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Body fat depots and body condition score relationship: a comparison of two Spanish sheep breeds (Churra *vs* Merina)

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SUMMARY - Knowledge of the body fat depots is of central importance in extensive sheep production systems. The Body Condition Score (BCS) method has often been used as an index of nutritive status of the animals. Nevertheless, it must be considered that this is a subjective technique that was developed working with British sheep meat production genotypes, and variations in fat depots distribution have been reported when different genotypes are compared. To compare body fat depots and Body Condition Score relationship in two Spanish sheep breeds, 15 Churra mature ewes and 9 Merina ones were used. All animals were slaughtered and internal fat depots (channel and kidney, omental and mesenteric) removed and weighed. Chemical carcass and non-carcass fat were estimated in laboratory. The results of this work showed that BCS and body fat depots relationship was not different for both breeds. Churra ewes present a higher proportion of total internal fat in the empty body weight than Merina ones and a different internal fat depots distribution.

Key words: Sheep, body fat depots, body condition score.

RESUME - *"Relation entre les dépôts adipeux corporels et la note d'état corporel : comparaison de deux races ovines espagnoles (Churra vs Medina)". Connaître le contenu adipeux des animaux est très important dans les systèmes extensifs de production ovine. La note de l'état corporel a été amplement utilisée comme indice de l'état d'engraissement des brebis. Cependant, il faut tenir compte du fait qu'il s'agit d'une technique subjective développée avec des races anglaises sélectionnées pour la production de viande, et que l'on a trouvé de nombreuses variations dans la distribution de la graisse corporelle quand on compare les différents génotypes. Avec l'objetif de comparer la relation existante entre les dépôts adipeux corporels et la note de l'état corporel dans deux races espagnoles, on a utilisé 15 brebis Churras et 9 Merinas. Après l'abattage des animaux, les dépôts adipeux internes (épiploïque, mésentérique et périrénal) ont été séparés et pesés. La graisse de la carcasse et de la non-carcasse a été estimée en laboratoire. Les résultats de ce travail montrent que la relation entre la note de l'état corporel et les dépôts adipeux corporels n'est pas différente pour les races. Les brebis de race Churra présentent une proportion supérieure de graisse interne dans le poids vif vide par rapport à celles de race Merina, et une distribution différente des dépôts adipeux internes.*

Mots-clés : *Brebis, dépôts adipeux corporels, état corporel.*

Introduction

Most sheep production systems under grazing conditions are dependent on the ability of the animals to mobilize their body reserves during food restriction periods and to recover them when the food on offer increases.

Russel *et al.* (1969) developed a subjective technique, adapted from the one described by Jefferies (1961), in which each of six grades, from 0 to 5, were defined in terms of palpable characteristics in the lumbar region. It must be considered that this method was developed working with British sheep meat production genotypes, and variations in fat depots distribution has been showed when different genotypes are compared (Taylor *et al.*, 1989).

Some works have indicated breed differences in fat accumulation and, also, in fat partitioning. Milk production genotypes tend to deposit more of its total body fat internally and meat production ones in carcass fat (McClelland and Russel, 1972; Butler-Hogg, 1984). These breed differences in fat accumulation and distribution made necessary the development of specific prediction equations for body fat depots based on body condition score for different breeds (Wright and Russel, 1984).

Differences between Churra and Merina Spanish sheep genotypes have been showed in digestive tract proportions (Frutos *et al.*, 1992), diet selection (Revesado *et al.*, 1992), ruminal activity (Ranilla *et al.*, 1993), etc.

The present study was conducted in order to compare body fat depots and Body Condition Score relationship in these two breeds: Churra (noted for milk production) and Merina (noted for meat production).

Material and methods

Twenty-four mature ewes (averaging 5-7 years old) were used according to a 2x2 factorial design represented by: (i) 2 breeds: Churra (15 ewes), Merina (9 ewes); (ii) 2 Body Condition Score groups, according to the technique described by Russel *et al.* (1969): Good: BCS >2.5 (8 Churra and 4 Merina ewes), Poor: BCS <2.5 (7 Churra and 5 Merina ewes).

All animals were slaughtered, using the traditional method described by Mantecón *et al.* (1986).

Internal fat depots (omental, mesenteric and channel and kidney) were removed and weighed individually. Samples of carcass and non-carcass were minced. All of them were freeze-dried and their chemically fat content determined.

Analysis of variance and regression were carried out according to Steel and Torrie (1981) procedures.

Results and discussion

Empty body weights and body condition scores are given in Table 1. Means of EBW and BCS were similar for both breeds, but statistically different (P<0.001) for BCS groups. It wasn't found any significant interaction between breed and BCS.

Total body fat, carcass fat and non-carcass fat, expressed either in kg or as percentage, were affected by BCS (P<0.01) (Table 2). Sheep with a better BCS had always the higher values, what is comparable with some other studies made with different breeds (Russel *et al.*, 1969; McClelland and Russel, 1972; Teixeira *et al.*, 1989; Oregui, 1992; Mantecón *et al.*, 1993).

Contrary to that results, any significant differences between breeds in chemically fat distribution and accumulation were found (proportion of total body fat in carcass fat or in non-carcass fat) (Table 2).

Table 1. Body condition scores and empty body weights

	Churra		Merina		Significance	
	BCS <2.5	BCS >2.5	BCS <2.5	BCS >2.5	Breed	BCS
BCS	1.5 ± 0.13	3.1 ± 0.15	1.6 ± 0.17	3.2 ± 0.40	NS	***
EBW (kg)	25.5 ± 1.44	36.9 ± 0.84	29.6 ± 2.59	37.9 ± 5.94	NS	***

NS: non significant; ***P<0.001

Table 2. Body fat distribution

	Churra		Merina		Significance	
	BCS <2.5	BCS >2.5	BCS <2.5	BCS >2.5	Breed	BCS
Carcass fat						
kg	2.62 ± 0.477	6.69 ± 0.468	2.57 ± 0.725	5.79 ± 1.591	NS	***
/carcass weight	0.18 ± 0.025	0.31 ± 0.015	0.17 ± 0.034	0.26 ± 0.040	NS	***
Non-carcass fat						
kg	1.93 ± 0.372	4.17 ± 0.336	2.51 ± 0.763	3.96 ± 1.263	NS	**
/non-carcass weight	0.17 ± 0.024	0.29 ± 0.016	0.20 ± 0.043	0.28 ± 0.043	NS	***
Total body fat						
kg	4.56 ± 0.829	10.87 ± 0.520	5.09 ± 1.446	9.76 ± 2.826	NS	***
/Fleece-free EBW	0.16 ± 0.023	0.29 ± 0.010	0.17 ± 0.036	0.26 ± 0.039	NS	***

NS: non significant; **P<0.01; ***P<0.001

Total internal fat (TIF) and its components, expressed either in kg or as proportion of empty body weight (EBW) and TIF, are showed in Table 3.

The Churra ewes presented a higher proportion of TIF in the EBW than Merina ewes. In an earlier study, Frutos *et al.* (1993), reported a higher internal fat (dissected) respect EBW in Churra genotype. In the present study, we have also found that dissected internal fat distribution was different between both genotypes. As proportion of TIF, the omental depot was greater for Churra and the mesenteric for Merina.

Table 3. Total internal fat (TIF) and its components

	Churra		Merina		Significance	
	BCS <2.5	BCS >2.5	BCS <2.5	BCS >2.5	Breed	BCS
Perirenal fat						
kg	0.23 ± 0.054	0.82 ± 0.087	0.28 ± 0.136	0.56 ± 0.183	NS	***
/TIF	0.19 ± 0.014	0.27 ± 0.024	0.20 ± 0.046	0.25 ± 0.028	NS	*
Omental fat						
kg	0.60 ± 0.139	1.41 ± 0.246	0.37 ± 0.191	0.75 ± 0.342	NS	*
/TIF	0.46 ± 0.030	0.44 ± 0.044	0.29 ± 0.043	0.32 ± 0.053	**	NS
Mesenteric fat						
kg	0.44 ± 0.095	0.88 ± 0.069	0.43 ± 0.010	0.93 ± 0.250	NS	***
/TIF	0.35 ± 0.032	0.29 ± 0.030	0.51 ± 0.074	0.43 ± 0.052	**	NS
Total internal fat						
kg	1.28 ± 0.269	3.11 ± 0.339	1.08 ± 0.420	2.24 ± 0.704	NS	***
/EBW	0.05 ± 0.008	0.08 ± 0.008	0.03 ± 0.011	0.05 ± 0.009	*	**

NS: non significant; *P<0.05; **P<0.01; ***P<0.001

These differences probably reflect their different adaptation along time and production ability (milk and meat production, respectively). In Castilla-León, Churra genotype has been exploited, traditionally, feeding on available pastures and stubbles. On the contrary, Merino genotype has been exploited in trashumance conditions, where the available pastures are homogeneous along the year (Mantecón *et al.*, 1993).

When expressed in absolute terms, internal fat depots (omental, mesenteric and channel and kidney) were affected by BCS.

As proportion of TIF, channel and kidney fat depot was significantly higher from notes of BCS bigger than 2.5, as has previously considered in another breeds as Latxa, Rasa Aragonesa and Scottish Blackface (Russel *et al.*, 1971; Teixeira *et al.*, 1989; Oregui, 1992).

Mesenteric fat depot presented a higher development in animals with lower BCS, but this was not statistically significant (P=0.1538).

The regression relationships between body fat depots and BCS in Churra and Merina breeds are listed in Tables 4 and 5, respectively.

Table 4. Relationship between body fat depots (carcass fat: CF; non-carcass fat: NCF and total body fat: TBF) and BCS in Churra ewes

Equations	RSD	r^2
CF(g) = -866 + 2390 BCS	1113	0.808
NCF(g) = 1119 + 5893 log BCS	1064	0.522
TBF(g) = 1811 + 17964 log BCS	1825	0.776

Table 5. Relationship between body fat depots (carcass fat: CF; non-carcass fat: NCF and total body fat: TBF) and BCS in Merina ewes

Equations	RSD	r^2
CF(g) = -1884 + 2552 BCS	1261	0.826
NCF(g) = 2663 - 1114 BCS + 493 BCS^2	1681	0.522
TBF(g) = 3719 - 1204 BCS + 1001 BCS^2	2894	0.730

These relationships were not significantly different for Churra and Merina sheep. Nevertheless, when different equations for each genotype were used, more precise estimations were achieved.

Better prediction of carcass fat was obtained with a linear regression in both breeds. When consideration was given on non-carcass and total body fat, for Churra genotype, better predictions were achieved with semi-logarithmic regressions, but with quadratics for Merina.

As the results of this study are based on a comparison of two breeds with relatively few animals representing each breed, it does suggest that further studies are necessary.

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