EFFECTS OF THE METHOD OF CHILLING, ELECTRICAL STIMULATION AND BONING TIME ON QUALITY CHARACTERISTICS OF CHICKEN BROILER BREAST MEAT.

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SUMMARY

In a study the interaction of the effects of electrical stimulation, the way of chilling and the moment of boning was studied. Stimulation was conducted by applying an electric current (100 V, AC) during 1.5 minutes (0.5 s stimulation and 1 s intervalls) by head/feet (ES1) and breast/feet (ES2). Non stimulated birds served as a control. Also carcasses were chilled in slush ice and air respectively during time periods from 30 to 180 minutes before boning. A non chilled sample, boned before chilling, served as a control. The breast meat samples were stored chilled at 0 °C overnight. Shear, juiciness, pH, R-values and CieLab colour values were estimated.

The results of the study show an effect of e.s. on pH of the meat. Due to an e.s. treatment an average pH drop of 0.3 has been found. This effect of accelerated aging is also shown by the R-values found at the moment of boning. Stimulation resulted in significant increase of R-values by 0.1 in the e.s. groups. Shear values are significantly affected by boning. Values drop from 58.6 N to about 25 N when boning time is increased from 0 to 180 min after evisceration. Interaction of e.s. and boning however appeared not to be significant. Chilling procedure and e.s. treatment resulted in significant interactive effects. Furthermore some minor significant effects have been found in juiciness values and CieLab colour values.

Introduction

Electrical stimulation (ES) of broiler chicken carcasses during processing to increase the aging process has been subject of many studies. (Dawson, *et al.*, 1987, Thompson, *et al.*, 1987) Results from these studies show a remarkable variation. Especially tenderness of breast filets is affected by the e.s. treatment. In some studies (Webb, *et al.*,1988) tenderness is improved, in other studies (Froning and Uijttenboogaart, 1988, Uijttenboogaart, 1991) no effect or even a negative effect has been found. A possible explanation of the differences found in the studies is that interactions occur with other process parameters like method of chilling, moment of boning, the way of stimulation, etcetera.

In this study the interaction of the effects of stimulation, the way of chilling and the moment of boning was studied.

Materials and methods

Three trials of 108 broiler chickens from one flock were slaughtered at the Spelderholt experimental slaughterhouse. The birds were exposed to different electrical stimulation treatments, boning time and way of chilling according to the scheme given in table 1:

Table 1. Number of birds per treatment as used for each trial.

ES treatment

C: Non stimulated control birds. Birds were kept during 1.5 minute after bleeding to correct for time as compared to the stimulated birds.

ES1: Electrical stimulation was applied during 1.5 minute at 100 V AC, pulses of 0.5 s, relax time 1 s after bleeding. Equipment used as is described by Froning and Uijttenboogaart (1988)

ES2: Electrical stimulation was applied by a copper electrode placed at the breast of the birds. Time, voltage, type of current, etc was as described for ES1.

Chilling

Birds boned 0.5 to 3 hours after evisceration were kept at room temperature or chilled in ice slush. After boning the breast muscle (M. pectoralis) was wrapped in a poly ethylene bag and stored overnight at 4 °C.

Analyses

pH was measured after stimulation, boning and overnight storage using the method of Jeacocke (1977) by mixing a meat sample in a iodo-acetate solution.
R-value was measured according to the method described by Honikel and Fischer (1977) after boning and overnight storage.
Colour measurements were carried out using a Minolta Chromameter and expressed in L*, a* and b* values.
Shear force was measured using the Warner-Bratzler shear as described by Uijttenboogaart and Froning (1977).
pH and R-value measurements were carried out in one breast half, the other breast half was used to estimate colour and shear.
The results were statistically analyzed using an analysis of variance (Genstat V, statistical program)

Results and discussion

In tables 2 to 4 the results of the shear measurements are given. Analyses of variance of the results only shows a significant main effect of boning time. This result has been shown in many other studies (Lyon, *et al.*, 1985, Froning and Uijttenboogaart, 1988)

Significant interaction results of method of chilling and stimulation treatment have been found (Table 4). Electrical stimulation improves shear force values when birds are ice chilled. In the ice chilled groups electrical stimulation by the use of a copper electrode (ES2) even results in more tender birds compared to the ES1 treatment using a waterbath.

Air chilled birds show no (ES1) or even a significant negative (ES2) effect on shear force values. These differences in effect found in this study may explain differences found in literature when studying the use of ES to improve tenderness.

R-values are given in table 5 to 8. Significant effects have been found for three-way interaction (stimulation treatment * chilling method * boning time - table 5), two-way interaction (stimulation * boning time - table 6) and main effects on boning time (table 7) and chilling method (table 8).

Especially these main effects on R-values can be explained by the fact that aging is delayed by ice chilling which results in lower R-values. Longer aging periods pre-boning results in higher R-values.

ES itself results in a significant higher R-value Differences in R-values between control and stimulated birds is increased at 30, 60 and 120 minutes boning time. Aging appears to be accelerated in stimulated birds, not only during the stimulation treatment but also during the period after stimulation.

pH values. not given in this paper, roughly follow the results of the R-values. pH is affected by boning time (=aging), and electrical stimulation. The decrease of pH value due to the stimulation treatment is about 0.3. Chilling does not affect pH significantly.

Results of colour measurements only show a few minor significant differences. The differences found are of an order that can not be detected by the human eye.

Table 2. Mean shear force values per treatment.

Values followed by a different letter are significantly different ($p<0.05$)

Table 4. Significant interaction effects of chilling and ES treatment on shear values (N).

Values preceded (within columns) or followed (within rows) by a different letter are significantly different ($p<0.05$)

Table 5 Mean R-values per treatment and significant differences found.

Values preceded (within columns) or followed (within rows) by a different letter are significantly different ($p<0.05$)

Table 6 Significant interaction effects of boning time * stimulation on R-values.

Values followed by a different letter are significantly different ($p<0.05$)

Table 8 Significant main effect of chilling method on R-values.

Literature

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