INFLUENCE OF SEX AND SLAUGHTER AGE ON BREAST MEAT QUALITY OF TURKEYS REARED UNDER INTENSIVE SYSTEM

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BACKGROUND

The market shift towards further processed products has stressed the necessity for improving meat quality in order to maximize product yield, and to maintain sensory quality and functional properties of the meat. Traditionally, quality grading systems around the world give little consideration to the meat functional properties such as water holding capacity and texture (Barbut, 1998). Problems with meat quality are usually caused by aberration in the biochemistry and morphology of individual muscle, as well as by post mortem events (Solomon *et al.*, 1998). It is generally recognized that genetic selection for muscle growth in turkey has resulted in poorer meat quality for further processing with special regard for breast muscles (Dransfield and Sosnicki, 1999). Current poultry meat quality problems (soft texture, poor cohesiveness, and poor juiciness) seem to be associated with a rapid onset of rigor mortis that is similar to the PSE condition that occurs in pork during *post mortem* period (Barbut, 1998; Rathgeber *et al.*, 1999; Owens *et al.*, 2000). In poultry, the muscle fibre cross-sectional area increases with age. This increase is also associated with an increase in the number of giant fibers, which typically have cross-sectional areas 3 or 5 times larger than normal, these may also result in severe contraction (hypercontracted fibers) (Dransfield and Sosnicki, 1999). Current research suggests that animals with a greater number of muscle fibres of moderate size produce meat of better quality (Rehfeldt *et al.*, 2000). In Italy the turkey production system is organized in such way that hens are slaughtered younger than toms (13 *vs.* 20 wk-old) according to the significant sexual dimorphism. To maximize system efficiency, toms and hens are reared in the same house but in separate groups. At 13 wk-old, hens are slaughtered and toms have free access to the overall house until their slaughter at 20 wk-old. Because of the effects of both sex and different slaughter age, meat quality traits could be different between toms and hens.

OBJECTIVES

The aim of the present research was to study the effect of sex (toms *vs.* hens) and slaughter age (standard age *vs.* standard age + 2 wk-old) on breast meat quality traits from turkeys reared under intensive conditions.

METHODS

Forty-eight BUT "Big 6" turkeys were analysed in a 2×2 (sex: toms *vs.* hens and slaughter ages: standard *vs.* standard + 2 wk-old) factorial experimental design. The birds were reared under commercial intensive conditions, and fed *ad libitum* according to BUT "Big 6" nutrient recommendations. Hens were slaughtered under standard plant conditions at 13 wk-old (standard age) and 15 wk-old (standard age + 2 wk-old) whereas toms were slaughtered at 20 wk-old (standard age) and 22 wk-old (standard age + 2 wk-old). Immediately before picking, pH at 15 min *post-mortem* (pH_1) was measured on each fillet (*Pectoralis major*) by using the probe method (Crison® 507 pH-meter). Whole breast fillets were removed from carcasses at 6 h *post mortem* and the following measurements were subsequently taken: colour values for lightness (L*), redness (a*), and yellowness (b*) (CIE, 1976; Minolta CR-300 colorimeter) by averaging three colour measurements from the meat on the surface, in an area free of colour defects (bruises, blood spots, or surface discolorations due to possible over scalding); pH at 6 h *post-mortem* (pH_2) by using the probe method; water holding capacity (WHC) according to the filter paper press (Kauffman *et al.*, 1986), and reported as percentage of water released from the meat sample; drip loss after 24 h storage at 2-4 C of 80 g core samples and cooking loss by cooking the samples from drip loss on a water bath (80 °C) to the end-point temperature (72 °C) (Honikel, 1998). The meat composition for moisture, protein, and intramuscular fat were also determined according to reference methods (AOAC, 1990). Furthermore, the water distribution in breast meat was studied by calculating the Low-Field NMR parameters T2a, T2b, and α by using Minispec Bruker PC 120, according to the method previously described by Petracci *et al.* (1999). Two-ways ANOVA was performed with GLM/SAS® (SAS, 1988) using a model that included sex, slaughter age and their interaction.

RESULTS AND DISCUSSION

Breast meat quality traits from turkey breast fillets are reported in Table 1. As regard to the sex, as expected, toms exhibited both higher carcass (15.0 *vs.* 6.4 Kg, $P<0.01$) and skinless breast (4.50 *vs.* 1.93 Kg, $P<0.01$) weight than hens. Concerning the meat colour, breast fillets from toms had a significantly higher redness values (a*, 5.84 *vs.* 4.39, $P<0.01$) and tended to be paler (L*, 51.4 *vs.* 49.8, $P=0.07$). Breast fillets from toms also exhibited a significantly ($P<0.01$) lower water holding capacity as measured by drip loss (2.06 *vs.* 1.09 % for toms and hens respectively) and cooking loss (27.7 *vs.* 25.7 % for toms and hens respectively). These results are consistent with the NMR parameter α that was significantly higher in toms (14.8 *vs.* 9.5 %, $P<0.01$) (Fig. 1). The parameter α estimates the fraction of the detectable-by-NMR water less tightly bound to the meat structure. When the α increases, the proportion of water less tightly bound to the meat structure increases. This condition has been associated with a lower WHC. A close relationship among NMR parameters and traditional methods to assess WHC has been reported in earlier studies in rabbits (Petracci *et al.*, 1999), pork (Brown *et al.*, 2000; Bertram *et al.*, 2001) and poultry (Cavani *et al.*, 2001). Data from the current study suggest that breast fillets from hens have higher water holding capacity than breast fillets from toms. These findings are consistent with some observations by the industry technologists who referred that hen meat is more suitable for further processed products. These findings might be due to the effects of selection towards toms that has stressed muscular hypertrophy (McCurdy *et al.*, 1996), decreasing meat quality. As regard to meat composition, breast fillets from toms were found to have lower moisture (72.8 *vs.* 73.6 % $P<0.01$) and higher protein content (24.8 *vs.* 24.5 %, $P<0.01$) than hens.

As concerns the slaughter age, turkeys slaughtered at the standard age + 2 wk-old resulted in both higher carcasses and skinless breast weights ($P<0.01$) than those slaughtered at standard age. However the slaughter age did not affect the main meat quality traits except for cooking loss and intramuscular fat which were found to be higher in breast fillets from birds slaughtered at standard age + 2 wk-old. These results are consistent with the findings reported by Klosowska *et al.* (1999) that found no important differences in meat quality traits between hens slaughtered at 13 and 15 wk-old respectively.

CONCLUSIONS

These results suggest that: i) breast meat from hens could be considered potentially better than meat from toms for further processed products where the functionality of the meat is a primary issue such as products where low or no salts and phosphates are added to enhance the water-binding capacity and protein functionality. ii) To delay the standard slaughter age, at present adopted in Italian intensive systems, does not affect the overall meat quality, while resulting in higher cooking loss and lipid content of breast meat.

PERTINENT LITERATURE

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Table 1 – The Effects of slaughter age and sex on breast meat characteristics.

	Sex		Slaughter age		
Parameters	*Toms*	*Hens*	*Standard*[1]	*Standard+2wk*	*SEM*
Birds, n	24	24	24	24	
Carcass wt., kg	15.0^{A}	6.4^{B}	9.7^{B}	11.7^{A}	0.66
Skinless Breast wt., kg	4.50^{A}	1.93^{B}	2.90^{B}	3.54^{A}	0.20
$pH_{15\ min}$	6.19	6.09	6.16	6.12	0.03
$pH_{6\ h}$	5.79	5.68	5.70	5.78	0.03
L*	51.4	49.8	50.2	51.0	0.45
a*	5.84^{A}	4.39^{B}	5.10	5.13	0.17
b*	1.93	1.96	1.91	1.97	0.12
Drip loss, %	2.06^{A}	1.09^{B}	1.44	1.70	0.13
Filter paper press, %	17.5	16.7	16.6	17.6	1.97
Cooking loss, %	27.7^{A}	25.7^{B}	26.0^{B}	27.4^{A}	0.31
Moisture, %	72.8^{A}	73.6^{B}	73.4	73.0	0.13
Protein, %	24.8^{a}	24.5^{b}	24.6	24.7	0.08
Lipid, %	1.51	1.48	1.35^{A}	1.64^{B}	0.06
LF-NMR					
T_{2a}, ms	110.0	115.7	111.3	114.4	1.73
T_{2b}, ms	39.3	39.7	39.4	39.6	0.24
α, %	14.8^{A}	9.5^{B}	11.6	12.7	0.70

^{A,B}: P<0.01; ^{a,b}: P<0.05. No significant interaction between Sex and Slaughter Age was found.
[1]Toms: 20 wk-old; Hens: 13 wk-old.

Figure 1: *Water holding capacity and proportion of the water detectable by LF-NMR less tightly bound to the meat structure (α) in toms and hens breast meat. **= P<0.01.*