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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

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Changes in Light Reflectance and Extent of Thawing Loss after Extended Freezing with Breast Fillets from Late Marketed Broiler Males Using Population Representatives Having L* above and below the Median

J. Galobart[1] and E.T. Moran, Jr.
Poultry Science Department, Auburn University, Auburn, AL 36849, USA
E-mail: emoran@acesag.auburn.edu

Abstract: Skin-less boneless fillets obtained from 500 broiler males at 56 days of age exhibited a median 48h PM L* = 63.0. Ten samples randomly representing the population below (L* < 62.5, average = 60.4) and 10 above (L* > 63.5, average = 65.1) were held at -20°C for 5 months. Muscles were thawed 3 days at 4°C. Total drip was 10.7%, and similar losses occurred for samples above and below the 48h PM L* median. L* values measured on thawed fillets significantly decreased from their respective 48PM values with samples that had been located above the median but were similar with those below. Redness (a*) was similar among fresh samples, whereas a greater yellowness (b*) occurred with muscles having L* above the median than below it. Freezing led to increased a* and b* to the same extent after thawing. Light reflectance of fillets from late-marketed broilers indicates that PSE-like muscle would prevail with the population-at-large and uniformly exhibit associated problems.

Key words: Broiler breast, frozen storage, light reflectance, *Pectoralis major*, thawing loss

Introduction

Moisture release from frozen meat upon thawing depends on time and conditions of storage (Cunningham, 1975). Lightness (L*) of breast fillets from young broilers negatively correlated with water holding capacity and losses incurred with refrigeration and cooking, and values at the upper end of the population generally exhibit pale-soft-exudative (PSE) like characteristics (Allen *et al*., 1998; Woelfel *et al*., 2002). Freezing leads to a reduction in L* with the thawed meat, and resulting moisture loss is greater than occurs from weep during refrigeration. Fillet L* is known to increase with age, and broilers at heavy weight are generally preferable for further-processing purposes. In present experimentation light reflectance of breast fillets was measured with a population of late age broiler males after processing, then samples above and below the population's median L* were frozen for repeat measurements and determination of weight loss.

Materials and Methods

Broiler males (500 Ross x Ross 308) were grown to 8 weeks of age in floor pens under common terms of feeding and management. Fillets (*Pectoralis major*) were obtained 24h post mortem (PM) from the entire population on stationary cones using commercial personnel. Trimming to define the entire muscle of the right side was the basis of weight changes. Fillets were held in polyethylene bags at 4°C until the following day until measurement of light reflectance (L*a*b* 48h PM) on the skin-side surface at the thickest portion (Miniscan XE having illuminant D65, standard 10° observer). All fillets were individually frozen (-20°C) in polyethylene bags then collectively held 5 months in waxed boxes. Ten representative fillets were randomly taken from the population (median L* = 63.0 at 48h PM) that had values below the median (L* < 62.5) and 10 representatives above the median (L* > 63.5). Frozen fillets were individually wrapped in absorbent paper then replaced in their polyethylene bags and held at 4°C to thaw over 3 days. Weight and light reflectance were measured daily in the same manner and location as conducted at 48h PM. All data were analyzed using ANOVA by means of the General Linear Model procedure of SAS (SAS Institute, 2001).

Results and Discussion

Broiler males used in present experimentation were 56 days of age and had a final live weight of 4102 g (SEM = 23.5) and total *Pectoralis major* yield of 703 g (SEM = 6.1). Previous studies in our laboratory revealed that the skin-side of the fillet gave less variable light reflectance than the coarse side next to the frame. The resulting median L* of 63.0 having an SEM = 0.25 at 24h PM indicated that the population at-large would likely express PSE-like problems. Samples below (62.5) and above (63.5) the median were intended to represent each aspect of the population. Given their random distribution, the difference in these average L* values (60.42 vs. 65.08, $P \leq 0.05$) was expected to be low. No differences existed in these samples from each half of the population with either their absolute weight or

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Table 1: Change in relative weight and absolute values for light reflectance using fillets from late marketed broiler males during thawing of population representatives above and below the median L* value at 48h PM

		Values 48h PM	Δ (%)			
			Day 1	Day 2	Day 3	Total
Weight (g)	<62.5	323.4	-7.47	-1.95	-1.05	-10.23
	>63.5	328.2	-7.85	-2.11	-0.90	-10.62
	SEM	13.14	0.702	0.153	0.079	0.690
	P	NS	NS	NS	NS	NS
L*	<62.5	60.42	-1.04^{+}	0.00^{+}	0.26^{+}	-0.78^{+}
	>63.5	65.08	-3.16	0.60^{+}	0.18^{+}	-2.41
	SEM	0.285	0.641	0.357	0.243	0.686
	P	***	*	NS	NS	NS
a*	<62.5	6.47	2.52	0.58	0.44^{+}	3.55
	>63.5	5.68	1.91	0.43	-0.05^{+}	2.30
	SEM	0.433	0.385	0.175	0.239	0.476
	P	NS	NS	NS	NS	NS
b*	<62.5	14.66	3.60	1.01	-0.26^{+}	4.34
	>63.5	16.64	2.69	1.41	0.32^{+}	4.41
	SEM	0.517	0.441	0.409	0.311	0.503
	P	*	NS	NS	NS	NS

*,P ≤ 0.05, ***, P ≤ 0.001, +: Not different from 0

relative thawing loss (Table 1). All samples exhibited a 7.7% loss after the first day that increased to a total of 10.4% by the third day. Other research that documented thawing losses reported a range from 2 to 18.5% total loss depending on duration and temperature (Crigler and Dawson, 1968; Jakubowska *et al.*, 1997; O'Neill *et al.*, 1998; Zocchi and Sams, 1999); however, none measured their associated L*. Research has shown that fresh fillets having high L* exhibit greater moisture losses during refrigerated storage and cooking than those having low values (Allen *et al.*, 1998; Woelfel *et al.*, 2002); however, these data largely involved broilers approximating 6 weeks of age and marginal for PSE-like problems.

Change in L* from 48h PM to thawed state after freezing was only apparent as a reduction in value with the fillets > 63.5, particularly through the first 24h. Although redness (a*) at 48h PM was similar between fillets having low and high L*, yellowness (b*) was greater for the latter than former. Alterations in redness (a*) and yellowness (b*) from fresh to thawed state also occurred but as uniform increases. Agnelli and Mascheroni (2002) also observed a decrease in L* and increased a* after thawing of chicken escallops that had been frozen in an air-blast tunnel. On the other hand, Lyon *et al.* (1976) did not observe any differences in Hunter values of breast fillets between samples kept fresh and those held frozen 6 days and thawed 12hr at 2°C. Present results indicate that increases in a* and b* with freezing and thawing followed the loss in weight, whereas L* decreased but only with fillets >63.5 and without any relationship to weight loss.

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