summer 2010, evaluation on a sheep population coming from an incomplete absorbent crossbreeding of Corriedale by Australian Merino breeds was done in Magallanes Region, Chile. All three and five year-old ewes (62 and 50, respectively) were measured. Fourteen body measurements were taken and nine body indexes were calculated. Results show that the evaluated sheep population does not show significant intergenerational differences in most of the morphostructural variables. At the same time, there is a high between-age similarity in the correlations between zoometric indexes. Therefore, it can be stated that the morphostructural model of Marin Magellan Meat Merino ewes shows a high degree of stability and harmony.

KEY WORDS: Sheep; Genetic crossbreeding; Morphology; Morphostructural stability.

INTRODUCCIÓN

The census of Chilean sheep livestock indicates that there is about two and a half million head of sheep. Most of this animal stock corresponds to Corriedale breed, which hold a marked aptitude to the production of medium-fineness wool. Value addition to production has led many producers to a crossbreeding process with Merino breed, in order to produce a finer wool with higher commercial value (Bianchi *et al.*, 2006; Cardellino & Müeller, 2008). One of the most widespread crossbreedings has been the absorption of Corriedale by Australian Merino, process that, in many cases, has not been complete, leading to the appearance of animal populations which differ from the breeds on which the crossbreeding was based, and favoring the appearance of a new genetic resource. In this regard, the characterization of the morphological attributes is the first step for the management of a genetic resource (Azor *et al.*, 2008; Traoré *et al.*, 2008; Ducheve & Groeneveld, 2006; Salako, 2006). By characterizing the animal population resulting from the incomplete absorbent crossbreeding of Corriedale by Australian Merino, it was evidenced a significant morphostructural differentiation in relation to the breeds that

originated the crossbreeding, with a high degree of homogeneity within the population itself (Latorre *et al.*, 2011); this allowed the official registration of a new breed, the Marin Magellan Meat Merino, and the opening of the respective genealogical register (Sánchez *et al.*, 2011).

The definition of a breed clearly involves the differentiation of this new population from others, and at the same time, a delimited variability among the members of the population itself (Sierra, 2001; Herrera & Luque, 2009). Nevertheless, when the new breed is the result of a crossbreeding process, is essential to determine if the morphostructural format keep its characteristics from one generation to the next, as it depends that the characteristic attributes of the population are sustained over time (Herrera *et al.*, 1996; Legaz *et al.*, 2011).

Therefore, the aim of this study was to evaluate the stability and harmony of the morphostructural format of the Marin Magellan Meat Merino breed in order to contribute to the knowledge about the differentiation of this sheep population.

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MATERIAL AND METHOD

In summer 2012, an aleatory sampling was carried out on 900 Marin Magellan Meat Merino ewes. As mentioned, this sheep breed is the product of an incomplete absorbing crossing of Corriedale by Australian Merino breeds (Latorre *et al.*).

Population sample size was estimated following the method proposed by Canon & Roe

Where:
$$\text{Sample Size} = \frac{1}{\left(\frac{1}{n_1} + \frac{1}{Pop}\right)}$$

Pop = is the population size

And
$$n_1 = \frac{4pq}{L^2}$$

Being p proportion of individuals in the population which are expected to be of the new incomplete absorbed crossing.

And q = 1- p L = accepted error.

It was assumed that 85% of the animals in the population belonged to Magellan Meat Merino breed, despite not being registered yet in the official genealogical register. Accepted error was 5%, and therefore sample size was estimated on 200 randomly selected ewes. All three and five year-old ewes from this sample (62 and 50, respectively) were measured. Fourteen body measurements were recorded, following the suggestions and protocols of Herrera *et al.*, Álvarez *et al.* (2000), Calderón *et al.* (2009), Herrera & Luque and Bravo & Sepúlveda (2010). Body measurements were: Face Length (FL), Cranial Length (CraL), Cranial Width (CraW), Head Width (HW), Chest Width (ChW), Thorax Perimeter (ThP), Back Length (BaL), Rump Width (RW), Rump Length (RL), Thigh Length (TL), Body Depth (BD), Thorax Width (TW), Body Length (BoL), Withers Height (WH) and Rump Height (RH).

In addition, nine indexes were calculated from body measurements. These indexes were: Body Index (BI), Cephalic Index (CI), Cranial Index (CraI), Facial Index (FI), Thoracic Index (ThI), Thorax Relative Depth Index (TRDI), Ilium-Ischium Index (II), Longitudinal Ilium-Ischium Index (LII), Transversal Ilium-Ischium Index

(TII), Metacarpal Thoracic Index (MTI) and Metacarpal RibIndex (MRI). Indexes were calculated following the recommendations of Salako and Bravo & Sepúlveda.

The differences between the two age groups were assessed by the T-Student test, comparing body measurement means. The morphostructural format stability was evaluated by comparing the correlations between the zoometric indexes, calculated by means of a Pearson matrix estimated for each age group. Data were stored in an Excel electronic spreadsheet and analyzed by means of the Xlstat 2011 software.

RESULTS AND DISCUSSION

In the process of creation of Magellan Meat Merino Breed, the original (absorbed) breed was Corriedale, while the absorbing breed was Australian Merino. This crossbreeding was stopped and stabilized at an intermediate stage before the total absorption of Corriedale, leading to the appearance of a kind of animal which was different from the original breeds, with a degree of intra-population variability similar to that of recognized sheep breeds (Latorre *et al.*). Nevertheless, the conformation of an animal population as a new racial group requires the determination of the degree of the morphostructural format stability, in such a way that it shows a minimal variation and a similar general harmony in different generations.

Table I shows that there are no significant differences ($P > 0.05$) between three and five-year-old ewes for most of the morphological variables evaluated, mainly in those of ethnological relevance (FL, CraL, CraW, HW, RW and RH). Significant differences ($P < 0.05$) can be observed only in the size of the thoracic area (ChW and ThP). The reason could be that the breeds involved in the absorbent crossbreeding are very different in terms of its thoracic format, so it is expected that the stabilization process of this trait will be slower. In this sense, it can be assessed that sheep resulting from this process show an advanced degree of intergenerational stability, but still in process of maturation.

Relating to indexes, in our study there are 21 coincident and 4 non-coincident significant correlations between the two age groups (Table II). CrI shows four coincident significant correlations: -0.404 (3 years) and -0.499 (5 years) between CrI and TRDI; -0.423 (3 years) and -0.542 (5 years) between CrI and FII; -0.800 (3 years) and -0.682 (5 years) between CrI and MTII, and -0.443 (3

Table I. Means (cm), difference (cm) and statistic significance (T test) for the differences in body measurements between three and five year-old Marin Magellan Meat Merino ewes.

Biometric variables	3 year-old sheep (a)	5 year-old sheep (b)	Difference (a-b)
FL	18.62	18.68	-0.06
CraL	7.27	7.27	0.00
CraW	7.57	7.20	0.37
HW	12.15	12.17	-0.02
ChW	22.17	22.77	-0.60*
ThP	85.75	89.95	-4.20*
BaL	38.00	37.14	0.86
RW	12.20	11.85	0.35
RL	13.53	12.84	0.70
TL	26.26	26.00	0.26
BD	30.75	31.16	-0.42
TW	22.17	23.11	-0.94
BoL	70.28	71.63	-1.35
WH	68.24	70.05	-1.81
RH	69.64	71.35	-1.71

* P<0.05

years) and -0.382 (5 years) between CrI and MRI. FI shows coincident significant correlations in all cases between the two ages. There are also a coincident significant correlation between FI and CI: 0.681 (3 years) and 0.495 (5 years). ThI shows a coincident significant correlation with BI between the two age groups: -0.568 (3 years) and -0.437 (5 years). TRDI shows a coincident significant correlation with BI between the two age groups: -0.336 (3 years) and -0.412 (5 years). For LII, there are coincident significant correlations with BI and II: -0.347 (3 years) and -0.441 (5 years) in the first case, and -0.425 (3 years) and -0.477 (5 years) in the second. TII shows three coincident significant correlations between ages. For TII and TRDI, 0.567 (3 years) and 0.518(5 years); for TII and II, 0.518 (3 years)

and 0.611 (5 years), and for TII and LII 0.544 (3 years) and 0.484 (5 years). MTI shows coincident significant correlations with BI: 0.629(3 years) and 0.665 (5years); with FI: 0.395 (3 years) and 0.479 (5 years), with TRDI: -0.409 (3 years) and -0.378 (5 years), with II:-0.419 (3 years) and -0.359 (5 years) and with TII: -0.452 (3 years) and -0.378 (5 years). MRI shows coincident significant correlations with BI: 0.614 (3 years) and 0.513(5 years); with ThI: -0.710(3 years) and -0.639 (5 years); with TRDI -0.488 (3 years) and -0.456 (5 years), with II: -0.460 (3 years) and -0.536 (5 years), and with MTI: 0.713 (3 years) and 0.693 (5 years).

The four discordances between ages were found for II with TRDI, TII with BI, MTI with TII and MRI with TII. Therefore, there is a similar harmony in the body format of both generations. This reaffirms the idea that the incomplete absorbent crossbreeding which lead to the appearance of Marin Magellan Meat Merino breed has reached the stability in the morphostructural format, and therefore the productive abilities ascribed to this format remain the same between generations (Zaitoun *et al.*, 2005; Yakubu *et al.*, 2010). This way, morphostructural stability is expressed as a desirable and defining characteristic of this animal breed’s definition (Sierra; Herrera & Luque).

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Table II. Pearson’s correlation matrix of zoometric indexes of three year-old (above diagonal) and five year-old (below diagonal) Marin Magellan Meat Merino ewes.

Indexes	BI	CI	CraI	FI	ThI	TRDI	II	LII	TII	MTI	MRI
BI	1	-0.037	-0.404*	0.224	-0.568*	-0.336*	-0.103	-0.347*	-0.406*	0.629*	0.614*
CI	-0.199	1	0.077	0.681*	0.302	-0.069	0.004	0.153	0.143	0.011	-0.161
CraI	-0.499*	0.477	1	-0.423*	-0.035	0.230	0.209	0.035	0.209	-0.800*	-0.443*
FI	-0.254	0.495*	-0.542*	1	0.109	-0.234	0.027	0.084	0.126	0.395*	0.234
ThI	-0.437*	-0.100	-0.120	-0.020	1	0.165	0.162	0.154	0.280	-0.174	-0.710*
TRDI	-0.412*	0.248	0.177	0.124	0.340	1	0.491*	0.164	0.567*	-0.409*	-0.488*
II	0.307	-0.175	0.046	-0.143	-0.358	0.449	1	-0.425*	0.518*	-0.419*	-0.460*
LII	-0.414*	0.253	0.359	0.273	0.330	0.289	-0.477*	1	0.544*	-0.087	-0.069
TII	-0.313	0.169	0.309	0.104	-0.217	0.518*	0.611*	0.484*	1	-0.452*	-0.472*
MTI	0.665*	-0.078	-0.682*	0.479*	0.013	-0.378*	-0.359*	0.186	-0.352	1	0.713*
MRI	0.513*	-0.113	-0.382*	-0.071	-0.639*	-0.456*	-0.536*	-0.254	-0.412	0.693*	1

*P<0.05

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RESUMEN: El objetivo de este estudio fue evaluar la estabilidad y la armonía del formato morfoestructural de la raza ovina Marin Magellan Meat Merino en la Región de Magallanes (Chile), con el fin de contribuir al conocimiento de la diferenciación de las poblaciones ovinas. En el verano de 2010 se evaluó esta nueva raza, que es producto de un cruzamiento absorbente incompleto de Corriedale por Merino Australiano. Se midieron todas las hembras de tres y cinco años (62 y 50, respectivamente). Se tomaron catorce mediciones corporales y se calcularon nueve índices. Los resultados indican que la población ovina evaluada no muestra diferencias intergeneracionales significativas en la mayor parte de las variables morfoestructurales estudiadas. Al mismo tiempo, hay una gran similitud entre edades respecto a las correlaciones entre índices zoométricos. Por lo tanto, se puede afirmar que el modelo morfoestructural de las ovejas Marin Magellan Meat Merino evidencia un alto grado de estabilidad y armonía.

PALABRAS CLAVE: Oveja; Cruzamiento genético; Morfología; Estabilidad morfoestructural.

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