EFFECTS OF HIGH FREQUENCY STUNNING COMBINED WITH ELECTRICAL STIMULATION ON CHICKEN BREAST *(P. Major)* TENDERNESS

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SUMMARY

In each trial chickens weighing 2,2 - 2,5kg were stunned for 11s at 40V, 1000Hz, using a current with bipolar square wave. After a 5min. bleeding the chickens were electrically stimulated at 45, 80 and 100V fr 30s. A Control group was not stimulated. Five of the 10 birds used in each treatment were boned after defeathering (hot boning) and the other five followed normal slaughtering procedures. Hot boned breasts were chilled at 21°C for 15min and then for 3°C for 30min. Warner Bratzler shear values breasts cooked to an internal temperature of 85°C were measured in an INSTRON. Tenderness, juiciness and overall quality were sensory evaluated using a non-structured descriptive scale. Shear values decreased with the increase of electrical stimulation voltage from 7,4 kgf/g at 45V to 5,9kgf/g at 100V. The non-stimulated breast had a statistically higher shear value of 7,8kgf/g. The non-stimulated breast had a statistically higher frequency stunning and electrical stimulation at 100V resulted in lower shear value for conventionally boned breast meat (4,2kgf/g) when compared to non-stimulated samples (7,7kgf/g) and non-stimulated samples (9,1kgf/g). All treatments submitted to high frequency stunning and different electrical stimulation voltages had a shear value lower than the value 8kgf/g, the upper limit to consider chicken breast meat tender. The sensory analysis confirmed these objective measurements with the conventionally boned breast stimulated at 100V receiving tenderness scores of 8,1 and the corresponding hot boned samples receiving scores of 5,8. There was no significant differences in juiciness and overall quality was influenced just by the factor voltage, receiving scores of 6,9 and 6,8 for 80 and 80V respectively.

It can be concluded that: 1) high frequency current stunning had a tenderizing effect on chicken breast meat but not enough to substitute electrical stimulation and; 2) Electrical stimulation at 100V increases the tenderness of conventionally and hot boned chicken breast meat.

INTRODUCTION

The stunning of chickens during slaughter has humanitarium and technological reasonings. Stunning prevents or minimizes bird suffering during the bleeding operation, reduces the stress and bird movement minimizing wings and legs bruising.

Stunning efficiency depends on parameters like voltage, amperage frequency and immersion time. GREGORY *et ali.* (1991) states that stunning at high frequency causes reduction on convulsions at the beginning of the current flow, but it is not established if this improves carcass quality.

Electrical stunning reduces the post mortem glicolysis rate reducing sarcomere shortening and improves meat tenderness (LEE et al. 1979; KIM et al. 1988). However to improve the tenderness of hot boned breasts the use of electrical stimulation has been suggested. An extensive review on this subject was done by LI et al (1993). They concluded that tenderness of electrically stimulated poultry meat was affected by electrical parameters, physical, physiological and biochemical factors, and experimental factors.

In a previous work CONTRERAS et al (1993) studied the effects of low voltage electrical stimulation on tenderness of hot and conventionally boned chicken breast, using birds stunned at conventional conditions of 40V, 60Hz (30 - 50mA). They concluded that electrical stimulation had a tenderizing effect on both types of breast meat.Hot boned

breast meat was as tender as non-stimulated conventionally boned meat. The aim of the present study was to determine if high frequency stunning could eliminate the need for electrical stimulation of hot and conventionally boned breast meat.

MATERIALS AND METHODS

In a trial forty chickens, divided in four lots selected at random from a population of 45 day old Cobb breeding, and weighing 2,2 - 2,5kg, were stunned at 40V and current of 1000Hz for 11s. Frequency was measured using an oscilloscope Tectronix mod. 5103N. After a bleeding period of five minutes the carcasses were subjected to pulsed electrical stimulation (2s on; 1s off) at voltages of 45, 80 and 100V using an electrical stimulator supplied by JARVIS DO BRASIL. The pulses were completed after 30s.

A control lot was not subjected to electrical stimulation. After defeathering half of each lot was suspended from a shackle by the neck and the breast fillet (*Pectoralis superficialis*) was removed. The fillets with the wings attached were chilled at 21°C for 15 minutes and then at 3°C for 30 minutes. The other half of the lot followed the normal line and was deboned after chilling and dripping. There trials were conducted in different periods.

The breast fillets were kept at 2 - 3°C for 24h, wrapped in aluminium foil and cooked to an internal temperature of 85°C according to the Working Group (1987). After cooling for 24h at 2°C samples from the right, side of 2cm x 1,3cm, were sheared in an INSTRON equipment model TM-2318 using a Warner-Bratzler device.

The left side of the breasts was used for sensory analysis. Tenderness, juiciness and overall quality were evaluated by 14 trained judges using a non structured descriptive scale. The statistical design was incomplete blocks. The panel was conducted using a Computerized Sensory Analysis developed by Compunsense, Inc., V4.2.

The data were analyzed according to the factorial model using analysis of variance and Tukey's multiple range test available in the Statistical Analysis System (Statgraphics, V4.0)

RESULTS AND DISCUSSION

The effect of electrical stimulation voltage and type of boning on the shear values is shown in Table 1. The voltage effect was considered statistically significant (P = 0,0006). Increase in electrical stimulation voltage contributed to decrease the shear values Non-stimulated breast showed the highest shear value, of 7,8kgf/g where the lowest shear value of 5,9 kgf/g was obtained using stimulation of 100V.

These values were lower than those reported by CONTRERAS *et alii* (1993) using the same conditions of processing and electrical stimulation but using a standard stunning current of 60Hz at 40V.

Hot boning contributed to increase shear values (P = 0,00001). Hot boned muscles showed an average shear value of 8,4 kgf/g against 5,3kgf/g showed by the conventionally boned ones. The shear values obtained, with the exception of the ones from hot boning, were lower than the value 8kgf/g considered by SIMPSON & GODWIN (1974) as the limit for tender meats.

The relationship between electrical stimulation voltage and shear value can be described as a linear regression, as shown in Figure 1. This means that an increase of 10 units of voltage produces a decrease of 0,2kgf/g in shear value.

The combined effects of stunning and electrical stimulation voltage on shear value and tenderness of breast meat is shown in Table 2.

For both treatments, conventionally and hot boning lower shear values were obtained using an electrical stimulation voltage of 100V with values of 4,2kgf/g and 7,7kgf/g respectively. Comparing these figures with those for non stimulated carcasses it can be concluded that electrical stimulation reduced shear values by 2,2kgf/g for the conventional process and 1,4kgf/g for hot boning.

Non stimulated hot boned carcasses showed an average shear value of 9,1kgf/g, lower than the 11,3kgf/g reported by CONTRERAS *et al.* (1993) using the same conditions of processing, except for the current frequency of 60Hz.

These results indicate that stunning at high frequency contributes to reduce shear values for both types of boning.

Sensory analysis of the breast meat showed that for both types of boning, conventional and hot boning, there was an increase in tenderness with the increase in voltage, similar to the results obtained by measuring shear values. Conventionally and hot boned breast at 100V showed a score for tenderness of 8,1 and 5,8 respectively. Lowest scores were recorded at 45V of 6,8 and 4,7 for the conventionally and hot boning respectively.

The effects of electrical stimulation (E.S.) voltage and type of boning on the sensory attributes of juiciness and overall quality are shown on Table 3.

There was no statiscally significant difference in juiciness due to E.S., with scores ranging from 5,6 - 6,2. Overall quality scores increased with E.S. voltage from 6,2 to 6,9. This cannot be atributed to increased tenderness since the overall quality of non-stimulated breasts was not statiscally different from those stimulated at 100V.
Hot boned breast were significantly less juicier than conventionally boned ones and had significantly lower score for overall quality.

CONCLUSIONS

1) High frequency current stunning had a tenderizing effect on chicken breast but not enough to substitute E. S..
2) Electrical stimulation at 100V increases the tenderness of conventionally and hot boned breast meat.

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