Ultrasonic estimates of fat thickness, C measurement and longissimus dorsi depth in Rasa Aragonesa ewes with same body condition score

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Ultrasonic estimates of fat thickness, C measurement and longissimus dorsi depth in rasa aragonesa ewes with same body condition score

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SUMMARY - Ultrasonic estimates of fat thickness, C measurement and longissimus dorsi depth were assessed in 14 Rasa Aragonesa ewes with same body condition score. The ultrasonic estimates have been used for predicting total carcass fat and muscle. The 76% of the variation in carcass lumbar fat thickness was accounted for by variation in lumbar fat thickness assessed by ultrasonic machine, whereas 53% of the variation in C measurement was accounted. Nevertheless only 5% of variation in m. *Longissimus dorsi* depth was accounted for by variation in this measurement assessed by ultrasonics. The inclusion of cold carcass weight as an independent variable in a multiple regression with lumbar fat thickness assessed by ultrasonics and the same measurement obtained on carcass improve the precision of total carcass fat and muscle predictions (r=81 and 91%).

RESUME - On a estimé sur 14 brebis adultes Rasa Aragonesa la précision avec laquelle les ultrasons peuvent mesurer "in vivo" l'épaisseur du tissus adipeux sous-cutané, la mesure C et l'épaisseur du m. Longissimus dorsi, ainsi que l'utilisation de ces mesures comme prédicteurs du gras et du muscle total de la carcasse. L'épaisseur du gras lombaire déterminé "in vivo" par ultrasons exprime 76 et 53 p.100 respectivement des variations de l'épaisseur du gras lombaire et de la mesure C prise sur la carcasse, alors que l'épaisseur du m. Longissimus dorsi déterminé par ultrasons n'explique que 5 p.100 de la variation. L'incorporation des variables : poids de la carcasse froide et épaisseur du gras lombaire mesurée sur la carcasse et par ultrasons dans l'équation de régression multiple, améliore la précision pour prédire le gras ou le muscle total de la carcasse (r= 81 et 91 p.100 respectivement).

Introduction

The ultrasonic scanning have been used for predicting the subcutaneous fat, fat thickness and m. *Longissimus dorsi* depth and area of live pigs (Kempster *et al.,* 1979) and cattle (Eveleigh et al., 1985; Gresham *et al.,* 1986 and Bailey *et al.,* 1986).

In a detailed revision about the use of ultrasonics to estimate the cow carcass composition, Simm (1983) and Andersen (1984) showed that generally the areas of muscles are best predictors of carcass yield, muscle/bone ratio and weight of commercial joints and the fat thickness measurements are best estimators of fat and muscle contents.

A little information has been published about ultrasonics use in live ewes (Kempster *et al.*, 1982). Hiner (1958) had suggested that the ultrasonics have a little use in prediction fat thickness and m. *Longisssimus dorsi* area of ewes. Nevertheless Campbell *et al.* (1959) reported a significant correlation between *Longissimus dorsi* depth estimated by ultrasonics and measured on sheep carcass.

Moody *et al.* (1965) using 235 live lambs, for a period of three years, showed that ultrasonics predicted with an acceptable accuracy the fat thickness and m. *Longissimus dorsi* area, whereas the correlation between m. *Longissimus dorsi* area assessed by ultrasonics in live animal and the same measurement obtained on the carcass was only 0.66, and the correlation between subcutaneous fat thickness assessed by ultrasonics and the same measurement assessed on the carcass was 0.34.

Kempster *et al.* (1982) using an evaluation of two ultrasonic machines have found little precision for predicting the body composition of live sheep and questioned the use of these machines for prediction of the muscle in practical works.

According to different authors the higher difficulty for assess the mentioned parameters in sheep is the fleece. This difficulty can be removed by shearing the body region where the measurements are assessed.

The principal objective of the present study was to determine the precision of the use of ultrasound to predict the fat thickness, C measurement, *longissimus* depth and total carcass muscle and fat in Rasa Aragonesa ewes, with same body condition score.

Material and methods

14 Rasa Aragonesa ewes aged 3 years with the same body condition score (3) were taken from the experimental flock of Servicio de Investigación Agraria de la Diputación General de Aragón.

24 hours before slaughter the lumbar fat thickness (Figure 1) and m. *Longissimus dorsi* depth (Figure 2) was assessed by ultrasonic machine (Toshiba Sonolayer scanner, model Sal - 32 B, with a 5,0 MHz sounder) on live animal on the 4th lumbar vertebrae. The ewes were slaughtered in the experimental slaughter house of SIA. - DGA, after 24 hours fasting.

The carcasses were cooled at 6°C during 24 hours. After then the fat thickness was measured on carcass with calibre on the same anatomical point where assessed in live animal with ultrasonic machine.

The carcasses were halved carefully and the left side was dissected into muscle, bone, subcutaneous,

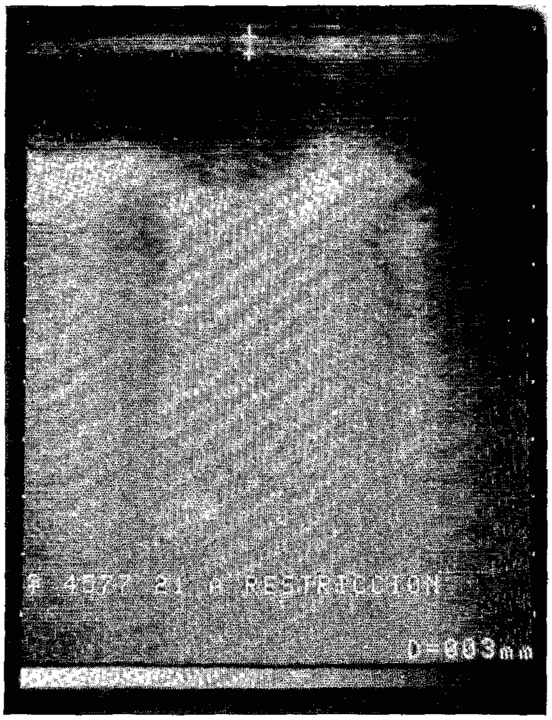

Fig. 1. Lumbar fat thickness assessed by ultrasonic machine.

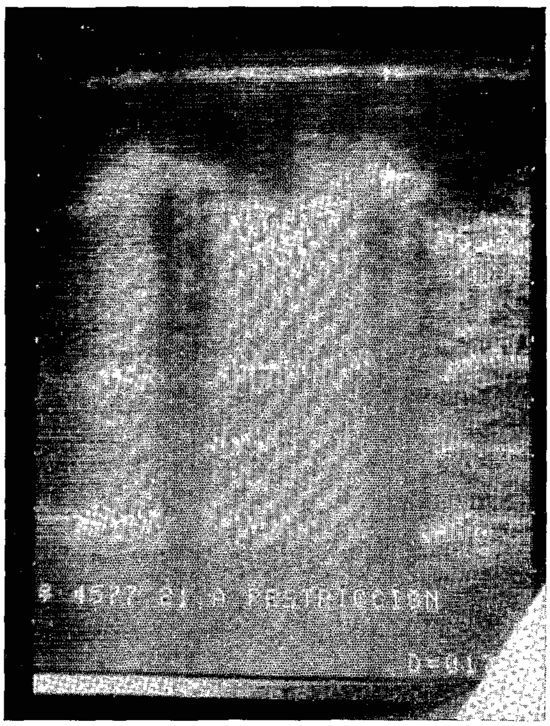

Fig. 2. M. Longissimus dorsidepth assessed by ultrasonic machine.

intermuscular, kidney and pelvic fat. The B measurement (depth of eye muscle - the greatest distance at right angles to A measurement on the same surface) and C measurement (thickness of back-fat over the deepest part of the eye muscle) (Palsson, 1939) were measured on the cut between 3rd and 4th lumbar vertebrae of a lumbar joint described by Delfa, Teixeira and Colomer- Rocher (1989).

The relationships between the measurements assessed by ultrasonic machine in live animals and measured on carcass were analyzed using correlation and regression analyses (Steel and Torrie, 1980).

Results and discussion

The correlation coefficients between the measurements assessed by ultrasonic machine in live animals and measured on carcass, are showed in Table 1.

76% of the variation in carcass lumbar fat thickness was accounted for by variation in lumbar fat thickness assessed in live animal by ultrasonic machine, whereas 53% of the variation in C measurement was accounted. The correlation coefficients are different because there are different subcutaneous fat distribution on the various anatomical regions and confirm the variation of correlation coefficients reported for different authors, according the anatomical point selected for ultrasonic measurements Simm (1983).

The small correlation between m. *Longissimus dorsi* depth assessed by ultrasonics and the same characteristic measured on the carcass (0.22), suggest that ultrasonics are not a good technic to evaluate this measurement, because the depth is highly correlated with m. *Longissimus dorsi* weight (Starke and Joubert, 1961).

Nevertheless Moody *et al.* (1965) found the correlation coefficients of 0.52, 0.63 and 0.66 between m. *Longissimus dorsi* area and the real area, respectively for the first, second and third year of their experiment.

Figures 3, 4 and 5 summarized the relationships previously exposed and the Table 2 show the correlation coefficients between the total carcass fat with the cold carcass weight and measurements measured on live animal with ultrasonic machine and measured on carcass. Table 3 shows the correlation coefficients between total carcass muscle with the cold carcass weight, measurements assessed by ultrasonics and the same measurements obtained on carcass. All coefficients are significant ($P<0.01$).

The inclusion of cold carcass weight as an independent variable in a multiple regression with lumbar fat thickness assessed by ultrasonics and the same measurement obtained on carcass improve the precision of total carcass fat and total carcass muscle predictions:

Total carcass fat = 227.45 CCW + 454.24 LFThC - 253.86 LFThUlt. - 1172.19 ($r=0.90$; $s_{yx}=551.66$)

Total carcass muscle = 625.51 CCW + 70.68 LFThC - 453.96 LFThUlt + 671.03 ($r=0.95$; $s_{yx}=403.28$)

These results suggest that the inclusion of measurements assessed by ultrasonics and obtained on carcass as independent variables in a multiple regression are good predictors of muscle and carcass weights; this agrees with the results of Simm (1983) and Anderson (1984) obtained working with cattle.

Conclusions

From the results obtained, we could conclude:

- The ultrasonics estimates are good predictor of lumbar fat thickness in Rasa Aragonesa ewes;

- The anatomical region, where we assessed the fat thickness in live animals, can change the prediction of carcass fat thickness;

- The ultrasonics do not estimate with accuracy the m *Longissimus dorsi* depth;

- The lumbar fat thickness assessed by ultrasonics in live animal or measured on carcass are the best predictors of total carcass muscle and fat.

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Table 1. Correlation coefficients between measurements obtained on carcass and assessed in live animals by ultrasonic machine.

	LFThUlt	LFThUlt	B Ult
LFTh C	0.87**	-	-
C	-	0.73**	-
B	-	-	0.22 N.S.

** P< 0.01
NSP>0.05
Lumbar fat thickness measured on carcass (LFThC)
Lumbar fat thickness assessed by ultrasonics (LFThUlt)
C measurement (C)
B measurement obtained on carcass (B)
B measurement assessed by ultrasonics (B Ult)

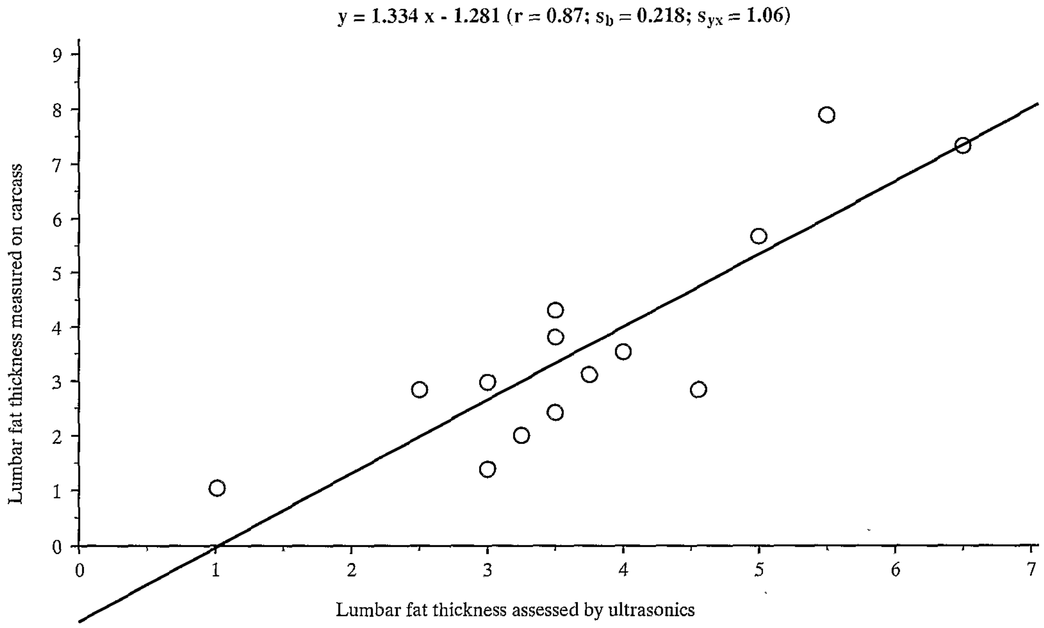

Fig. 3. Relationship between Lumbar fat thickness assessed by ultrasonics (x) and measured on carcass (y)

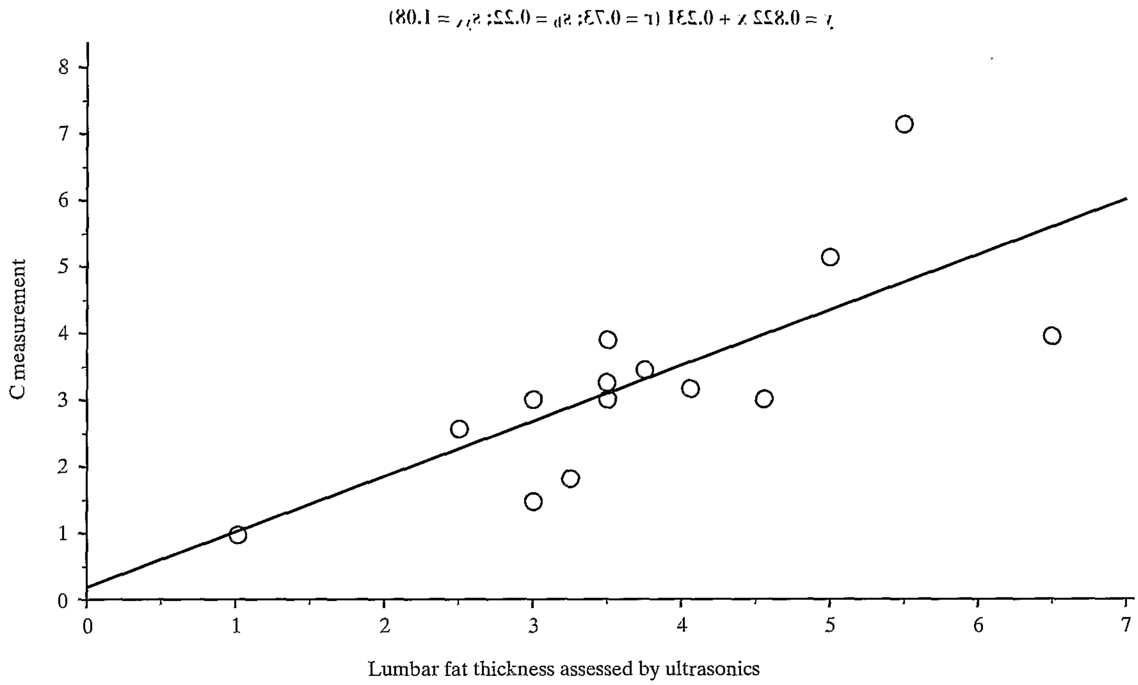

Fig. 4. Relationship between Lumbar fat thickness assessed by ultrasonics (x) and measurement C (y)

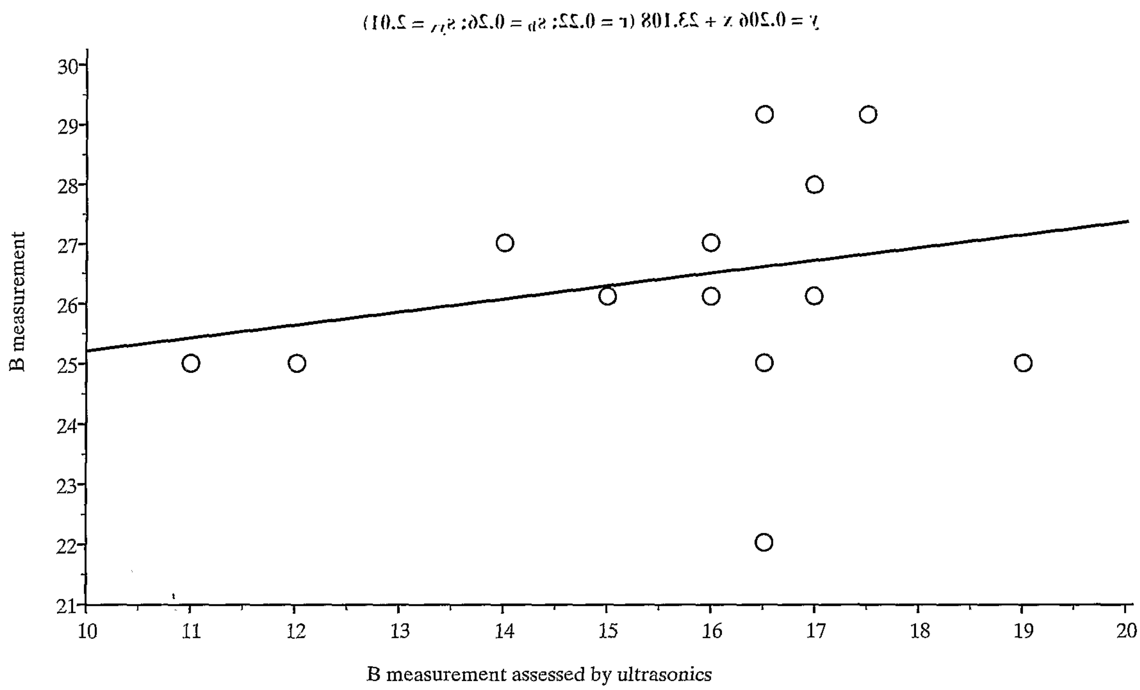

Fig. 5. Relationship between B measurement assessed by ultrasonics (x) and B measurement (y)

Table 2. Correlation coefficients between total carcass fat and cold carcass weight, measurements obtained on carcass and assessed in live animals by ultrasonic machine.

	TOTAL CARCASS FAT
LFThUlt	0.63**
LFThC	0.81**
CCW + LFThUlt	0.81**
LFThUlt + B Ult	0.82**
CCW + LFTh C	0.89**
CCW + LFThC + LFThUlt	0.90**

** P< 0.01
Lumbar fat thickness measured on carcass (LFThC)
Lumbar fat thickness assessed by ultrasonics (LFThUlt)
B measurement assessed by ultrasonics (B Ult)
Cold carcass weight (CCW)

Total carcass fat = 227.45 CCW + 454.24 LFThC - 253.86 LFThUlt - 1172.19
(r=0.90; s_{yx}=551.66)

Table 3. Correlation coefficients between total carcass muscle and cold carcass weight, measurements obtained on carcass and assessed in live animals by ultrasonic machine.

	TOTAL CARCASS MUSCLE
CCW	0.88 **
CCW + B Ult	0.88**
CCW + LFThUlt	0.90**
CCW + LFThUlt + B Ult	0.90**
CCW + LFTh C	0.93**
CCW + LFThC + LFThUlt	0.95**

** P< 0.01
Lumbar fat thickness measured on carcass (LFThC)
Lumbar fat thickness assessed by ultrasonics (LFThUlt)
B measurement assessed by ultrasonics (B Ult)
Cold carcass weight (CCW)

Total muscle fat = 625.51 CCW + 70.68 LFThC - 453.96 LFThUlt - 671.03
(r=0.95; s_{yx}=403.28)