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Relation between conformation grade and different measurements of IGP *Ternera de Navarra* beef carcasses using computer image analysis

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SUMMARY – The relationship between the conformation score (SEUROP scale) and 32 morphologic measures of the carcass has been studied in 24 carcasses of young bulls of Pirenaica breed from the IGP *Ternera de Navarra*. Measures were made on 2 photographs of the carcass (lateral and dorsal) in the slaughter line. The measurements were made by an image analysis software. The results show that conformation score is positively correlated with weight (r = 0.58; P<0.05), area (r = 0.70; P<0.01) and compactness (r = 0.80; P<0.001) of the carcass. The highest value of correlation (r = 0.87; P<0.001) was obtained between the conformation score and measurement h, indicator of the degree of convexity of the round of the carcass. After a *stepwise* regression analysis, in which the score of conformation was considered as dependent variable and the 32 morphologic measures as independent variables, the combination of 3 parameters from them explained 93% (r^2=0.93) of the variability of the conformation score. These results would show that the classification of the carcass according to conformation could be made by methods with higher objectivity than the current visual evaluation of the carcass in the SEUROP system.

Keywords: Beef carcass, conformation, image analysis.

RESUME – *"Relation entre la note de conformation et les différentes mesures chez les carcasses de veaux sous IGP Ternera de Navarra à l'aide de l'analyse d'images par ordinateur". Dans 24 carcasses de veaux mâles de race Pirenaica appartenant à l'IGP* Ternera de Navarra *on a étudié la relation existant entre la note de conformation (échelle SEUROP) et diverses mesures morphologiques effectuées dans la carcasse. Ces mesures ont été de 32 et ont été effectuées sur 2 photographies de la carcasse (une latérale et une autre dorsale) prises dans la ligne d'abattage. Les mesures ont été effectuées par ordinateur par la technique d'analyse d'image. Les résultats obtenus montrent que la note de conformation a été positivement corrélée au poids (r = 0,58 ; P<0,05), surface (r = 0,70 ; P<0,01) et compacité (r = 0,80 ; P<0,001) de la carcasse. Aussi, on a obtenu une valeur de corrélation r = 0,87 (P<0,001) entre la note de conformation et la mesure h, indicatrice du degré de convexité du tiers postérieur de la carcasse. On a effectué une analyse de régression stepwise, dans laquelle on a considéré la note de conformation comme variable dépendante et les 32 mesures effectuées dans la carcasse comme variables indépendantes, et on a obtenu une combinaison de 3 de ces paramètres qui expliquent 93% de la variabilité de la note de conformation (r^2 = 0,93). Ces résultats nous inclineraient à penser que la classification des carcasses selon leur conformation pourrait être effectuée par des méthodes avec un plus grand degré d'objectivité que le système SEUROP utilisé actuellement.*

Mots-clés : *Carcasse bovine, conformation, analyse d'image.*

Introduction

In Europe conformation and fat cover are the main parameters for establishing the quality and the price of bovine carcasses. In order to grade carcasses for conformation score, SEUROP classification scale is used (EC 2237/1991). This system is based on the use of photographic patterns to grade carcasses in 6 classes according to their conformation. With the aim of becoming this system more faster, objective and automatic new classification systems are being developed in the last years based on the use of video image analysis at the moment of slaughter (f.e. BCC2 in Denmark; Normaclass in France; VBS-2000 in Germany and Viascan in Australia). These systems are based on the use of equations for predicting carcass yield from different measures made in the carcass. Besides artificial neuronal networks (Hill *et al.,* 2000) and artificial intelligence techniques (Díaz *et al*., 2006) are being applied to improve the accuracy of the estimation. However, depending on factors such as the specie, the genotype, the age, the accuracy of these equations could vary and perhaps the most precise equations for a specific market could not be appropriated for another different (Allen and Finnerty, 2000). The present work studies the relation between conformation score assigned

according to SEUROP system and different morphologic measures obtained by an image analysis software in bovine carcasses from yearling bulls raised under the IGP *Ternera de Navarra* (O.F. 19/06/2000).

Material and methods

24 carcasses from Pirenaica young bulls from the *Ternera de Navarra* IGP (379±12.8 kg of LW and 356±15.9 d of age) have been used. The animals were slaughtered at *La Protectora* slaughter house (Pamplona, Spain). The official graders of this slaughter house classified each carcass according to conformation score using SEUROP scale (subdivided each score in 3 subclasses, scale 1-18).

Previously, in the slaughter line two photographies were taken (Sony DSC-S75-S85 digital camera) from each carcass, one from the right lateral side and another one from the dorsal side (Fig. 1). Based on the anatomical measures described by de Boer *et al*. (1974), to characterize bovine carcasses, different lengths, perimeters, areas and diameters were determined by an image analysis software (Optimas V. 6.5; Media Cybernetics, USA) obtaining a whole of 32 measurements.

Fig. 1. Image of the right lateral side and dorsal image of the carcass in the slaughter line.

Pearson coefficients correlations between the conformation score (SEUROP scale, transformed to 1-18) and the considered 32 morphologic measures were calculated. A stepwise regression analysis between conformation score of each carcass and the different measures obtained by image analysis has been calculated for predicting the conformation score assigned to each carcass.

Results and discussion

The results show that there is a significant correlation coefficient between conformation score and carcass weight ($r = 0.58$; $P<0.05$). It agrees with the results obtained by Goyache *et al*. (2006) in young bulls of several Spanish breeds and it confirms that conformation improves with the development and growing of the animals. Conformation score showed a higher correlation coefficient with carcass area ($r = 0.70$; $P<0.01$) than with carcass weight.

In order to correct the influence that could have the weight or the area of the carcass over the assignation of conformation score, a new parameter was calculated, carcass compactness, that was

defined as the relationship between weight and length of the carcass (de Boer *et al.,* 1974). In the present work the correlations between this parameter and conformation score was r = 0.42 (P<0.10). Nevertheless, other parameters of compactness based on the profiles that carcass shows are interesting to check. One of them is defined by the equation: $C=0.28\ P/\sqrt{A}$, where P is the perimeter and A the area of the carcass. This compactness index would be 1 when the considered surface was a circle. When this index was used the correlation coefficient with conformation score was r = 0.71 (P<0.01), and when it was focus only on the round then it increased to r = 0.79 (P<0.001). Because of a bovine carcass resembles more a cylindrical shape than a spherical one and, in a bidimensional plane, more to a rectangle than to a circle, a more suitable index of compactness could be the proportion between the carcass area and the rectangle that would include that carcass (Fig. 2). The value of the correlations between the note of conformation and this new compactness index was 0.80 (P<0.001).

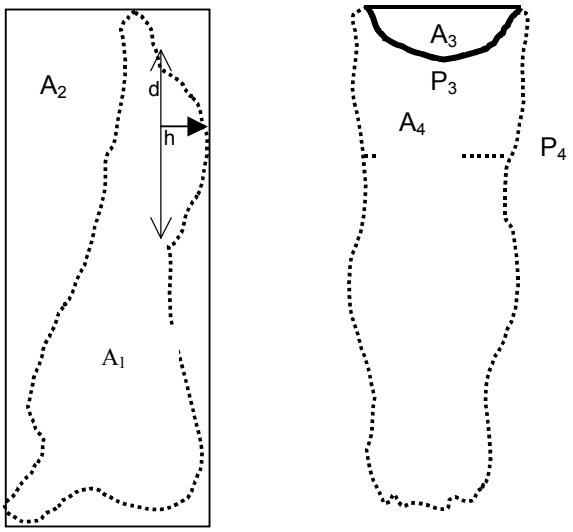

Fig. 2. More representative measures obtained in lateral and dorsal images of bovine carcass. A_1: area of the carcass; A_2: area of the rectangle that frames the carcass; A_3: area of the inside round; A_4: area of the round; P_3: perimeter of the inside round opening; P_4: perimeter of the round; d: distance between ends of the curvature of the round; h: height until the vertex of the round.

Because of subprimal cuts with greater meat yield are located in the round and owing to the expert classifiers of the carcasses examine thoroughly this primal to grade carcasses according to conformation score, the measurements made in this region showed high correlations with conformation score. It is worth to emphasize the measurement h (Fig. 2) whose coefficient of correlation was 0.87 (P<0.001). This measurement would show the convexity of the leg and therefore, the degree of development or conformation of this anatomical region. In this sense, round compactness measured in the dorsal image ($C=0.28\ P_4/\sqrt{A_4}$; Fig. 2) showed a high correlation coefficient (r = 0.79; P<0.001) with conformation score too.

The results of the stepwise regression analysis show that the model that integrates 3 of the measured parameters [measure h, the compactness of the carcass (A_1/A_2) and the compactness of the inside round opening (Fig. 2)] in a prediction equation, explains 93% (RSD=0.34 units, in 1-18 score) of the total variability of conformation scores (Table 1).

When comparing these results with those of a previous experience, carried out in the same slaughter house with a group of more heterogeneous carcass from different breeds (Limousine, Blonde d'Aquitaine and Pirenaica, mainly) which showed a conformation score range from S to R, the

prediction equation obtained explained 69% of the total variance in conformation score (Mendizabal *et al*., 2004). Therefore, the results of the present experience can be considered much more precise. This would indicate that when a slaughter plant slaughters a very defined type of carcass (in the present case carcasses from yearling bulls of Pirenaica breed) the graders have a very high accuracy in the grading, whereas when the range of carcass is bigger the accuracy in the classification decreases.

Table 1. Regression stepwise between the note of conformation (variable y) and the different morphological measures made in the carcass (variable x)

Step	V. Independent (x)	r^2	RSD
1	h	0.76	0.58
2	$Compactness_1$	0.90	0.40
3	$Compactness_2$	0.93	0.34

h: height until the vertex of the round; $Compactness_1$: A_1/A_2 (A_1: area of the carcass; A_2: area of the rectangle that frames the carcass); $Compactness_2$: $0{,}28*P_3/\sqrt{A_3}$ (P_3: perimeter of the inside round opening; A_3: area of the inside round opening).

Conclusions

In summary, it is possible to state that in a close future automatic classification systems of classification of bovine carcass will be introduced and they will replace the visual grading. So it will be necessary to establish the equations of prediction based on the type of carcass produced in each market. In addition, these new systems will provide data concerning to the saleable meat yield and the meat quality if additional parameters as the colour and the marbling of meat are included.

References

Allen, P. and Finnerty, N. (2000). *Objective beef carcass classification. A report of a trial of three VIA classification systems*. The National Food Center, Ireland, 35 pp.

De Boer, H., Dumont, B.L., Pomeroy, R.W. and Winiger, J.H. (1974). Manual on E.A.A.P. reference methods for the assessment of carcass characteristics in cattle. *Livest. Prod. Sci*., 1: 151-154.

Díaz, J., Albertí, P., Ripoll, G., Lahoz, F., Fernández, I., Olleta, J.L., Panea, B., Sañudo, C., Bahamonde, A. and Goyache, F. (2006). Using maching learning procedures to ascertain the influence of beef carcass profiles on carcass conformation scores. *Meat Sci.,* (in press).

Goyache, F., Fernández, I., Díez, J., Bahamonde, A. and del Coz, J.J. (2006). *Proyecto INIA RTA 01-106. Informe final*, 40 pp.

Hill, B.D., Jones, S.D.M., Robertson, W.M. and Major, I.T. (2000). Neuronal network modelling of carcass measurements to predict beef tenderness. *Can. J. Anim. Sci*., 80: 311-318.

Mendizábal J.A., Legarra, A. and Purroy, A. (2004). Relation entre la note de conformation et différentes measures anatomiques des carcasses bovines espagnoles définies avec analyse d'image. *11ème Rencontres Recherches Ruminants,* Paris (France), 120 pp.