Recommendation of an Initial Group of Reference Methods for the Assessment of Physical Characteristics of Meat

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As a spin off of an OECD Workshop on pork quality held in Helsinki in 1992, a group of scientists with many years of experience in the field of meat quality assessment convened in 1993, 1994 and 1995 in Kulmbach at the German Federal Centre for Meat Research under the auspices of the OECD research project „Management of Biological Resources„. Three specific areas were discussed and published: water-holding capacity (Barton-Gade et al, 1993), tenderness (Chrystall et al. 1994) and colour of meat (Cassens et al. 1995), in order to develop internationally accepted reference methods. After long discussions the versions were brought into their final form in the autumn of 1997 and are in press (Honikel 1998).

Despite many efforts over the years, there is still little consensus regarding methods of measuring physical quality characteristics of meat. But standardisation of methods is essential, if investigations carried out by different groups is to be directly comparable. Thus some agreement should be made regarding methods of measuring physical quality characteristics in meat. The lack of standard measurement is in contrast to accepted methods of chemical components of meat. In considering reference methodology it was recognized that evalutions of physical characteristics like water-holding capacity, tenderness and colour of meat could be applied for at least three different reasons:

- a)As a quality assurance (QA) tool, within a processing operation,
- b)As an assessment of the effectiveness of production and processing treatments, where there may be an interest in being able to compare results between laboratories or countries,
- c)As a research tool, in fundamental structural studies of muscle and meat.

Where international comparison is important it is essential that methodology be standardized. This would include all aspects of the testing procedure and it is this aspect to which the reference methods are primarily directed. In contrast where assessments are being made of the physical properties of meat as a function of structural (chemical or physical) changes methodology should not be constrained by reference methods. Instead researchers are encouraged to develop and use methodologies which enhance differences and lead to an understanding of the basic mechanics. It is likely that it will be from this area that new understanding will develop and lead, eventually, to methods which more closely predict consumer assessments of meat characteristics.

General Principles for all Reference Methods

The origin and treatment of the live animal, the slaughter and post-mortem handling should be described as precisely as possible. These can include species, breed, sex, age, feeding regime, transport and preslaughter/handling, slaughter conditions, chilling and ageing regime. The rate of pH and temperature fall post-mortem and final pH of the muscle studies should be reported. It is not always possible to know all the history nor is it always important but if it is known it should be reported.

Reference Methods for the Assessment of Water Holding Capacity in Meat

There is a multitude of methods for measuring WHC of meat and meat products. We have chosen to divide the methods according to the type of meat product and the process to which the meat is subjected to: 1. drip loss in raw, whole meat 2.water loss in cooked, whole meat. For each category, recommended methods are described together with their limitations (Barton- Gade et al. 1994, Honikel 1998).

Reference Methods for the Assessment of Meat Tenderness

Methods for the assessment of meat tenderness are variable in terms of approach and usefulness. Although some attempts at standardization have taken place for instrumental (Boccard et al. 1981) and sensory techniques (Anon 1978) they do not appear to have been universally accepted. Tenderness measurement is important in both whole tissue and processed meats. However, the methodology discussed here has been restricted to whole tissue products, since the nature of processed products and the requirements for objective measurement of their texturel characteristics is diverse.
The three methodologies described (Tensile Test method, Warner- Bratzler shear test, Penetrometer measurements) will provide information which can be related to consumer sensory assessments (Honikel 1998). Each method has its advantages and limitations, but no single method provides complete information. All of the tests can be carried out in any of a wide variety of noncomplicant test

References

AMSA (1991): Guidelines for Meat Color Evaluation. Am. Meat Sci. Assoc. And Nat. Live Stock and Meat Board. Chicago, IL.

Anon (1978): Guidelines for the cookery and sensory evaluation of meat. American Meat Science Association and National Livestock and Meat Board, Chicago.

Barton-Gade, P.A., D. Demeyer, K.O. Honikel, R.L. Joseph, E. Puolanne, M. Severini, F.J.M. Smulders and E. Tornberg (1994): Final Version of Reference Methods for water Holding Capacity in Meat and Meat Products; Procedures Recommended by an OECD Working Group and Presented at the 39th ICoMST in 1993. Proc. 40th ICoMST. The Hague, The Netherlands, File S-V.05.

Boccard, R., Buchter, L., Casteels, E., Cosentino, E., Dransfield, E., Hood, D.E., Joseph, R.L., MacDougal, D.B., Rhodes, D.N., Schön, I., Tinbergen, B.J. and Touraille, C. (1981): Procedures for measuring meat quality characteristics in beef production experiments. Report of a working group in the Commission of the European Communities (CEC). Beef Production Research Programme, Livest. Prod. Sci. 8, 385 - 397.

Cassens, R.G., D. Demeyer, G. Eikelenboom, K.O. Honikel, G. Johansson, T. Nielsen, M. Renerre, I. Richardson, and R. Sakata (1995): Recommendation of Reference Method for Assessment of Meat Color. Proc. 41st ICoMST San Antonio, USA Vol II, C86, 410- 411

Chrystall, B.B., J. Culioli, D. Demeyer, K.O. Honikel, A.J. Moller, P. Purslow, F. Schwägele, R. Shorthose and L. Uytterhaegen (1994): Recommendation of Reference Methods for Assessment of Meat Tenderness. Proc. 40th ICoMST. The Hague, The Netherlands File S-V.06.

Honikel, K. O. (1998): Reference Methods for the Assessment of Physical Characteristics of Meat, Meat Science in press.

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frames e.g. Instron Universal Testing Instrument (Chrystall et al. 1994). When the testing is used to evaluate consumer products it is strongly recommended that the methods should be validated against sensory panels. The reference methods described are advanced as appropriate at this time but it is stressed that new techniques are likely as researchers explore mechanical properties of meat and the changes with handling procedures. The ideal of a single measurement to accurately predict consumer perceptions under all conditions may not be achievable.

Reference Method for Assessment of Meat Colour

Colour is the visual characteristic of meat which gives the all-important first impression when a sample is viewed. Colour measurement is a research tool to quantify production and processing treatments and is used in quality control programmes. Guidelines for human evaluation of meat colour have been published by AMSA (1991).

There are three sources of colour variation in meat:

(1) the content of pigment is intrinsic to the muscle, being dependent on primary production factors such as species, age of animal and nutritional regimen;

(2) the preslaughter period, the slaughter process and subsequent processing affect colour by influencing the rate of pH and temperature decline;

(3) during storage, distribution and display the processes of oxygenation and oxidation influence colour.

Besides these external factors of influence the instrumental set up is decisive for comparable results(Cassens et al. 1995, Honikel 1998).

Epilogue

With this paper and the one in press (Honikel 1998) the author speaking for the scientists involved in the development of the three mentioned reference methods wants to generate a permanent discussion group which evaluates and improves existing or newly developed methodologies or develops itself reference methods for other physical characteristics of meat and meat products. There is a need for a internationally accepted methods in the measurement of pH in meat and salted and fat containing meat products and of water and fat binding in meat batters. Please contact me for further details and the progress.