USE OF COLOR TO CLASSIFY PALE MEAT AND ITS RELATION WITH OTHER QUALITY ATTRIBUTES

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Introduction

Production of poultry meat is nowadays a very dynamic and highly competitive activity. In Brazil, in the last decades, due to the great increase of value-added meat products, the demand for high quality meat has been mandatory.

Because of their pale color, and mainly due to their property of not retaining water as normal muscles, pale, soft, and exudative (PSE) meats cause problems to industrialization. PSE-quality broiler breast meat presents low cooking yield, poor water-holding capacity (WHC), and low salty solution intake during marinade. Nevertheless, lately several researchers have been studying the relationship between the color of raw breast meat and its other functional properties (BIANCHI et al., 2005), and suggested that color measurement (L*) can be used as an indicator of quality for breast meat for further processing.

As cut off points used among researchers vary a lot, Barbut (1997) and Woelfel et al. (2002) suggested that each processor should determine their own L* value, depending on the chicken type, handling, processing factors, and final specifications of the product. Thus, the objectives of this experiment were to know the level of correlation between color and the other quality attributes of meat that were analyzed – pH, WHC, and drip loss (DL) –, and also establish our own cut off point aiming to check whether the lightness of color (L*) could be used as a tool to classify and indicate functionality, separating the samples into two distinct groups: pale and normal meat.

Materials and Methods

Birds and slaughter: 150 Ross broiler chicks were raised until 44 days of age using conventional methods with water and food available *ad libitum* and then slaughtered according to commercial methods.

Sampling: Forty-five minutes after chilling the carcasses at 0-2ºC, *Pectoralis major* were collected at a commercial slaughter and processing plant on five random days between the months of February and April 2006, characterized by high temperatures and high relative humidity (RH) (averages of 28°C and 67% RH). For each of the five samplings, 30 chicken breasts (*Pectoralis major*) were randomly selected. Color and pH were measured on the *Pectoralis major* muscle just after carcass deboning. Following that, samples were transported to the Meat Laboratory of ESALQ-USP for the remaining analyses 24 h *postmortem*.

Experimental design: After analyzing quality attributes, samples were classified and separated into two major groups, characterized by color/L* (pale and normal meat) using instrumental evaluation from a cut off point established by Classification and Regression Tree (CART).

Physicochemical analyses: 1) Color: for the physical determination of color, a portable Minolta Chroma Meter was used 45 min and 24 h *postmortem*; 2) pH: determined 45 min and 24 h postmortem using a pH spear probe in four different points of *Pectoralis major*; 3) WHC: this determination was carried out 24 h *postmortem*, according to Nakamura & Katoh (1985); 4) DL: the samples were weighed 24 h postmortem, kept for 72 h in a cooler at 2ºC±1ºC, reweighed then, and DL was calculated, according to Van Laack et al. (2000).

Statistical analyses: Correlation coefficients among the variables 45 min or 24 h postmortem were generated using the Pearson's Correlation Coefficient (SPSS 13.0 for Windows). Determination of cut off point to separate groups according to the color was performed by CART, according to Breiman et al. (1984). Evaluation of differences between the two groups, pale and normal meat, was carried out using Student's t test. All the results presenting $p < 0.05$ were considered statistically significant.

Results and Discussion

1) Evaluation of quality attributes of broiler breast meat: Some parameters used to evaluate quality attributes of broiler breast meat are correlated among themselves. Thus, it is possible to indirectly estimate or predict the behavior of some attributes if the characteristics that present correlation with the desired answer are known. In this case, it is of vital importance to know the level of correlation among the quality attributes under study.

According to the data obtained, it was possible to observe that L* values presented significant ($p < 0.01$) inverse correlation with pH for both periods of analysis (45 min = -0.391; 24 h = -0.603), i.e., the more pale the meat the lower is the pH, and this correlation was higher 24 h *postmortem* (Table 1).

L* values also presented significant ($p < 0.01$) direct correlation with DL for both periods of analysis (45 min = 0.392; 24 h = 0. 508), i.e., the more pale the meat the higher is the DL, and this correlation was higher 24 h *postmortem.*

Table 1. Correlation coefficients among the parameters evaluated 45 min and 24 h postmortem in broiler breast fillet samples. (n = 150) - * $p < 0.05$ ** $p < 0.01$

	L_{45}	a_{45}	b_{45}	pH_{45}	WHC(%)	DL(%)
L_{45}	1	-0,086	0,025	-0,391**	-0,119	0,392**
a_{45}		1	-0,070	-0,110	-0,139	0,041
b_{45}			1	0,144	-0,089	0,149
pH_{45}				1	0,091	-0,361**
WHC(%)					1	-0,466**
DL(%)						1
	L_{24}	a_{24}	b_{24}	pH_{24}	WHC(%)	DL(%)
L_{24}	1	-0,127	0,333**	-0,603**	-0,056	0,508**
a_{24}		1	0,145	0,178*	-0,204*	0,048
b_{24}			1	-0,313**	-0,134	0,344**
pH_{24}				1	0,114	-0,457**
WHC(%)					1	-0,466**
DL(%)						1

Higher L* values mean more DL, and this correlation is not independent, but related to pH. Thus, it is clear that pH has inverse correlation with DL, which could be observed in this research both at 45 min (-0.361) and 24 h postmortem (-0.457) ($p < 0.01$), and this correlation was higher 24 h *postmortem.*

Other researchers also found a relationship between poultry meat color and functional properties (VAN LAACK et al., 2000; QIAO et al., 2001; BIANCHI et al., 2005) and data similar to the ones obtained in this study.

2) Classification of meat samples: Using CART, it was possible to verify that among the tested parameters, the color value, specifically L* value at 24 h postmortem, was the principal point of distinction between groups. At 45 min postmortem, the classification presented a very high error (or deviation) and therefore was not useful to separate the samples between groups.

Cut off value established was L* 52.83, which was rounded off to 53, a more practical value; therefore, all tested samples were divided into two major groups based on this criterion, each of them with similar DL, WHC, and pH. Samples from the group presenting L* ≥ 53 showed higher DL values (3.73%) and lower ($p < 0.01$) WHC (50.38%) and pH (5.77), thus classified as pale meat, characterized by high lightness and exudative profile. Samples from the group presenting L* < 53 showed lower DL values (2.96%) and higher ($p < 0.01$) WHC (51.54%) and pH (5.94), thus classified as normal meat.

The results obtained in this experiment are consistent with other researches that classified broiler breast meat into prestablished color groups (QIAO et al., 2001; ALVARADO; SAMS, 2003), and indicate that extreme differences in raw broiler breast meat are mainly due to differences in pH, and result in variations in meat WHC.

Conclusions

These results denote the existence of significant variations in broiler breast meat color in commercial production, and they also demonstrate the high correlation between the color and the other quality attributes, consequently, color lightness (L*) can be used as a tool to classify and indicate functionality.

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