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PERFORMANCE OF THE SENSORY PANEL IN ASSESSMENT OF TEXTURE IN BEEF

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INTRODUCTION

Texture of meat can be analyzed in various ways; using different instrumental and chemical methods and also different sensory methods. The value of the result is dependent on the accuracy and objectivity of the method being used. All physical and instrumental methods are evaluated by how well they relate to sensory evaluation. For this reason it is extremely important that the sensory method used is an objective reproducible method. The need for standard methods and procedures in sensory analysis to be able to compare scientific results from different investigations, is obvious. Texture of meat is a composite of several parameters. Harris *et al.* (1972) used a texture profile method to examine the individual parts of the texture complex of meat. Most of the 7 sensory characteristics chosen were found to be not independent, and by factor analysis these could be reduced to two significant variables, toughness-tenderness and juiciness. This model was valid both on hot and cold meat for the toughness-tenderness variable, while juiciness on cold meat was not as valid. Cold tasting of meat has earlier been found to be preferable since this treatment gave higher degree of discrimination between the meat samples.

AIM

The aim is to use graphic tools in evaluating the performance of a sensory panel analyzing meat texture.

MATERIALS AND METHODS

M. longissimus dorsi muscles from 30 animals of the Norwegian Red Cattle breed were removed 45 min after stunning. The muscles were subjected to conditioning at 15 °C for 26 hours to avoid cold shortening and aged at 4 °C for up to 14 days. After 2, 7 and 14 days samples for sensory and texture (WB shear press) analyses were taken from all muscles. For texture and sensory analyses the samples were vacuum-packed, heat-treated in water baths at 70 °C for 50 (60 samples) or 75 min (30 samples), cooled in running ice water for 50 min, frozen and stored at -40 °C. Before analysis the samples were thawed overnight at 4 °C and stabilized for at least 30 min at 20 °C before analysis. Muscle slices of 1 cm thickness were cut along the fiber direction of the muscles. The second cut was also performed in the fiber direction to give the final samples cross-section dimensions of 1cmx1cm. Structures of visible fat and sinew were avoided. Five to ten subsamples were sheared at right angles to the fiber direction with the conventional Warner-Bratzler (WB) shear-press device with a triangular hole in the shear blade. An Instron Materials Testing Machine was used (Model 4202, Instron Engineering Corporation, High Wycombe, U.K.). The averages of the readings were used in the data analysis.

In this experiment a QDA-profile sensory method (ISO, 6564-1985) was used for testing the meat samples. 11 assessors, selected and trained according to ISO 6658-1985, followed the procedures for quantitative descriptive testing. The panel was trained in the glossary necessary for this task, i.e. the texture-attributes hardness, tenderness and juiciness. A continuos non-structured scale was used for evaluation, where the left side of the scale corresponded to the lowest intensity of the attribute and the right side corresponded to the highest intensity. Samples were given three digit randomized numbers for coding and served at a temperature of 20 °C in random order according to sample and assessor. Each assessor evaluated the samples at individual speed on a computerized system for direct recording of data (CSA Compusense, Canada). The computer transformed the numbers from 1.0 = no intensity to 9.0 = high intensity. The sensory facilities were of standards required in ISO 8589-1988 (Sensory analysis - General guidance for the design of test rooms), and IEG Guide 25.

ANOVA (Analysis of Variance) was used as the statistical method for separating specific sources of variation, in this case different sensory attributes of different beef samples. The MSE (Mean Square Error) is an estimate of the variance of samples and gives a measure of how well each single assessor repeats her/him-self. The p-value gives the largest level of significance at which the hypothesis that the varieties (meat samples) are equal, is rejected. This means that a «low» p-value indicates that the assessor can distinguish one or more of the varieties from the rest and a «low» MSE indicates that the assessor is repeating her/him-self. In this experiment we also used the graphical tool Egg-shell plot (Hirst & Næs, 1994) to focus on each assessor's performance on the texture attributes.

RESULTS AND DISCUSSION

Both instrumental and sensory analysis show that the beef samples analyzed were highly different in hardness and tenderness. The results show high negative and positive correlations between WB and the sensory attributes tenderness and hardness, while the attribute juiciness, as expected, is less correlated to WB. The calculated correlations are for WB-tenderness: -0.87, for WB-hardness: 0.89 and for WB-juiciness: 0.63.

A well trained panelist is expected to discriminate between samples (provided there is a difference between samples) and also to reproduce his/her scores on the sensory evaluation.

With the statistical tool Egg-shell plot we can, for each sensory attribute, visualize whether the panelist agrees with the consensus in ranking the samples. From the interval-scale the data are transformed to rankings prior to the graphical representation. Each panelist's ranking is shown as a curve inside the Egg-shell. The bold bottom line represents the ranking according to the consensus.

Figure 1: *Egg-shell plot of tenderness*, shows a panel which highly agrees on the ranking of the samples, while Figure 2: *Egg-shell plot of juiciness* shows a panel performance with less agreement.

A plot of p-values vs MSE adds information on the sensory performance. p-value vs MSE of tenderness shows that all the assessors discriminated very well between the beef-samples (p-value < 0.0000), but the assessors differed in reproducibility.

The attribute juiciness was a more difficult task for the panel. The p-value vs MSE plot shows that nearly all assessors could discriminate between the 90 samples (low p-value), and the MSE-values were less than 1.0 for all of them. This alone indicates that the panel was performing quite well, but the Egg-shell plot of attribute juiciness shows that there was little agreement among the panelists on the ranking of the samples. This can be explained by the fact that the samples were very close to each other in juiciness and for that reason impossible to rank. Another explanation could be that samples of beef from the same animal were uneven in juiciness, and each assessor therefore got samples which correctly should be assessed differently than the samples given to the rest of the panel. The most likely explanation is that the samples did not differ (or possibly very little) in the sensory perception of juiciness, but very much so in the perception of hardness and tenderness.

CONCLUDING REMARKS

The result from sensory analysis is usually the statistical mean of the scores from each assessor participating in the panel. It is therefore of great importance to keep in control the sensory performance of each single person in the panel. The conclusions from the sensory task in question will be influenced by the agreement or disagreement among the assessors. By using the different statistical and graphical tools as in this experiment, the sensory result is possible to evaluate in a more correct way.

KEY WORDS

Sensory analysis, beef texture, shear press (WB), assessor validation.

REFERENCES

Harries, J.M., Rhodes, D.N. and Chrystall, B.B. 1972. Meat texture. I. Subjective assessment of the texture of cooked beef. *J. Texture Studies*, 3, 101-114.

Hirst, D. and Næs, T. 1994. A graphical technique for assessing differences among a set of rankings. *J. Chemometrics*, 8, 81-93.

Figure 1. Egg-shell plot of the attribute tenderness

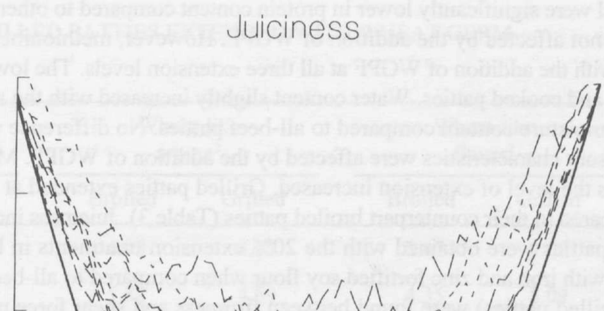

Figure 2. Egg-shell plot of the attribute juiciness