COLOR PARAMETERS AND REFLECTANCE RATIOS OF DIFFERENT STATES OF MYOGLOBIN IN MECHANICALLY DEBONED POULTRY MEAT

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Background

Several reasons have produced a high comsuption of poultry products (BSE and other diseases in pork) around the world. Mechanically deboned poultry meat (MDPM) has become an important source of low cost proteins, due to an increased production of cut-up and processed meat that provided considerable quantities of pieces suitable for deboning. This kind of meat has red color because of its high myoglobin content. Color is an important characteristic in this product. Color study is being carried out to improve the control of this raw material. Several studies have pointed out the significance of the different states of myoglobin in determining the color changes that take place during processing. The aim of this study was to characterize the color parameters (CIELAB coordinates, reflectance spectrum and reflectance ratios) of the three myoglobin forms (deoxymyoglobin, oxymyoglobin and metmyoglobin) in mechanically deboned poultry meat. The deoxymyoglobin present in MDPM was converted into the pure states and color parameters (lightness, redness, yellowness, hue, chroma and a*/b* ratio), reflectance spectrum (360-740 nm) and reflectance ratios (R560/R500, R650/R570, R630/R580 and R630-R580) were obtained. All the color parameters, except ligthness, and reflectance ratios varied according to the state of myoglobin.

Objetives

The aim of this work was to study the color parameters (CIELAB coordinates, reflectance spectrum and reflectance ratios) of the three myoglobin forms (deoxymyoglobin, oxymyoglobin and metmyoglobin) in mechanically deboned poultry meat.

Methods

The myoglobin present in the fresh meat was converted into the pure states (deoxymyoglobin, oxymyoglobin and metmyoglobin) following the recommendations of Fernández-López *et al.* (2000). To convert into 100% metmyoglobin the samples were place in 1,0% potassium ferricyanide for 1 min, then, the samples were drained, blotted and packaged in oxygen permeable film to oxidize at 2ºC for 12 h, and the samples were measured immediately. To convert into 100% deoxymyoglobin, the samples were placed in 10% dithionite solution, drained, blotted and vacuum packaged to reduce for 1 to 2 h at room temperature. The samples were then repackaged in an oxygen permeable film and measured immediately. To convert into 100% oxymyoglobin, the samples were stored at 0ºC to 2ºC in a high-oxygen atmosphere and flushed with 100% oxygen for 10 min. Then, the samples were packaged in a oxygen permeable film and measured immediately. Ten color determinations were made in each piece following the recomendations of American Meat Science Association for color measurements, using a Minolta spectrophotometer, CM-2600D (D_{65} as illuminant and 10º as standard observer), in accordance with Cassens *et al.* (1995). Statistical analysis of the variance (ANOVA) with one factor (myoglobin state) and the Tukey test were applied (Gómez & Gómez, 1976; Afifi & Azen, 1979; Gacula & Singh, 1984). All the analyses were carried out by means of the statistical package Statgraphics Plus for Windows, version 2.1 (Statical Graphics Corp., Rockville, USES).

Results and discussion

Color parameters: The results of the ANOVA of the myoglobin state on color parameters of MDPM are presented in Table 1. The results for ligthness (L*) pointed out no significant differences between the three states of myoglobin. Significant differences for redness (a*) were obtained, according to Warren *et al.* (1996), that reported that chemical modification of pigment state influenced external and internal appearance and produced significant differences in redness. The ANOVA revealed significant differences for the treatment factor when b* (yellownes) was analysed. The psycophysical parameters chroma (C*) and hue (H*) reveals significant differences among the states of myoglobin.

Reflectance ratios: There were significant differences for the treatment factor when ANOVA was applied to R560/R500, R650/R570, R630/R580 and R630-R580 ratios. Tukey test pointed out significant differences between the three states of myoglobin.

Reflectance spectrum: figure 1 presents the reflectance spectra (360-740 nm) for the different myoglobin states (metmyoglobin, oxymyoglobin and deoxymyoglobin) in mechanically deboned poultry meat. Few researches have been refered to reflectance spectrum of meat and meat products (Snyder, 1975 and Fernández-López, 2000). Our results are similar to the results obtained in pork shoulder meat. In studies of dry-cured sausages, the wide variations seen in the ratios and differences between reflectance values make any comparison very difficult. Different authors have attributed this behaviour to factors such as the degree of mincing and fat content (Pérez-Álvarez. et al., 1998 and Fernández-López, 1998)

Conclusions

All the color parameters (redness, yellowness, chroma, hue and a*/b* ratio) and reflectance ratios (R560/R500, R650/R570, R630/R580 and R630-R580), but not lightness (L*), varied according to the state of myoglobin.

Pertinent literature

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Table 1.- MEAN VALUES OF THE COLOR COORDINATES, PSYCOPHYSICAL MAGNITUDES, a*/b* RATIOS FOR THE DIFFERENT STATES OF MYOGLOBIN IN MECHANICALLY DEBONED POULTRY MEAT

COLOR PARAMETERS	METMYOGLOBIN	DEOXYMYOGLOBIN	OXYMYOGLOBIN
LIGHTNESS (L*)	55,82a	54,03a	54,72a
REDNESS (a*)	7,39a	8,41b	13,21c
YELLOWNESS (b*)	13,16b	8,56a	13,77b
CHROMA (C*)	15,12b	12,06a	19,08c
HUE (H*)	60,30b	45,25a	46,16a
a*/b* RATIO	0,56a	0,98b	0,96b
R560/R500	1,10c	0,71a	0,80b
R650/R570	1,56a	2,30b	2,65c
R630/R580	1,22a	1,97b	2,44c
R630-R580	5,51a	18,69b	24,97c

[a-c] For each variable, means within the same row with different superscripts differ significantly ($P<0,01$)

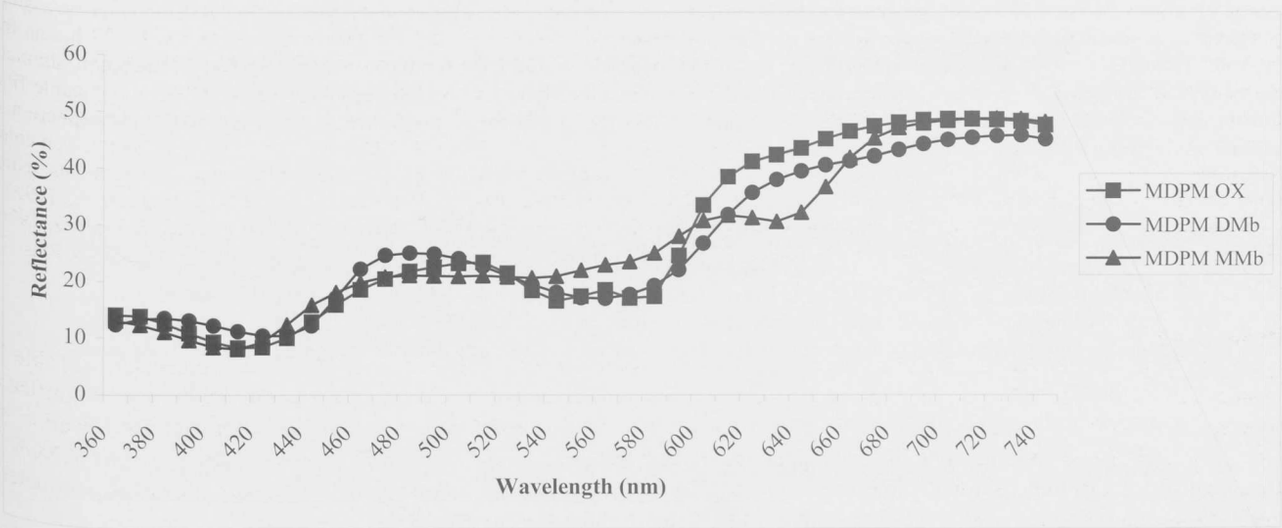

Fig. 1.- Reflectance spectrum (360-740 nm) of the different states of myoglobin (Deoxymyoglobin (DMb), metmyoglobin (MMb) and oxymyoglobin (Omb) in mechanically deboned poultry meat