

Effect of preslaughter transport duration on meat quality of broilers slaughtered at different body weights and seasons

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Abbreviated title: Meat quality influenced by transport duration and season

Summary

The aim of the present study was to investigate the effect of preslaughter transport duration on meat quality of broilers slaughtered at 2 weight groups (1.8 and 2.6 kg) and 2 seasons (summer and winter). Transport duration was 1.5 and 3 h/season/slaughter weight. The study was conducted on Ross broiler flocks slaughtered at one of the commercial processing plants in Turkey. A total of 12 carcasses from each group (total 96) were randomly collected to measure pH 15 min (pH_{15}) and 24 h (pH_{24}), L^* , a^* , and b^* values.

Three way interactions were significant for pH_{15} , L^* , a^* and b^* values. Season had no significant effect on pH_{15} for 1.8 kg broilers slaughtered after 1.5 h transport. Lower breast pH_{15} values were obtained for 2.6 kg broilers slaughtered in summer regardless of transport duration. Longer transport duration increased L^* values for 2.6 kg broilers slaughtered in summer. Similar a^* values were found for 1.8 kg broilers regardless of season and transport duration. Season had no significant effect on b^* values for 1.8 kg broilers and transported 1.5 h. The b^* values were higher for 2.6 kg broilers and slaughtered in summer compared to in winter.

Keywords: breast meat quality, transport duration, season, slaughter weight

Introduction

Transport duration commonly ranges from 1 to 6 h, however it is recommended that loading, traveling and unloading duration should be less than 2 h and should not exceed 4 h (Turner et al., 2005). There are conflicted results on transport distance effect on meat quality. Debut et al. (2003) found no effect of transportation on meat color while it was reported that short distance transported broilers had higher a^* values than broilers transported for long distance (Bianchi et al., 2006).

It was shown that body weight of broilers may also influence meat quality; i.e. the heavier birds produce a darker breast meat (Fletcher, 2002). Fraqueza et al. (2006) reported increased rate of postmortem pH fall in turkeys with higher body weight. However, Smith et al. (2002) found no variation in breast meat color in broilers slaughtered from 42 to 52 d.

Although there are many results on the effects of summer high ambient temperatures on broiler meat quality (McCurdy et al., 1996; McKee and Sams, 1997; Akşit et al., 2006) showing that heat stress may lead to pale, soft and exudative meat, much less is known on its interaction with slaughter weight and transport duration. Therefore, the present study was aimed to evaluate the quality of breast meat of broilers with heavier and lighter body weights reared under summer and winter conditions in Turkey and transported 1.5 or 3 h.

Materials and Methods

The study was conducted at two seasons; summer and winter; on Ross broiler stocks slaughtered at one of the commercial processing plants in Turkey. Broilers were reared under commercial conditions until they reached to average 1.8 (lighter) or 2.6 kg (heavier) and were deprived of food 8 h before transport to slaughter. Transport duration was 1.5 or 3 h/season/slaughter weight. Broilers were allowed to rest 1 h before being slaughtered.

All broilers were slaughtered in identical conditions; electrically stunned, bled, scalded, defeathered, eviscerated and prechilled before debonning. A total of 12 carcasses from each group were randomly sampled. The pH 15 min and 24

h postmortem (pH₁₅ and pH₂₄, respectively) was recorded on left pectoralis major muscle with a portable pHmeter. Color (L*, a*, and b* values) was measured at 24 h postmortem on pectoralis major muscle with Minolta Colorimeter.

Three-way ANOVA using the JMP statistic package was applied to data with a model including season, body weight, and transport duration, and possible interactions. When significant differences occurred for a response (p<0.05), Tukey was performed to separate treatment means.

Results and discussion

For lighter broilers, 1.5 h of transport had no significant effect on breast meat of pH₁₅ regardless of season, however, higher pH₁₅ values were obtained for broilers transported for 3 h and slaughtered in winter than in summer. Season effect was significant for heavier broilers being lower in summer than in winter regardless of transport duration (Table 1). Average pH₁₅ was 6.48 in summer and 6.79 in winter (P<0.001).

Table 1. Effect of slaughter weight, season and transport duration on pH₁₅ of breast meat

Slaughter weight, kg	Season	Transport duration, h	
		1.5	3
1.8 kg (lighter)	Summer	6.58 ^a	6.41 ^a
		NS	*
	Winter	6.72 ^a	6.95 ^a
2.6 kg (heavier)	Summer	6.46 ^a	6.46 ^a
		*	*
	Winter	6.79 ^a	6.70 ^a

^aMeans in rows not sharing a letter differ significantly (p<0.05), * Shows significant difference in columns
NS not significant

Average pH₂₄ was 5.76 and 5.95 for summer and winter, respectively (p<0.001) (Table 2). The pH₂₄ of breast meat of heavier broilers was lower than those lighter broilers (5.81 and 5.90, respectively). Transport duration effect was also significant and longer durations resulted higher pH₂₄ values. However a two-way interaction between season and

transport duration indicated that lower pH₂₄ values were obtained in summer regardless of transport duration while pH₂₄ was higher for breast meat of broilers transported for 3 h in winter.

Table 2. Effect of season and transport duration on pH₂₄ of breast meat

Season	Transport duration, h	pH ₂₄
Summer	1.5	5.75 ^a
	3	5.77 ^a
Winter	1.5	5.88 ^b
	3	6.03 ^a

^{a,b}Means in columns not sharing a letter differ significantly ($p < 0.05$)

There was a significant 3-way interaction for L* values of breast meat. For lighter broilers, there was no significant effect of transport duration on breast meat lightness. The L* values were higher in breast meat of lighter broilers slaughtered in summer than in winter. For heavier broilers, although transport duration has no effect on L* values of breast meat in winter, longer transport duration increased L* values for heavier broilers and slaughtered in summer (Table 3).

Table 3. Effect of slaughter weight, season and transport duration on breast meat color

Slaughter weight, kg	Season	Transport duration, h							
		1.5		3		1.5		3	
		L*		a*		b*			
1.8 kg (lighter)	Summer	57.07 ^a	56.00 ^a	3.64 ^a	3.54 ^a	5.15 ^a	6.78 ^a		
		*	*	NS	NS	NS	*		
	Winter	54.37 ^a	53.31 ^a	4.36 ^a	3.62 ^a	3.43 ^a	2.59 ^a		
2.6 kg (heavier)	Summer	55.18 ^b	57.85 ^a	4.18 ^a	3.11 ^b	5.86 ^a	4.17 ^a		
		NS	*	NS	*	*	*		
	Winter	55.09 ^a	54.70 ^a	3.53 ^b	4.11 ^a	2.10 ^a	1.11 ^a		

^{a,b}Means in rows not sharing a letter differ significantly ($p < 0.05$)

* Shows significant difference in columns

NS not significant

The a^* values were similar regardless of season and transport duration for lighter broilers. However, for heavier broilers the redder meat was for broilers transported for 1.5 h in summer and 3 h in winter.

Heavier body weight increased yellowness. Season effect was significant resulting in higher b^* values in summer ($p < 0.001$), except lighter broilers transported for 1.5 h had similar b values at both seasons.

These results are consistent with previous studies considering the effect of summer high ambient temperatures on breast meat pH_{24} and lightness (McCurdy et al., 1996; McKee and Sams, 1997; Petracci et al., 2004; Akşit et al., 2006). It was clearly showed that transport duration did not have a direct effect on pH_{15} , L^* and b^* values. However, it interacted with slaughter weight and season showing that although transport duration had no effect on pH_{24} and L^* in summer, longer durations resulted in higher pH_{24} and lower L^* in winter (darker meat). This result may be due to transport stress that accelerates metabolism to a point of depletion of muscle glycogen, resulting in higher muscle pH. Similar result was also reported in turkeys by Owens and Sams (2000). In the present study, breast meat of 1.8 kg broilers transported shorter duration in winter exhibited redder meat than heavy broilers transported for shorter duration in summer. In conclusion, the results of the study indicated that variation in pH and color of breast meat was affected by season, slaughter weight and transport duration.

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