Italian Journal of Animal Science

ISSN: (Print) 1828-051X (Online) Journal homepage: http://www.tandfonline.com/loi/tjas20

Sensory evaluation of meat.t. colour. using photographs

Alberto Brugiapaglia & Gianluigi Destefanis

To cite this article: Alberto Brugiapaglia & Gianluigi Destefanis (2009) Sensory evaluation of meat.t. colour. using photographs, Italian Journal of Animal Science, 8:sup2, 480-482, DOI: 10.4081/ijas.2009.s2.480

To link to this article: https://doi.org/10.4081/ijas.2009.s2.480

Sensory evaluation of meat colour using photographs

Alberto Brugiapaglia, Gianluigi Destefanis

Dipartimento di Scienze Zootecniche, Università di Torino, Italy

Corresponding author: Alberto Brugiapaglia. Dipartimento di Scienze Zootecniche. Facoltà di Agraria, Università degli Studi di Torino. Via Leonardo da Vinci 44, 10095 Grugliasco, Torino, Italy - Tel. +39 011 6708573 - Fax: +39 011 6708563 - Email: alberto.brugiapaglia@unito.it

ABSTRACT - Five *m. longissimus thoracis* steaks from different breeds, purchased at retail, were cut into samples and simultaneously photographed under standard shooting conditions. The first photo was taken on samples just arrived at the laboratory, the second one on a freshly cut surface after blooming. Two consumer panels evaluated beef colour using respectively photo 1 and photo 2. Each consumer was asked to rank samples in order of preference. Rank sums were evaluated with Fridman's test. Immediately after taking the photos, colour was measured with a colorimeter. Regarding photo 1, consumers were able to discriminate one sample, the worst, from all the others. Concerning photo 2, consumers discriminated the worst sample, as in photo 1, but also the best one. Therefore a more accurate colour evaluation can be obtained if the assessment is carried out on a fresh cut surface after blooming. In general consumers preferred samples with high lightness and a relatively high yellowness. The sensory evaluation of meat colour using photographs is a promising tool to overcome the difficulties when the meat is directly evaluated. But it is very important to standardize the shooting conditions to obtain a true reproduction of the meat. For this purpose the use of a colour target is useful to check the validity of the adopted parameters.

Key words: Meat colour, Photographs, Sensory evaluation.

Introduction - Undoubtedly, appearance determines how consumers perceive quality at retail and significantly influences purchasing decisions (Faustman and Cassens, 1990). In the case of beef, purchasing decisions are influenced by colour more than by any other quality factor, because consumers relate the bright cherry red colour of oxymyoglobin to freshness and wholesomeness, while the brown colour of metmyoglobin is considered undesirable (Mancini and Hunt, 2005). In fact the visible colour on meat surface continuously changes during display and storage, influencing consumer acceptance of beef. Meat colour measurement is performed either by visual appraisal or by instrumental analysis using colorimeters and spectrophotometers (AMSA, 1991). These instruments are accurate, fast and easy to perform, but they express data as colour space coordinates and do not give a measure of consumer preference.

Visual appraisal is the meat colour assessment most closely related to consumer evaluation, but it is complex, expensive and time-consuming. The long period for the sensory evaluation negatively affects the meat colour stability and consequently the acceptability. Difficulties of using meat in consumers surveys could be overcame through the use of photographs for the colour evaluation. Therefore the aim of this study was to evaluate the possibility of using photographs for the sensory evaluation of beef colour.

Material and methods - Five *m. longissimus thoracis* steaks from dairy and beef breeds (A, B, C, D, E) were purchased at local supermarkets and butcher shops. Upon arrival at the laboratory, each steak was cut into samples 5x5x4 cm, coded with random three-digit numbers, placed flat on a uniform

non-glare black background and illuminated with two daylight fluorescent lamps (with a colour temperature of 5400K) set at an angle of 45° with the samples.

The uncut surface of the samples were photographed simultaneously using a NIKON Coolpix 990 digital camera mounted on a photographic bench (photo 1). The camera was set up with the lens aligned 50 cm from the meat surface and the focus set at 50 cm. The image was saved into TIFF file format to keep the high quality resolution. Preliminary experiments were carried out to test different setting conditions. The best one was: aperture priority mode, with the aperture value set at f/2.9 and the exposure corrected to +0.7 stop. The colour-reproduction capability of the camera was tested with the aid of the GretagMacbeth Color-Checker, which is a chart containing 24 colored patches, photographed with the meat samples.

Immediately after, the colour of each sample was determined objectively by a Minolta colorimeter CR 331 C with a 30-mm-diameter measurement area, using the D_{65} illuminant and the 2° standard observer. The instrument was calibrated against a white and red standard plates. The results were expressed in terms of lightness L*, redness a*, yellowness b* in the CIELAB colour space model (CIE, 1978) and a*/b* ratio was calculated (Renerre, 2006).

Prior to take the second photograph (photo 2), a 1 cm thick slice was cut from each sample and the fresh surface was allowed to "bloom" for 60 min at 3°C (Boccard *et al.,* 1981). Then the colour was re-measured by the colorimeter. The two photographs (20x30 cm) were printed on glossy paper and sticked on a black cardboard.

Two consumer panels consisting of 90 and 54 people (regular meat buyers), homogeneous for sex, age and status, evaluated the beef colour using photo 1 and photo 2 respectively. The photos were presented once to consumers. Sensory evaluation was performed by a ranking test (BSI, 1980) and each consumer was asked to rank samples in decreasing order of preference for colour (1 corresponded to the highest preference, 5 to the lowest preference). Rank sums for each sample were calculated and evaluated statistically with the Friedman's test (Meilgaard *et al.*, 1999).

Results and conclusions - The results of the sensory analysis are reported in table 1. As regards the photo 1, a significant difference ($P<0.05$) was observed between sample C, which reached the highest rank sum, and the other samples which were preferred. With regard to this result, it must be underlined that samples had remained at retail at different storage time and temperature, which could have caused surfaces discoloration. Probably the presence of the three forms of myoglobin on the meat surface did not allow consumers to discriminate effectively the samples.

In relation to photo 2, sample A was preferred to the others ($P<0.05$); sample C, as in photo 1, was judged as the worst ($P<0.05$). In this case consumers discriminated sample A from samples B, D and E. Therefore a more accurate colour evaluation can be obtained if the assessment is carried out on a fresh cut surface after blooming.

The instrumental colour measurements for the five samples are reported in table 2. Comparing the meat of the photo 2 with that of photo 1, in all the samples a clear influence of blooming was observed which caused an increase of the lightness (from 37.17 to 39.76), a decrease of the redness and yellowness values (from 29.71 to 27.62 and from 11.39 to 10.78 respectively) and a slight reduction of the a*/b* ratio (from 2.63 to 2.57).

In fact the lightness always increased in photo 2, especially in A, D and above all in sample E. The redness increased in sample A and decreased in all the other samples, in particular in D and B. The yellowness decreased in samples C, D, and B, and increased in sample A and, slightly, in sample E. The a*/b* ratio decreased in samples A and E, increased in samples B and D, while was almost the same in sample C.

It is not easy to compare the results of the preference test with those of the instrumental analysis and to find the relationships between a single preference judgment with the trichromatic coordinates which are linked each other in different ways. Both panels disliked very much sample

C, which had a low lightness and, in photo 2, the highest a*/b* ratio, indicating a redder colour. In other words, sample C showed a deep red and dark meat colour. In photo 2 consumer preferences were for sample A, which showed a bright red colour and had the highest lightness and a relatively high yellowness. Sample B, which had a* and b* values similar to those of sample A, was penalized for its lowest lightness.

In conclusion, the sensory evaluation of meat colour using photographs is a promising tool to overcome the difficulties when the meat is directly evaluated. By photographs it is possible to "freeze" the meat colour exactly in the moment of the instrumental measurement. Photographs can be used for a long time, with the possibility to collect a large number of ratings from many consumers. But it is very important to standardize the shooting conditions like the lighting, background and camera setting, to obtain a true reproduction of the meat. For this purpose the colour chart is a useful tool for adjusting the colour correctness of the photo and to check the validity of the adopted parameters. In the next step the sensory evaluation of meat colour using photographs will be compared to the direct evaluation.

Table 1. Rank sums of ranking test.

	A	B	C	D	E
Photo 1	251[a]	260[a]	321[b]	269[a]	249[a]
Photo 2	118[a]	157[b]	211[c]	158[b]	166[b]

[a, b, c] *differences between ranks on the same row: P<0.05.*

Table 2. Instrumental colour measurements.

		Mean	A	B	C	D	E
Photo 1	L*	37.17	40.04	34.54	35.54	39.27	36.44
Photo 2	L*	39.76	43.14	36.42	37.01	40.62	41.63
Photo 1	a*	29.71	27.15	34.02	29.55	30.38	27.47
Photo 2	a*	27.62	28.20	28.70	26.86	27.26	27.10
Photo 1	b*	11.39	9.49	13.95	11.06	12.28	10.15
Photo 2	b*	10.78	11.07	11.22	10.30	10.88	10.43
Photo 1	a*/b*	2.63	2.86	2.44	2.67	2.47	2.71
Photo 2	a*/b*	2.57	2.55	2.56	2.61	2.51	2.60

REFERENCES - A.M.S.A., 1991. Guidelines for meat color evaluation. Proceedings of the Reciprocal Meat Conference, 44, 1-17. **Boccard**, R., Buchter, L., Casteels, E., Cosentino, E., Dransfield, E., Hood, D.E., Joseph, R.L., MacDougall, D.B., Rhodes, D.N., Schon, L., Tinbergen, B.J., Touraille, K., 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". Livestock Production Science, 8, 385-397. **British Standard Institution** 1980, "Methods for sensory analysis of food", Part I, Introduction and general guide to methodology. British Standard 5929. **C.I.E.** 1978. International Commission on Illumination, Recommendations on uniform color spaces, color-difference equations, psychometric color terms. **Supplement no.2 to CIE publication no. 15 (E.-1.3.1) 1971/(TC-1.3.) 1978. Bureau de la CIE,** Paris, France. **Faustman**, C., Cassens, R.G. 1990. The biochemical basis for discoloration in fresh meat: a review. Journal of muscle foods, 1 (2), 217-243. **Mancini**, R.A., Hunt, M.C., 2005. Current research in meat colour. Meat Science, 71, 100-121. **Meilgaard**, M, Civille, G. V., Carr, B.T., 1999. Sensory Evaluation Techniques. CRC PRESS, Inc. Boca Raton, Ann Arbor, Boston, London. **Renerre**, M. 2006. La mesure de la coluler de la viande. **Station QUAPA. Unitè BPM. Theix: INRA. 257-258.**