DEVELOPMENT OF MARBLING ESTIMATION METHOD FOR PORK USING A FAT O MEATER DEVICE

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Abstract. Suitability of measurements taken with an optical needle device (Fat o meater) was analyzed in terms of estimation of marbling in the longissimus dorsi muscle. Results collected from measurements of 36 porcine carcasses were analyzed using the Fourier transformation and compared with visual evaluation and fat content determined chemically. Correlations of 0.64 and 0.46 were obtained for each of these traits. Applying this method muscle marbling may be accurately estimated in approx. 74% analyzed population of porcine carcasses.

Index Terms – marbling, optical-needle, Fourier transformation

INTRODUCTION

Marbling is a major quality attribute of meat, connected with its sensory value (Yang et al. 2006, Killinger et al. 2004, Cannata et al. 2010) and its suitability for the production of supreme products, e.g. raw maturing ham. A positive consumer examination score for intramuscular fat content has some limitations defined by Fernandez et al. at 3.5% (1999). In the last twenty years significant changes have been observed in pig production in most European countries, consisting in the systematically increasing proportion of lean fatteners in the population of slaughter animals. For example in Poland the mean leanness of fatteners increased from 44% in 1993 to 54.5% in 2009 (Lisiak and Borzuta 2009). This is an effect of an increased proportion of lean fatteners of low meat marbling (1 to 2% fat in m. LD) to approx. 86%. The selection of carcasses with high meat marbling to be used for the production of attractive traditional products and fermented products has become an important technological problem. An instrumental method is required for rapid evaluation of marbling in muscles remaining inside the carcass, without the need to have them cut.

AIM

The aim of the study was to develop an objective method to estimate marbling in pork, based on the analysis of optical signals generated by a Fat o meater optical needle device.

MATERIAL AND METHODS

On the slaughter line 36 porcine carcasses were examined using a Fat o meater optical needle device. Measurements were taken in the lumbar section of the longissimus dorsi muscle over the last rib. After 24h

carcass cooling at the same point meat samples were collected for laboratory analyses. At the cross-section of m. LD marbling was evaluated, using the Canadian standard (Wise 1981) within a scale of 1 to 5 points (1 point - no marbling, 5 points - high marbling). Moreover, in meat samples fat content was determined according to Soxhlet.

In the analysis of meat marbling measured with a Fat o meater device algorithms were applied, adopted from science. A series of algorithms used to signal filtering and tampering was used. After these algorithms were applied the sampled signal was subjected to the discriminant function. Such a prepared sample may in a simple way be subjected to the classical determination of variance and standard deviation. For such a prepared sample Fourier transformation was used to determine the amplitude spectra. A linear regression equation was developed to estimate marbling.

Tab. 1.   Results of marbling evaluation and determination of intramuscular fat content in longissimus dorsi muscle

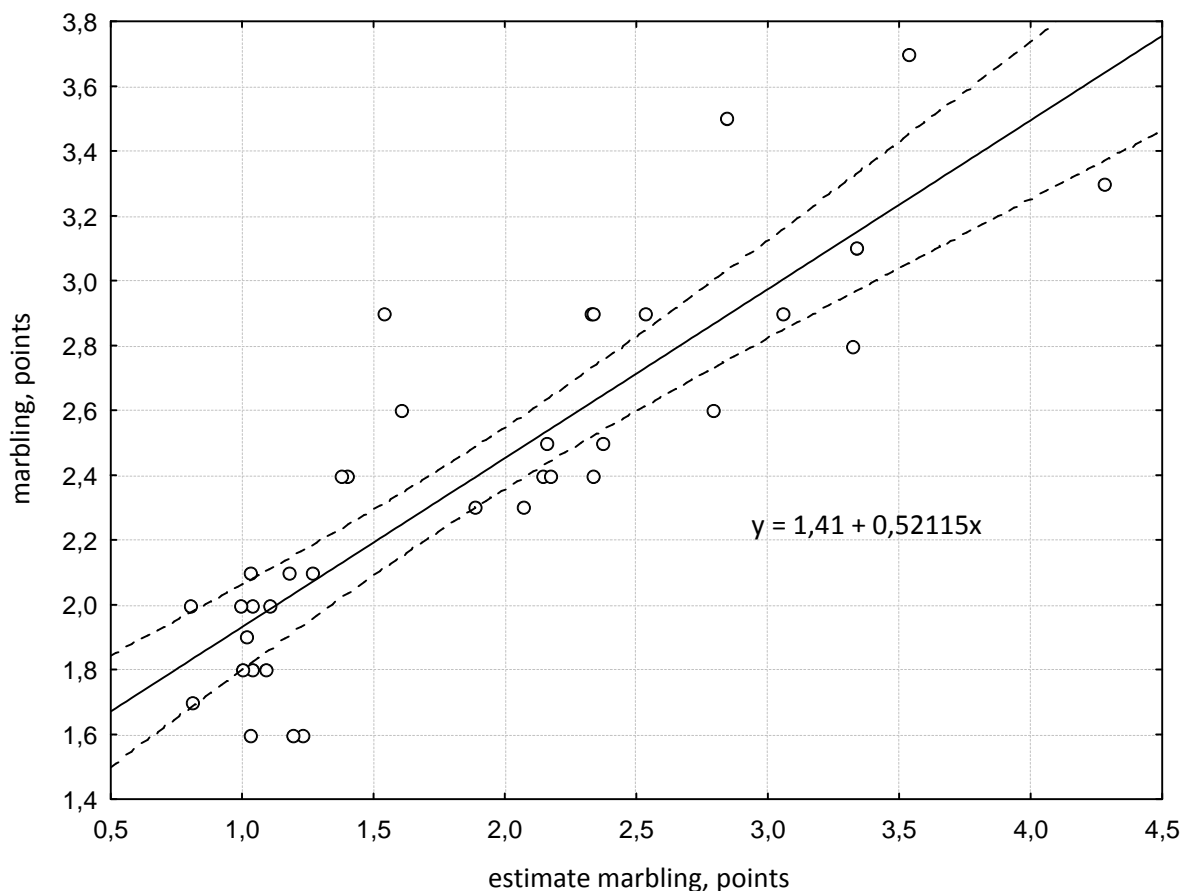| trait	mean	SD	Min.	Max.
Marbling evaluated visually, points	2.38	0.54	1.60	3.70
Marbling estimated with Fat o meater	1.87	0.90	0.81	4.28
Extraction fat content, %	3.64	1.32	1.40	6.08

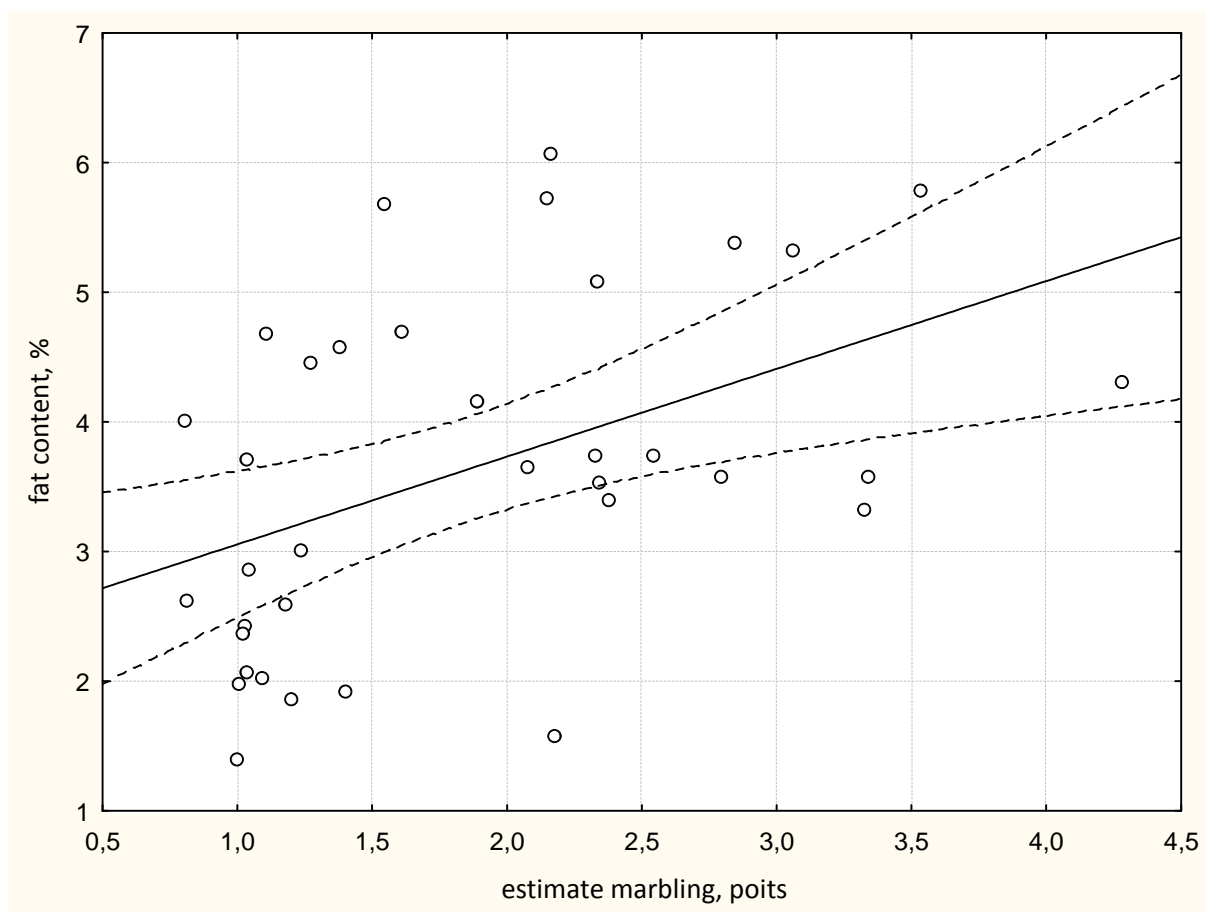Fig. 1 diagnostic graph for regression equation to estimate marbling (r = 0.86)

Fig. 2 Diagnostic graph for regression equation to estimate intramuscular fat content (r = 0.46)

RESULTS AND DISCUSSION

The selected experimental group was characterized by a high mean intramuscular fat content and high variation of this trait, which was manifested in the results of marbling evaluation (tab. 1). In view of the methodological character of the study such a variation of analyzed traits needs to be considered advantageous and confirming an appropriate selection of animals for the experiment. The following correlation coefficients between fat content and evaluation of marbling were obtained:

-       fat content x marbling evaluated visually r=0.64

-       fat content x estimated marbling (Fat o meater) r=0.46

-       marbling evaluated visually x estimated marbling (Fat o meater) r=0.86

        Using the algorithm with the application of Fourier transformation formed on the basis of optical signals with the use of a Fat o meater device and the results of marbling evaluation and chemically determined intramuscular fat content the regression analysis was used and two regression equations are given in Figs. 1 and 2. A more advantageous diagnostic graph was plotted at the estimation of marbling than that of intramuscular fat

content (r=0.86 vs. r=0.46). Using the algorithm with the application of Fourier transformation marbling in m. LD may be accurately estimated in approx. 74% analyzed population of porcine carcasses. It needs to be stressed that from the point of view of consumer examination the visual evaluation of marbling was more important than the laboratory determination of fat content. Between these two parameters the correlation was relatively low, since it amounts to r=0.64. This is confirmed by studies by Young et al. (2006), who stated that correlation coefficient between IMF content and the number of fat lines at the cross-section of m. LD was only 0.58.

Results of this study are promising, since they indicate that with a relatively high probability meat marbling may be estimated with the use of an optical needle device, at the same time used in the classification of porcine carcasses at the slaughter line. Thus the proposed solution does not cause disturbances in the operation of the technological line and it may be used in plants of different production scales.

CONCLUSIONS

1. It was found that the interdependence between intramuscular fat content and visual evaluation of marbling in m. LD of porcine carcasses is medium and it amounts to r=0.64.

2. The advanced analysis of optical signals generated by the Fat o meater device, using e.g. Fourier transformation, makes it possible to accurately estimate marbling in m. LD in approx. 74% porcine carcasses.

3. A relatively high correlation (r=0.86) was observed between meat marbling evaluated visually and that estimated with the use of the Fat o meater device, which is of considerable importance from the point of view of consumer examination traits.

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