Predicting Horse Skin Weight from Carcass Weight

Predicción del Peso de la Piel de Caballo a Partir del Peso de la Canal

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SUMMARY: A study was conducted to provide information on the skin weight of Pyrenean horses and to determine whether there is a measurement to predict this based on carcass weight. Hot carcass weight (HCW) and fresh skin weight (SW) were recorded for 58 horses aged 12 months entering a Catalan commercial slaughter facility between September 2009 and June 2010. Data on the breeder, age and coat characteristics were collected and subsequently collated for each animal. Prior to analysis, horses were subdivided into sex and coat groups. Data did not differ ($P < 0.001$) among these. The absence of differences in SW could be viewed as a reflection of limited nutritional differences between seasons. Regression procedures were used to develop equations to predict SW from HCW. Equations predicting SW had significant bias, 7.3-7.5 kg, and low R^2 values. The coefficients of determination obtained for predicting skin weight were not satisfactory and therefore validation was not considered worthwhile.

KEY WORDS: Animal measurements; “Cavall Pirinenc Català”; Predictive equations.

INTRODUCTION

The effect of differences among breeds on equine abattoirs under seasonal pasture-based systems has received insufficient attention. In Catalunya (Spain), horse meat is valued as per kilogram delivered to the farmer. Producers receive only 3-4 for the entire skin, regardless of its weight, length or quality. Although the skin weight or quality has no effect on its monetary value, horse skin is a good material for leather manufacture.

Studies describing the degree of carcass finish in the Catalan horse population have not been conducted. Nevertheless, if value-based marketing is to become a reality for the horse industry, an accurate method of estimating certain aspects of body composition is essential. This is also true for non-carcass dressing. The development of prediction equations would make it possible to put a value on the economic loss associated with possibly failing to achieve acceptable standards of finish.

The aim of this study was to develop prediction equations for skin weight under production conditions based on hot carcass weight in the “Cavall Pirinenc Català” breed, as the effect of the two variables has not been investigated. The “Cavall Pirinenc Català” breed (Catalan Pyrenean Horse) is an equine breed found in the NE Pyrenees along the Spanish and French border (Fernández *et al.*, 2009). The

body of the breed has long proportions and short legs. It is a compact horse with a broad build, predominantly chestnut, although there are also strawberry, bay, roan and other colored animals (Parés & Parés, 1997). The estimated live weight at 12 months of age is about 356.8 kg. Horses are never stabled and are grazed throughout the year. It is an inexpensive and undemanding breed bred for meat that is reared out of doors year round.

MATERIAL AND METHOD

The data used in this study were obtained from 58 horses (31 males and 27 females) 12 months of age (with no erupted permanent incisors) and measured at a commercial slaughter facility between September 2009 and June 2010. The dataset represented horses from six different farms in northern Catalunya (Spain) and were reared under relatively uniform housing, feeding and management conditions. The killing was typical of the normal method of equine slaughter at this particular abattoir facility. The skin was removed by mechanical tearing with a lathe and cuts made to ensure that fat and muscle tissues did not adhere to the skin were always the same. Hot carcass (HC) and fresh skin (S, obtained before the block was formed) weights were

recorded for each animal. No animal presented any pathological appearance or was excessively dirty at antemortem inspection, and none of the females was gestational.

The animals were assigned to six different coat categories: chestnut, roan, strawberry, straw, black and chestnut bay. The numbers for each coat and overall animal proportions are shown in Table I.

The data were analyzed using PAST, version 1.94b (Hammer & Harper, 2009). A regression analysis with Data Fit, version 9.0.59 (<http://www.curvefitting.com>), was used to evaluate the association between predicted and observed hot carcass weight.

RESULT AND CONCLUSIONS

Both SW and HCW presented a normal distribution ($W>0.956$). The average SW was 22.2 ± 4.1 kg with an average percentage of 5.81 ± 1.05 %, clearly lower than those obtained for cows (Özlütürk, *et al.*, 2004; Parés, 2007) and sheep (Banerjee *et al.*, 2009). No differences appeared between male and female skin percentage ($t<0.001$) or between coat types ($F_{4, 52}=0.6413$).

Table I. Number and skin weight of animals in each coat category (N, average (kg) $\pm$ des.est.)

	Males	Females	TOTAL
Chestnut	22 (23.7 $\pm$ 4.8)	18 (21.5 $\pm$ 3.6)	40 (22.7 $\pm$ 4.4)
Strawberry	3 (21.1 $\pm$ 0.6)	0	3 (21.1 $\pm$ 0.6)
Roan	0	1 (27.6)	1 (27.6)
Black	0	2 (19.0 $\pm$ 2.5)	2 (19 $\pm$ 2.5)
Straw	2 (22.1 $\pm$ 0.9)	2 (18.9 $\pm$ 3.9)	4 (20.5 $\pm$ 2.9)
Chestnut bay	4 (20.6 $\pm$ 3.7)	4 (20.7 $\pm$ 2.0)	8 (20.7 $\pm$ 2.8)
TOTAL	31 (23.0 $\pm$ 4.4)	27 (21.2 $\pm$ 3.5)	58 (22.2 $\pm$ 4.1)

Table II. "Best" prediction equations

	Model 1	Model 2	Model 3
Sum of residuals	-1,7142E+07	1,2573E+06	-1,7142E+07
Average residual	-6,3489E+05	4,6566E+04	-6,3489E+05
Residual sum of squares (absolute)	9,9957E+14	1,0024E+14	9,9957E+14
Residual sum of squares (relative)	9,9957E+14	1,0024E+14	9,9957E+14
Standard Error of the Estimate	2,3565E+14	2,2969E+14	2,3565E+14
Coefficient of multiple determination (R^2)	0.6860	0.6851	0.6860
Proportion of variance explained	6,8603E+07	6,8515E+07	6,8603E+07
Adjusted coefficient of multiple determination (R_a^2)	0.5464	0.5691	0.5464

Model 1: $Y = a \cdot x^8 + b \cdot x^7 + c \cdot x^6 + d \cdot x^5 + e \cdot x^4 + f \cdot x^3 + g \cdot x^2 + h \cdot x + i$

Model 2: $Y = a \cdot x^7 + b \cdot x^6 + c \cdot x^5 + d \cdot x^4 + e \cdot x^3 + f \cdot x^2 + g \cdot x + h$

Model 3: $Y = a \cdot x^8 + b \cdot x^7 + c \cdot x^6 + d \cdot x^5 + e \cdot x^4 + f \cdot x^3 + g \cdot x^2 + h \cdot x + i$

Figure 1 shows the relationship between actual SW and HCW. SW presents no good correlation with HCW ($r=0.420$) (Fig.1). The "best" prediction equations with higher coefficients of multiple determination ($R^2>0.57$) for SW are presented in Table II. All of them were from sixth to eighth order polynomial. The low coefficients of determination indicate that the equations predicted differences in SW rather badly. The prediction equation resulted in a significant bias of 7.3-7.5 kg.

In summary, the coefficients of determination obtained for predicting skin weight were not satisfactory and therefore validation was not considered worthwhile. Hot carcass weight is not a useful predictor of skin weight and is therefore of limited value for predicting it. The absence of differences in skin weight could be also viewed as a reflection of limited nutritional differences between seasons.

Conflict of interest statement: The author of this paper has no financial or personal relationship with other people or organizations that could inappropriately influence or bias the content of the paper.

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Fig. 1. XY plot

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RESUMEN: Se realizó un estudio para proporcionar información sobre el peso de la piel de los caballos de los Pirineos y para determinar si existe una medida para predecir esta, basado en el peso de la canal. Peso de la canal caliente (PS) y peso de la piel fresca (SW) se registraron en 58 caballos de 12 meses provenientes de un centro comercial Catalán faenador entre septiembre de 2009 y junio de 2010. Los datos sobre las características reproductoras, la edad y el pelo se recogieron y posteriormente cotejados para cada animal. Antes del análisis, los caballos fueron subdivididos en grupos de sexo y pelaje. Los datos no fueron diferentes ($P < 0,001$) entre estos. La ausencia de diferencias en el SW podría ser visto como un reflejo de la limitada diferencias nutricionales entre las estaciones. Procedimientos de regresión fueron utilizados para desarrollar ecuaciones para predecir SW desde el PS. Las ecuaciones de predicción SW tenía un sesgo significativo, 7,3-7,5 kg, y valores bajos R². Los coeficientes de determinación obtenidos para la predicción de peso de la piel no fueron satisfactorios, por lo que la validación no se consideró que vale la pena.

PALABRAS CLAVE: Mediciones animales; “Cavall Pirinenc Català”; ecuaciones predictivas

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