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HEN MEAT QUALITY DURING STORAGE AFTER SLAUGHTERING

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Abstract

Post-mortem glycolysis, as described by muscle pH decline, was investigated in several hen muscles. While the gastrocnemius pars interna, femorotibialis medius, iliotibialis lateralis and iliofemoralis showed the normal descending pH decline pattern, the ambiens as well as the iliofibularis showed a very rapid pH decline until 2 hr post mortem whereafter pH increased.

Key words : ph, meat quality, meat storage, hen meat.

INTRODUCTION

Meat quality is influenced to a large extent by the rate of pH decline in the muscles after slaughter and by the ultimate pH. Type of muscle is one of the intrinsic factors that influences both the rate and the extent of post-mortem pH decline. The present study was conducted to evaluate post-mortem pH decline in various hen muscles as an indication of the rate of post-mortem glycolysis.

MATERIALS AND METHODS

Hens were electrically stunned and bled after a fasting period of 24 hr in a commercial abattoir at Salonta. At this abattoir an effective stun is attained by electrical current. The birds lose consciousness immediately without struggling before they are bled. Measurements of pH were obtained, using a calibrated (standard buffers at pH 4.0 and 7.0) Hanna portable pH meter, in the *gastrocnemius pars interna, femorotibialis medius, ambiens, iliotibialis lateralis, iliofibularis* and *iliofemoralis* at a depth of 1.5 cm in five mature hen carcasses at 0.5, 2, 4, 6, 8 and 24 hr post mortem. Conventional chilling of hens legs (separated from the pelvic girdle) comprises chilling at 0-4°C from approximately 0.5 hr post mortem for 24 hr.

The effects of time on pH of individual muscles were evaluated by analysis of variance techniques (Snedecor & Cochran, 1991). Individual animals were used as blocks to remove variation, due to differences among animals, from the error sum of squares (McKeith *et ai,* 1985). For

comparison of pH decline between muscles the parameters β_0, β_1 and β_2 (Kastner et al., 1993) were calculated for each muscle. Paired t-tests (Snedecor & Cochran. 1991) were used to test for significance between parameters for different muscles.

RESULTS AND DISCUSSION

The apparent ultimate pH was reached at 2 hr *post mortem* in the *ambiens* and *iliofibularis* and at 6 hr *post mortem* in the *gastrocnemius pars internet* and *femorotibialis medius*. The *iliotibialis lateraiis* and *iliofemoralis* formed an intermediate group reaching the apparent ultimate pH value at 3 hr *post mortem* (Table 1).

The mean ultimate pH values reported in Table 1 are within the normal range for poultry leg muscles. These authors used pH 15 min after slaughter to distinguish between normal, PSE and DFD meat in broilers. The use of an initial pH for DFD classification is, however, not general practice. Since meat is dark in colour like beef, comparison to red meat is appropriate. The mean ultimate pH values suggest that hen meat may be classified as an intermediate meat type between normal (pH < 5.8) and extreme DFD (pH > 6.2). The fact that small standard deviations were obtained (Table 1) indicates that this condition is common in hen with the possibility of a high proportion of muscle fibres adapted for glycogenolytic metabolism. An intermediate to high pH in meat results in a dark colour and although it is an advantage for water binding, it is unfavourable for receptivity to absorb cure, shelf life and flavour. Pre-slaughter stress is normally associated with this condition due to the depletion of glycogen reserves (Lawrie, 1985). Compared to the holding and slaughtering techniques for other meat animals, the techniques employed at the hen abattoir are favourable to minimise stress.

Comparisons between muscles, using the model of Kastner et al. (1993), showed clearly (Table 2) that the asymptotic minimum pH values differed significantly between muscles.

Furthermore, it can be concluded from unrealistic initial pH values in Table 2 that the above model was not suitable for pH data regarding the *ambiens* and *iliofibularis*. These two muscles showed a rapid post-mortem decline until 2 hr after slaughter, whereafter an unusual increase in pH, as also found by Mellett (1985), was observed (Table 1). Thus, these two muscles were excluded from the pairwise comparison of parameters in Table 2. No significant differences ($P<0.05$) were found between the rate of pH decline in the remaining four muscles. This showed that possible differences in cooling rate did not significantly influence post-mortem glycolysis.

As for all other meat animals, the insertions of the *gastrocnemius* muscles are cut during carcass dressing, while for the *femorotibialis medius,* both attachments are intact after removal of the legs. According to Table 2, the *ambiens* and *iliofibularis* reach a pH≤6.2, whereafter the risk of cold shortening is reduced (Locker & Hagyard, 1963), at about 41 min and 32 min *post mortem,* respectively. There is, therefore, no risk of cold shortening

when these muscles are separated from the *os ilium.* The *iliotibialis lateralis* and *iliofemoralis* reach a pH≤6.2 at about 1 hr 53 min and 1 hr 33 min *post mortem,* respectively. In these muscles there is a risk of cold shortening when they are separated at 25-35 min *post mortem* as in standard practice. However, sarcomere length measurements indicate the absence of cold shortening in hen meat. Electrical stimulation (ES) is often applied to meat carcasses to increase the rate of pH decline (Carse, 1973) but the fast rate of pH decline in hen meat (Table 2) suggests the application of ES to hen carcasses is unnecessary. The present results thus explain the lack of improvement in tenderness in hen meat following ES.

Table 1

Mean pH Values and Standard Errors at Fixed Times After Death, of Different Muscles in a Cooling Hen Leg

Time hr	Gastrocnemius pars interna	Femorotibialis medius	Ambiens	Iliotibialis lateralis	Iliofibularis	Iliofemoralis
0.5	7.13^{a}±0.111	6.73^{a} ±0.194	6.32^{a}± 0.105	6.59^{a}±0.226	6.31^{a} ±0.152	6.5 I^{a} ±0.248
2.0	6.51^{b}±0.189	6.46^{b} ±0.172	5.85^{b}±0.119	6.27^{b}± 0.183	6.00^{c} ±0.087	6.17^{b}±0.150
4.0	6.26^{C}±0.094	6.18^{C} ±0.079	5.87^{h}±O.O51	5.97^{C} ±.0.177	6.07^{bt}± 0.060	5.91^{C} ±0.080
6.0	6.12^{d}±0.056	6.02^{cd} ± 0.074	5.94^{b}±0.014	5.99^{e}± 0.072	6.08^{bc}± 0.039	5.88^{c}±0.027
8.0	6.07^{d}± 0.058	6.03^{cd}± 0.075	5.94^{b}± 0.032	5.96^{l} ±0.022	6.09^{bc}± 0.036	5.94^{C}± 0.038
24.0	6.05^{d}± 0.089	5.99^{d} ±0.055	5.92^{b}± 0.054	5.94^{l} ±0.056	6.13^{b} ±0.096	5.84^{c}±0.109

[a-d] Values in columns with different superscripts differ significantly ($P<0.05$).

Table 2

Estimated parameters of pH decline (Kastner et al., 1993) and estimated time to reach pH 6.2

Muscles	β_0	$\beta_0 - \beta_1$	β_2	*Time to reach pH 6.2*	
				hr	*min*
Gastrocnemius pars interna	7.49^{a} ±0.143	6.06^{a}±0.048	-0.589^0.217	3	57
Femorotibialis medius	6.96^{b} ±0.218	5.98^{ab}±0.069	-0.443^{a}±0.167	3	22
Ambiens	9.80 ±4.327	5.72±0.418	-3.035 ±2.616	0	43
Iliotibialis lateralis	6.80^{c} ±0.246	5.92^{b}±0.030	-0.564^{a}± 0.215	2	03
Iliofibularis	9.01 ±2.096	5.86±0.462	-3.918 ±2.306	0	34
Iliofemoraiis	6.76^{bc}± 0.461	5.85^{C}±0.066	-0.574^{a}± 0.295	1	41

[a-c] Values in columns with different superscripts differ significantly ($P<0.05$).

β_0 = estimated pH at time = 0; $\beta_0 - \beta_1$ = asymptotic minimum pH; β_2 = rate of pH decline

CONCLUSIONS

During storage after slaughtering the hen meat from studied parts of carcasses reveal a lack of improvement in tenderness following ES.

There is, therefore, no risk of cold shortening when *ambiens* and *iliofibularis* muscles are separated from the bones.

The *iliotibialis lateralis* and *iliofemoralis* present a risk of cold shortening when they are separated as in standard practice.

Cold shortening in hen meat is not present so the application of ES to hen carcasses is unnecessary.

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