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Short communication. Prediction of weight of major cuts by mean slaughter or carcass weight in Iberian pigs

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Abstract

The aim of this study was to assess the possibility of predicting the weight of major joints in the carcass of Iberian pigs. One hundred and nineteen castrated Iberian pigs of the Torbiscal line, fattened under free-range conditions, were used. Simple regression analyses were carried out to find the relationships between slaughter or carcass weight with ham, foreleg and loin weights. The best predictions were obtained by linear and quadratic functions. To determine the accuracy of the regression equations data from 20 free-ranged Iberian pigs barrows of the Torbiscal line and 12 of the Guadyerbas line were used. A good prediction of ham weight was obtained both with linear and quadratic functions in Torbiscal pigs when the slaughter or carcass weight was considered as independent variable. However, in these pigs the prediction of loin weight was weak. For the Guadyerbas line the slaughter weight, in linear and quadratic functions, predicted adequately ham weight, but overestimated foreleg weight. It is concluded that slaughter or carcass weight can be used to predict ham weight in Iberian pigs. Since genetic line affects the accuracy of the regression equations, specific equations should be developed for each line.

Additional key words: foreleg, ham, loins.

Resumen

Comunicación corta. Predicción del peso de las partes nobles de la canal mediante el peso al sacrificio o el peso canal en cerdos Ibéricos

El objetivo de este estudio fue investigar la posibilidad de predecir el peso de las partes nobles de la canal en el cerdo Ibérico. Se utilizaron 119 cerdos Ibéricos de la estirpe Torbiscal acabados en montanera. Se calcularon ecuaciones de regresión simple con el fin de buscar la relación entre el peso de jamones, paletas y lomos con el peso al sacrificio o canal, logrando los mejores ajustes mediante funciones lineales o cuadráticas. Para determinar la fiabilidad de las ecuaciones de regresión calculadas se utilizaron los datos procedentes de 20 cerdos Ibéricos de la estirpe Torbiscal y de 12 de la estirpe Guadyerbas acabados en montanera. La cantidad de jamones de la estirpe Torbiscal se predijo adecuadamente mediante funciones lineales o cuadráticas que consideraban como variables independientes el peso al sacrificio o el peso canal. La cantidad de lomos de esta estirpe también se predijo adecuadamente por ecuaciones lineales o cuadráticas con el peso vivo como variable independiente. Para la estirpe Guadyerbas, el peso al sacrificio incluido como variable independiente en ecuaciones lineales o cuadráticas fue un buen predictor de la cantidad de jamones, pero sobreestimaba la cantidad de paletas. Se concluye que el peso al sacrificio o el peso canal permiten predecir aceptablemente el peso de los jamones en cerdos Ibéricos, aunque la línea genética tiene influencia sobre la fiabilidad de las ecuaciones de regresión predictoras.

Palabras clave adicionales: jamones, lomos, paletas.

Iberian pig production in Spain has recently reached 2,000,000 animals per year. However, due to geographical limitations of the mediterranean forest (*Quercus rotundifolia* and *Q. suber*) and to annual variation in acorn production, only about 15% of these Iberian pigs are produced under traditional free-range conditions fed acorns and grass (Daza *et al*., 2006a).

In the Iberian pig production, the carcass characteristics, especially the ham, foreleg and loin yield, have an outstanding economic importance for the industry. Consequently, the prediction of the yield of the major

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cuts by means of easy measurements for producers such as live weight before slaughter or carcass weight, is interesting for producers and for the industry. It could help to prevent possible problems that appear in the commercial setting (fake practices).

Some previous experiments have calculated, by means of simple regression equations, the relationships between slaughter weight and ham, foreleg and loin weights of the carcass in Iberian pigs (Espárrago, 1998). However, there are not, to our knowledge, studies that have verified the accuracy of such equations to predict carcass joints in Iberian pigs. Therefore, the aim of this study was to assess the possibility of predicting the weight of the major joints from Iberian pigs, raised under free-range conditions, by means of simple regression equations that included as independent variable the slaughter or carcass weight.

One hundred and nineteen Iberian pig barrows of the Torbiscal line (14-15 months of age) from the *Centro de Investigación Agropecuaria* «El Dehesón» del Encinar, Junta de Comunidades de Castilla La Mancha, Oropesa, Toledo (Spain) were used. Animals were weighed 16 h before slaughter and slaughtered at a local slaughter house where weight of the carcass, trimmed hams, trimmed forelegs and loins were taken. During the fattening period all pigs were raised under free-range conditions. The slaughter and carcass weights varied between 118.2 and 192.7 and 93.4 and 154.6 kg respectively. The average slaughter and carcass weight were 149.5 ± 13.3 and 118.5 ± 11.4 kg respectively. Simple regression equations were carried out to find the relationships between slaughter or carcass weights (independent variables) with weigth of hams, forelegs and loins (dependent variables). The data were analysed by SAS program (SAS, 1999).

To determine the accuracy of the calculated regression equations 20 additional Iberian barrows of the Torbiscal line and 12 Iberian barrows of the Guadyerbas line from the same mentioned farm were used. These two groups of pigs were also weighed, approximately, 16 h before slaughter and slaughtered at the same local slaughterhouse where weight of the carcass, trimmed hams, trimmed forelegs and loins were also taken. During the fattening period these pigs were also raised under free-range conditions fed acorn and grass. The slaughter and carcass weights of the Torbiscal pigs varied between 122.0 and 168.0 and 94.0 and 128.8 kg respectively and the average slaughter and carcass weight were 152.6 ± 10.7 and 117.5 ± 8.7 kg respectively, whereas slaughter and carcass weights varied between 116.0 and 140.0 and 94 and 112.5 kg respectively and the average slaughter and carcass weight were 125.4 ± 8.6 and 100.8 ± 7.3 kg respectively for Guadyerbas pigs. Predicted ham, foreleg and loin weights from these two groups of pigs were calculated from the regression equations corresponding to a group of 119 Iberian pigs of the Torbiscal line. The data were analysed by paired t-test of the actual and predicted ham, foreleg and loin weights according to Swanteck *et al.* (1999) and Pearson's correlation coefficients were also used to discern relationships between actual and predicted ham, foreleg and loin weights.

Regression equations that relate ham, foreleg and loin weights with slaughter or carcass weight in the 119 barrows of the Torbiscal line are presented in Table 1.

Table 1. Linear and quadratic regression equations between hams (H), forelegs (F) and loins (L), weight (kg) and slaughter (SW) or carcass (CW) weights (kg) for free-range pigs

Equation	No.	R^2	RSD (kg)	P <
$H = 3.35 + 0.12\ SW$	(1)	0.70	1.04	0.0001
$H = -5.57 + 0.24\ SW - 0.0004\ SW^2$	(2)	0.70	1.04	0.0001
$H = 4.64 + 0.14\ CW$	(3)	0.71	1.03	0.0001
$H = -4.17 + 0.29\ CW - 0.0006\ CW^2$	(4)	0.71	1.08	0.0001
$F = 4.51 + 0.064\ SW$	(5)	0.64	0.65	0.0001
$F = 7.98 + 0.018\ SW + 0.0002\ SW^2$	(6)	0.64	1.23	0.0001
$F = 5.41 + 0.074\ CW$	(7)	0.61	0.67	0.0001
$F = 7.70 + 0.035\ CW + 0.0002\ CW^2$	(8)	0.62	0.87	0.0001
$L = 0.69 + 0.019\ SW$	(9)	0.34	0.36	0.0001
$L = 0.070 + 0.027\ SW - 0.00003\ SW^2$	(10)	0.35	0.73	0.0001
$L = 0.042 + 0.022\ CW$	(11)	0.37	0.96	0.0001
$L = 1.80 + 0.0063\ CW + 0.00007\ CW^2$	(12)	0.37	0.36	0.0001

n: 119 Torbiscal pigs for H and F and 97 pigs for L. R^2: coefficient of determination. RSD: residual standard deviation.

Table 2. Predicted *vs.* actual hams, forelegs and loins weights (means ± standard deviation) for free-range Torbiscal pigs

Actual value (kg)	Equation[1]	Predicted value (kg)	t value	P[2]	Correlation coefficient	P[3]
Hams	(1)	21.37 ± 1.27	0.90	> 0.1	0.81	0.0001
	(2)	20.86 ± 1.16	0.98	> 0.1	0.76	0.0001
21.14 ± 1.89	(3)	21.33 ± 1.29	0.74	> 0.1	0.81	0.0001
	(4)	21.23 ± 1.28	0.34	> 0.1	0.77	0.0001
Forelegs	(5)	14.32 ± 0.69	0.53	> 0.1	0.69	0.0001
	(6)	15.37 ± 0.74	5.83	< 0.0001	0.70	0.0001
14.41 ± 1.03	(7)	14.05 ± 0.62	2.08	< 0.05	0.68	0.0001
	(8)	14.57 ± 0.67	0.96	> 0.1	0.68	0.0001
Loins	(9)	3.56 ± 0.35	1.50	> 0.1	0.67	0.0001
	(10)	3.50 ± 0.33	0.55	> 0.1	0.66	0.0001
3.47 ± 0.33	(11)	2.75 ± 0.35	11.02	< 0.0001	0.64	0.0001
	(12)	3.60 ± 0.37	2.06	< 0.05	0.65	0.0001

[1] Equations are referred to Table 1. [2] Probability that actual and predicted means are equal. [3] P value of correlation coefficient.

The best relationships between independent and dependent variables were obtained by means of linear and quadratic functions. Potential, exponential and logarithmic functions were also calculated, but the determination coefficient (R^2) and residual standard deviation (RSD) values were lower and higher respectively than in the linear and quadratic functions. In both cases, slaughter weight accounted for 70% and 64% of the variation in ham and foreleg weights respectively, whereas in the linear and quadratic regression equations slaughter weight explained 34% and 35% respectively of the variation in loin weight. In the linear and the quadratic regression equations, the carcass weight accounted for 71% and 37% of the variation in ham and loin weights respectively, whereas in the linear and quadratic regression carcass weight accounted for 61 and 62% respectively of the variation in foreleg weight.

As it was expected, the weight of the hams, forelegs and loins increased significantly ($P < 0.0001$) with slaughter and carcass weights (Dobao *et al.*, 1985, 1987 ; De Pedro, 1987). Latorre *et al.* (2004) observed in heavy pigs a significant linear regression between slaughter weight and hams and forelegs weights, and estimated that slaughter weight accounted for 79% and 50% of the variation in hams and foreleg weights, respectively. Daza *et al.* (2006b) found in Iberian pigs that hams and forelegs weight increased 1.4 and 0.6 kg respectively per each 10 kg of slaughter weight increase, and that slaughter weight explained 64.9% and 47.1% respectively of the variation in hams and forelegs weight.

As shown in Table 2 results of the linear and quadratic functions are good predictors of ham weight in Torbiscal pigs when the slaughter or carcass weight are considered as independent variable. However, only the linear function with slaughter weight or quadratic function with carcass weight as independent variable were good predictors of foreleg weight. The prediction of loin weight was weak when slaughter weight was included as independent variable and carcass weight was not an adequate predictor for this variable.

Predicted *vs.* actual joint weights for Guadyerbas pigs are shown in Table 3. For this line of Iberian pigs the slaughter weight, in linear and quadratic functions, predicted adequately ham weight, but overestimated foreleg weight. Also slaughter weight in a quadratic function was a good predictor of loin weight. Carcass weight was not a good predictor of weights of cuts for Guadyerbas pigs, which can be explained because Guadyerbas is a Iberian pig line that has higher fat weight and lower ham and foreleg weights than Torbiscal line (Dobao *et al.*, 1985).

It is concluded that slaughter or carcass weight are easy measurements available for producers to predict ham weights in Torbiscal pigs. To predict adequately ham weights of other cuts in Iberian pigs from slaughter or carcass weights it is necessary to calculate regression equations between such weights and carcass major joints weights for each genetic line of Iberian pigs.

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Table 3. Predicted *vs.* actual hams, forelegs and loins weights (means ± standard deviation) for free-range Gyadyerbas pigs

Actual value (kg)	Equation[1]	Predicted value (kg)	t value	P[2]	Correlation coefficient	P[3]
Hams	(1)	18.40 ± 1.04	0.77	> 0.1	0.83	0.001
	(2)	18.21 ± 1.20	0.077	> 0.1	0.83	0.001
18.23 ± 1.37	(3)	18.75 ± 1.02	2.01	> 0.05	0.75	0.01
	(4)	18.93 ± 1.24	2.60	< 0.05	0.74	0.01
Forelegs	(5)	12.54 ± 0.55	10.21	< 0.0001	0.85	0.001
	(6)	13.40 ± 0.59	18.90	< 0.0001	0.85	0.001
11.41 ± 0.70	(7)	12.86 ± 0.54	11.15	< 0.0001	0.78	0.01
	(8)	13.27 ± 0.55	14.68	< 0.0001	0.78	0.01
Loins	(9)	3.07 ± 0.16	2.39	< 0.05	0.70	0.01
	(10)	2.98 ± 0.17	0.49	> 0.1	0.70	0.01
2.96 ± 0.23	(11)	2.26 ± 0.16	13.46	< 0.0001	0.62	0.05
	(12)	3.15 ± 0.15	3.68	< 0.01	0.63	0.05

[1] Equations are referred to Table 1. [2] Probability that actual and predicted means are equal. [3] P value of correlation coefficient.

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