C86

RECOMMENDATION OF REFERENCE METHOD FOR ASSESSMENT OF MEAT COLOR

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INTRODUCTION: An attempt is being made to harmonize the many procedures and variations extant for measurement of properties of meat into a set of clearly defined reference methods. Suggestions have been made for water holding capacity (Barton-Gade et. al., 1994) and for tenderness (Chrystall et. al., 1994).

Considered here is the assessment of color. Color is the critically important, visual characteristic of meat which gives the all-important first impression when a sample is viewed.

There are three sources of color variation in meat: (1) the content of pigment is a determining factor and is intrinsic to the muscle, being dependent on primary production factors such as species, age of animal and nutritional regimen; (2) the preslaughter period and the slaughter process itself affect color by influencing the rate of pH decline and the ultimate pH; (3) during storage, distribution and display the processes of oxygenation and oxidation impact color.

The reasons for assessing color of meat are numerous and of consequence. Measurement of color is a research tool used to measure and quantitate production and processing treatments. It is used in quality control programs. Consumers use the impression of color to judge quality of meat and thereby make purchase decisions. Establishment of a reference method is therefore important so that results can be compared and so that various parties can communicate clearly and accurately with each other.

Guidelines for human evaluation of meat color have been published by AMSA (1991).

RECOMMENDATIONS FOR PREPARATION OF SAMPLE: The history and description of the animal, carcass or portion from which the sample is taken should be reported with as much detail as possible. Included should be information about breed, genetics, nutrition, age, sex, transport, slaughter conditions, chilling, aging and pH. Chilling and pH are critical factors.

For carcasses, sampling should be conducted after at least 24 hr post mortem. The muscle name must be clearly specified and the location within the muscle described. Preference is given to the longissimus dorsi muscle, but others are obviously acceptable. In general, sampling should be a cross-section taken perpendicular to the long axis of the muscle, and the sample should have a minimum thickness of 1.5 cm. In the case of meat with very low myoglobin levels the relationship between sample thickness and light transmittance can be checked by measuring against both white and black backgrounds.

This procedure is essentially that used in sampling for tenderness. It is recognized that sampling from other than the carcass--for example, from vacuum packaged or frozen meat--may some times be called for and the situation must be described as fully as possible.

If storage is to occur, prior to exposing a surface for measurement of color, it should be refrigerated at no higher than 3°C. Storage conditions such as temperature, light and overwrap or packaging must be specified.

Blooming time is important and is dependent upon such factors as species and temperature. It is recommended that blooming be allowed for at least 1 hr (time of blooming must be exact) at a maximum temperature of 3°C. Surface drying must be avoided by use of an oxygen permeable film or by control of humidity. Subsequent measurement may be made with or without the film in place depending upon the instrumentation.

It is recommended that at least triplicate measurements be made on different sites of the exposed surface. It must be recognized that in some species/muscles differences of considerable magnitude exist between lateral and medial sites on the cross-section of the muscle.

INSTRUMENTAL CONDITIONS: The recommended parameters are a light source of D 65 with the illumination/viewing system as 45/0 or 0/45 or diffuse 8 (d/8). Recommended standard observer is 10° (CIE, 1964) and color scale as $L^* a^* b^*$ (CIE, 1976). Calibration should be minimum black standard as L = 0 and white standard (equivalent to $BaSO_4$ or freshly burnt MgO) as L = 100. The aperture should be as large as possible as supplied for the instrument (within the limitations of the sample to be measured). The instrument must be warmed up to the manufacturer's instructions. Specular reflectance should be excluded if within the capabilities of the instrument.

ALTERNATIVE PARAMETERS: If other parameters are used, then they must be specified in the method. It is the experience of the expert group that even when the recommended parameters were used different results could be obtained by different instruments within the same laboratory. This may be due to differences in instrumental design such as aperture size, Halogen versus Xenon lamp, illumination/viewing system, 45/0 versus diffuse 8 (d/8). Some instruments are also available in which the measured area is less than the illuminated area, thus minimizing edge effects due to translucency. It is recommended to develop a meat-like spectral reflectance standard which can be measured and quoted with all results published.

CONCLUSIONS: The recommendations made herein are for the purpose of standardizing the method for measurement of color of fresh meat. It is recognized that determining color stability is

another important criterion in fresh meat, but one in which pigment forms must be identified and quantitated. The recommendations are for laboratory instruments, but the continuing development and growing importance of portable instruments and invasive probes, for use in plants, is recognized. The goal is to draw together the reference methods for water binding, tenderness and color as a standardized means to characterize fresh meat. The project is a continuing effort as methods are revised and suggestions for improvement are welcome.

ACKNOWLEDGEMENT: Appreciation is expressed to OECD for support of the workshop.

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