EVALUATION OF VIDEO IMAGE ANALYSIS TECHNOLOGY FOR PREDICTING MARBLING OF BOVINE CARCASSES

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Abstract – Beef carcasses grading are classified in the abattoirs by muscle conformation and fat content. Recently there has been a growing interest in new technologies capable of improving accuracy of estimates, like video image analysis (VIA). The objective of this work was to estimate the marbling of bovine carcasses using image analysis technology (eMeater) and to compare it with intramuscular fat content determined by the solvent extraction method. Images of 70 bovine carcasses were obtained between the 12th and the 13th rib. The results showed a correlation coefficient of 0.86 between the marbling obtained by the eMeater and the intramuscular fat content (P<0.05). The obtained results suggest that this method is very useful for measuring carcass marbling and represents an objective and appropriate approach for reducing the human error that can result from subjective evaluations.

Key Words – Analysis image, bovine, intramuscular fat content.

I. INTRODUCTION

The quality and price of meat depend on carcass characteristics, which in turn depend on animal characteristics. The evaluation of carcass quality using a carcass classification system is an important tool for ensuring that producers are fairly paid and can also be adjusted to respond to consumer preference [1]. The classification standards for bovine carcasses in Mexico are based on estimating to the extent possible the physiological age and marbling of the meat through visual determination, which are performed by those who have received technical training from the corresponding government department. The chemical fat content is another parameter that can determine the quality of bovine carcasses [2]. To facilitate the classification of carcasses in slaughtering plants and cutting rooms, equipment currently exists in the market that can employ artificial vision like video image analysis (VIA) and use mathematical algorithms to perform this process with greater precision [1]. The objective of this work was to quantify the marbling of bovine carcasses using VIA and the solvent extraction method.

II. MATERIALS AND METHODS

In order to carry out this study, 70 bovine carcasses from cattle produced in Sonora, Mexico, were analysed (unisex, aged 2–3 years). The marbling percentage of the left side of the carcass (muscle: *Longissimus thoracis*) was determined through image capture, using a VIA equipment (eMeater) designed by Creato Tecnologías, S.A. de C.V. The USDA marbling methodology was determinate between the 12th and 13th rib [3], and the fat content was determined following the method established by the Association of Official Analytical Chemists (AOAC) [4]. Regression and correlation analysis were performed to analyse the data (NCSS, 2007).

III. RESULTS AND DISCUSSION

The frequency distribution of the marbling obtained by VIA is shown in Table 1. The results show a high distribution of marbling in bovine carcasses classified as modest > low > slight (P<0.05). The regression analysis of the intramuscular fat content and the VIA are shown in Figure 1. The classificatory image analysis (eMeater) showed a correlation of 0.8651 with respect to the intramuscular fat content, while the operational precision of the instrument was $r^2 = 0.7484$ (i.e. only 74% of the samples were related to the results for intramuscular fat). According to the procedures for approval of artificial vision instruments by

the USDA, the operational precision of the instrument must present an r^2 of 0.9 or higher [3]. Even so, these results show higher correlation values than those obtained by other researchers. For examples, values of 0.73 and 0.71 were previously obtained for Holstein and Charolais carcasses, respectively [5].

Table 1. Frequency distribution of the marbling obtained by VIA.

#	Categories	Carcass (n)	%
1	Zero	6	2.52
2	Trace	8	4.88
3	Slight	10	10.71
4	Low	13	18.09
5	Modest	16	23.25
6	Moderate	7	12.11
7	Slightly abundant	3	6.33
8	Moderately abundant	1	3.44
9	Abundant	6	18.67
	Total	70	100.00
	t-test	*	

*Significant differences at $P<0.05$

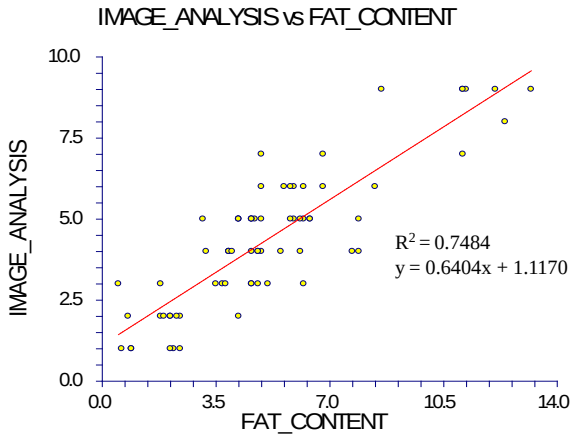

Image 1. Regression analysis of intramuscular fat and VIA.

IV. CONCLUSION

The eMeater system of artificial vision allowed the marbling to be evaluated and compared to intramuscular fat content. The obtained results suggest that this method can be improved and subsequently used to measure marbling and fat content as a means of reducing human error.

ACKNOWLEDGEMENTS

The authors express gratitude to CONACYT (Fondo de Innovación Tecnológica de la Secretaría de Economía) for its financial support of this project (ECO-2015-C01-260979).

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