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## THE EFFECT OF ELECTRICAL STIMULATION AND AGING ON THE SHEAR DEVELOPMENT DURING STORAGE OF FRESH CHICKEN BREAST MEAT

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### INTRODUCTION

Treatment of broiler chickens by electrical stimulation (ES) during the slaughtering process did not have the expected tenderizing effects on early-harvested breasts fillets (Froning and Uijttenboogaart, 1988; Uijttenboogaart, 1991).

However some studies were published in which a positive effect on tenderness development was described (Webb *et al.*, 1988).

Also Li *et al.* (1993) described studies being conducted on ES and the inconclusive results obtained in various studies. Reasons for differences in conclusions were mentioned:

1. ES parameters like voltage, wave length, frequency, duty cycle and systems of application varied.
2. The ES starting point in the processing sequence varied from experiment to experiment as did the post-mortem procedure.
3. Different processing and sampling methods were used. There were many different ways and waiting times used to age carcasses and debone meat after evisceration.

The study described here combines ES procedures, holding times at low temperature and different storage periods at 4°C. Effects of treatments/processes on meat quality characteristics were measured.

At present, the experiment has been partly executed and preliminary results will be presented.

### MATERIALS AND METHODS

Per sampling day 36 broiler chickens from one flock were randomly obtained from commercial processing plants nearby Spelderholt Centre. Parameters were the ES treatment, time of deboning and storage time.

## ES treatment

### C control

ES1 stimulation during 1.5 minute at 100 V (pulses of 0.5 s, relaxation 1 s) after bleeding, ES conducted as described by Froning and Uijttenboogaart (1988).

ES2 as ES1, after picking

ES3 as ES1, after evisceration

ES4 stimulation during 2 times 45 s at 100 V (pulses of 0.5 s, relaxation 1 s) after bleeding and after evisceration respectively

ES5 as ES1 but ES is applied by a copper electrode at the breast side of the carcass

Time of deboning: after 0, 0.5, 1, 3, and 6 hours chilled (0°C) storage

Storage time: 1, 2 and 6 days at 4°C

Results from former studies indicated that a major effect of time of deboning on breast meat shear can be expected. For practical reasons this effect has been combined with a possible flock effect. So per experiment, all five ES treatments and the control (not stimulated) were applied to six birds each. These six birds per ES treatment were stored at 4°C and two were sampled after 1, 2 and 6 days respectively.

## Meat quality analyses

\* pH (Jeacocke, 1977) and R-value (Honikel and Fischer, 1977) after bleeding, before ES after ES treatment (treatment ES4 two times) and at time of deboning.

\* colour of the meat immediately before heating using the Minolta chromameter.

\* shear force using the Warner Bratzler shear (Froning and Uijttenboogaart, 1988).

## Statistical analysis

Analysis of variance was used to analyse the shear force data and the L\* colour data using SPSS/PC+. The L\* colour data was analyzed using a one way ANOVA and Duncan's Multiple Range Test.

## RESULTS AND DISCUSSION

Figure 1 shows the pH drop in breast meat measured at deboning. ES1, ES4 and ES5 treatment showed a rapid decline of pH. In all these cases ES was applied directly after bleeding. Applying ES after picking or evisceration did not increase speed of pH drop as compared to the controls.

The R-values of the breast meat at the time of deboning are given in Figure 2. An increase in R-values was seen when ES1, ES4 and ES5 was applied. Remarkably, however, there was a rapid increase in R-value obtained when applying ES5. As the R-value is considered to measure rigor mortis it was concluded that in this case rigor was most advanced.

Figure 3 shows the mean shear force data averaged over the different storage periods. The interaction between deboning time and ES treatment was significant. The pattern of the shear force curve from ES5 was quite different. With this treatment ES was applied by a copper bar at the breast side of the chicken. Analyzing the data obtained from the samples deboned one hour after eviscerations showed, in all cases but ES5, an increase in shear force. However, the level of significance at that time between ES5 and the control was between 0.05 and 0.1.

Figure 4 shows the L\* colour values as obtained by different ES treatments. Data were averaged over deboning times.



Overall means are given in Table 1.

From these data a strong darkening effect of ES as compared to the control was observed. The L\* colour value of the control was significantly higher than the L\* value from all ES treatment groups. The average L\* value from the ES5 group was significantly lower than all but one other group. This confirmed, more or less, the results from the shear force data. ES5 seemed to be a more effective way of applying ES.

Further research is needed to confirm this finding and to investigate the effect of the method to apply ES.

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Table 1. Mean L\* colour values per ES treatment. Values followed by same character do not differ significantly.

	Mean L* colour value
Control	56.2 <sup>a</sup>
ES1	54.6 <sup>b</sup>
ES2	53.9 <sup>bc</sup>
ES3	54.5 <sup>b</sup>
ES4	54.6 <sup>b</sup>
ES5	52.5 <sup>c</sup>