

Using Image Analysis to Measure Pork Fat Color

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Abstract

The objective of this study was to measure pork fat color using image analysis and the Japanese pork fat models as benchmarks. Premium prices are paid for pork exported to Japan which meets the standards for extra white, numbers 1 and 2 fat blocks. The fat block models were scanned on an HP 6350 flatbed scanner and the uncompressed tif files were imported into the IPLab image analysis program. It was found that the yellow split of the CMY format produced linear results with a decent range. The values for the yellow image were as follows: extra white fat block no. 1 – 66.5; no. 2 – 75.8; no. 3 – 86.7; and slightly colored no. 4 – 96.0. Thirty pork loin chops were purchased at 4 local supermarkets. Small (1x4cm) samples of subcutaneous fat were cut and placed on a tray overwrapped with film. These trays were placed on the flatbed scanner and tif image files were produced and imported into IPLab to characterize the pork fat samples using the same procedure as described with the fat block models. The results were as follows for the yellow split image: supermarket no. 1-101.5(9.8); no. 2 – 86.2(2.2); no. 3 – 92.1(5.8); no. 4 – 86.4(6.7). None of the retail pork subcutaneous fat samples met the criteria for the premium Japanese no. 1 and no. 2 categories. Although the samples scored either no. 3 or no. 4 on the Japanese fat block models, they were rather typical of retail pork found in U.S. supermarkets.

Image analysis, Pork fat color, Japanese pork fat models

Figure 1. Japanese pork fat block models.

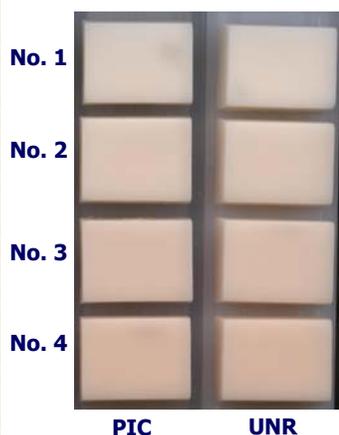


Figure 2. Relationship of yellow channel values to pork fat block models.

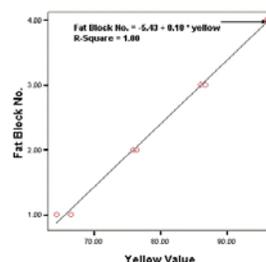
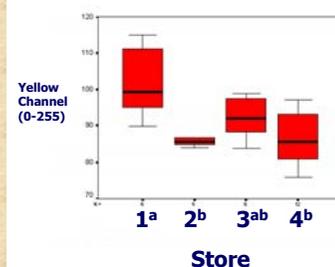


Figure 4. Results of store survey depicting yellow channel measurements by store.



Introduction

Color evaluation of lean and fat is included in most red meat grading systems but only as merit criteria if the trait is deficient (Price, 1995). There has been much more research and development on the objective and subjective evaluation of muscle color. There is a paucity of information on the measurement of pork fat color and especially objective methodology. Development of reference standard color blocks such as those produced for the Japanese meat grading system can be used to evaluate product in a production facility or anywhere along the distribution system. Price (1995) points out that repeatability of subjective measurements can be improved by the use of colored reference standards. This would certainly be true where the grader or evaluator can hold the reference next to the product to make decisions on borderline cases. Romans et al. (2001) says lard from pork fat should be white whereas tallows and greases can range from white to yellow. The purpose of this work is to use image analysis to develop an objective system to measure pork fat color.

Materials and Methods

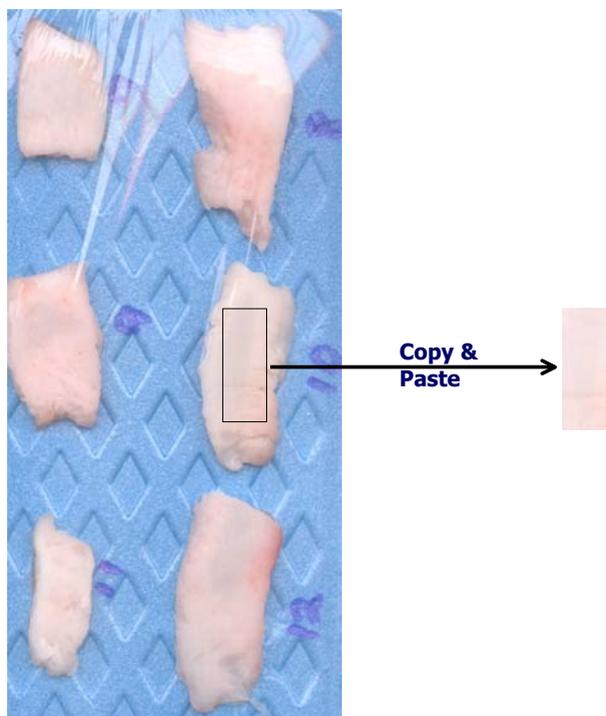
The fat block models were scanned on an HP 6350 flatbed scanner and the uncompressed tif files were imported into the IPLab (IPLab V3.6, Scanalytics, Fairfax, VA, USA) image analysis program. It was found that the yellow split of the CMY format produced linear results with a decent range.

Thirty pork loin chops were purchased at 4 local supermarkets. Small (1x4cm) samples of subcutaneous fat were cut and placed on a tray overwrapped with film. These trays were placed on the flatbed scanner and tif image files were produced and imported into IPLab to characterize the pork fat samples using the same procedure as described with the fat block models.

Procedure

1. Scan a piece of pork fat (4 sq. cm) under a film overwrap mounted on a blue or black styrofoam tray bottom. Remove the sides of the tray so there is good contact between film and fat. Slides of fat samples may also be used following the procedure of Ringkob(1997).
2. Use the freehand or rectangle tool to trace a ROI (region of interest) on the fat sample. Try to avoid wrinkles in the film, glare or other artifacts in the image. Cut or copy the ROI and paste into a new image template set to the size of clipboard image.
3. Convert the RGB image to the yellow channel split (CMYe) using the Math/ Split Color Channels command.
4. Use Analyze/Segment at the ROI command followed by Analyze/Quantify Segments. The Mean yellow channel value can be read in the Segment Totals window.

Figure 3. Procedure to copy and paste sample image into new window.



Results and Discussion

The Japanese fat block models were used as benchmarks to evaluate pork fat color. Images of the individual fat blocks (Figure 1) were produced by scanning and saving uncompressed tif files for preliminary analysis. The RGB, CMYe and HSU channel splits were checked using the IPLab image analysis program. The yellow channel (CMYe) produced the most consistent results. When plotted as shown in Figure 2, the yellow channel values were linear and had an adequate range (no. 1-66.5, no. 2-75.8, no. 3-86.7, no.4-96.0 on a 0-255 scale).

The fat samples were prepared for scanning and the 6 samples from one store from which individual scans were produced and saved as tif files as shown in Figure 3. The results are illustrated in Figure 4. All samples scored in the 3 and 4 range on the scale derived from the Japanese pork fat block models. Although the samples scored either 3 or 4, they were rather typical of retail pork found in U.S. supermarkets.

Price (1995) contends that white or creamy white are generally adequate descriptors; however, problems may arise when evaluating borderline cases. Development of image analysis could handle these problems and improve communication between buyer and seller, especially for international trade in pork.

Conclusions

The procedure using the yellow channel in IPLab image analysis program is able to classify pork fat using the Japanese pork fat models as benchmarks. The supermarket retail pork fat samples scored 3 and 4 on the Japanese model which is rather typical for U.S. pork fat.

Literature Cited

- Price, M. A. 1995. Development of Carcass Grading and Classification Systems, in Quality and Grading of Carcasses of Meat Animals, S. D. M. Jones, Ed. CRC Press, Inc, pp. 173-195.
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- Romans, J. R., W. J. Costello, C. W. Carlson, M. L. Greaser, K. W. Jones. 2001. The Meat We Eat. Interstate Publishers, Inc.