

ACCELERATION OF CHICKEN MUSCLE AGING BY ELECTRICAL STIMULATION

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Background

Meat flavor and tenderness have been shown to increase with aging. Subsequent to evisceration, the deboning, cutting and packing of chicken are carried out swiftly to expedite selling. Deboning, in a limited number of cases such as post-aging and *rigor mortis* is carried out in the broiler industry of Japan¹⁾, but with consequently less customer appeal. Assessment of tenderness and microbial data on aged chicken are thus rarely reported.

Objectives

Special attention in this study was directed to the chicken breast, since this particular meat is expected to quickly show aging with electrical stimulation (ES), according to results from preliminary experiments. With the ES system, the time required for aging and to make product display in the market is shortened^{2,3)}. In this way, processing efficiency is enhanced with greater quality assurance. The results of ES application with regard to texture and bacterial count in the carcass surface are discussed in the following.

Methods

An ES apparatus (Fig. 1) was designed for application to normal breast broiler chicken meat. The results were compared with those for the control (conventionally processed chicken) via the following experiments.

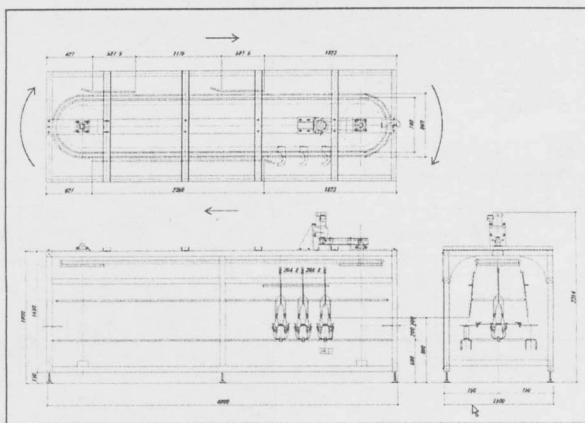


Figure 1. Apparatus for electrical stimulation for chicken.

1. Control and trial groups

1) Control group (conventional process): After evisceration, chicken carcasses were cooled (0~3°C, 40 min) and breast meat was removed.

2) Low temperature aging (LTA) group: The usual method was used. After the above cooling, the carcasses were refrigerated at 0~4°C for 4~8 hr and breast meat was removed.

3) ES group: Following evisceration and quick ES application (100V, 50Hz), the meat was placed in a refrigerator for 2 hr. The ES process was conducted as follows: 1st: 2 min ES 2nd: 1 min stop (pause) 3rd: 30 sec ES 4th: 1 min stop (pause) 5th: 30 sec ES.

2. Heat treatment

All breast meat specimens were vacuum-packed and then rapidly cooled to 0°C. They were heated at 85°C for 30 min. The upper and lower meat portions underwent assessment for texture.

3. Texture assessment

This assessment was conducted on cooked breast meat cut in the direction of muscle fiber (10 mm size). The two sampling sites were upper and lower in meat portions. Meat cutting was done by machine at exactly the power required as shear value (g) using the RHEO TEX (Type SD-305, San Kagaku Co., Ltd.).

4. Microbiological data

For clarification of the effects of ES on bacteria on the meat surface, the swab method was used with sterilized cotton as follows: Sampling area was 5×5 cm and bacterial number was measured with agar culture. Sampling was performed as follows: 1) Evisceration (all experimental groups), 2) After carcass cooling (all experimental groups), 3) Following removal of breast meat (control group), 4) At 4 hr aging and cutting (LTA group), 5) After ES (ES group), 6) At 2 hr aging and cutting (ES group).

Results and Discussion

1. Texture

An experiment was conducted to determine conditions for ES (7 chickens of each exp.). AC100V/50Hz (versus hen chicken) was found to give the best sensory score for tenderness. With DC48V (for hen chicken), bubbling and burning of the portion attached to electrode were noted. Thus ES with AC was used in the present.

As shown in Fig. 2, with aging, upper and lower portions of chicken meat were tenderized. The ES group of these portions showed the lowest shear value, as did also LTA tenderized chicken breast meat. Variation in ES, however, was less than in LTA.

2. Microbiological compilation

As shown in Fig. 3, bacterial count on the meat surface significantly decreased with ES. As noted previously²⁾, ES reduces the number of bacteria on chicken skin. The mechanisms for bacteria death by electricity may proceed through mechanical, chemical and thermal effects. In this study, bacterial count did not increase with ES after cutting. ES attack on bacteria under the surface may possibly be the reason for this.

Conclusions

Electrical stimulation has been used to accelerate the aging of cattle and sheep meat. In this study, ES had essentially the same effect on tenderness as low temperature at which chicken meat aging is generally conducted. ES may thus be considered to accelerate the aging of chicken meat. ES also caused decrease in bacterial count on chicken meat surface, this possibly being the result of cell membrane destruction. ES should also be examined for use in bacterial control in the meat industry.

Related literature

1) Okumura, T., Inuzuka, Y., Ogawa, M., Ogawa, T., Nakamura, T., Ide, H., Kuboi, M. and Nishimura, T. Effect of postmortem boning time on chicken breast meat qualities during aging – Physical, chemical, morphological and organoleptic properties. *Nihon Chikusan Gakkaiho*, 73: 291-298, 2002. 2) Yanbin, L.I., Siebenmorgen, T.J. and Griffis, C.L. Electrical stimulation in poultry: A review and evaluation. *Poultry Science*, 72: 7-22, 1993. 3) Sams, A. Commercial implementation of postmortem electrical stimulation. *Poultry Science*, 78: 290-294, 1999.

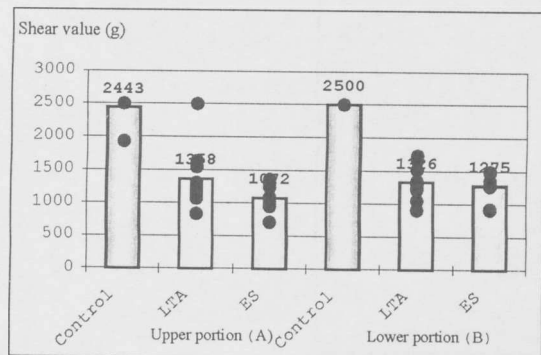


Fig. 2. Texture (shear value) of conventional (control), LTA and ES-processed chicken breast meat.

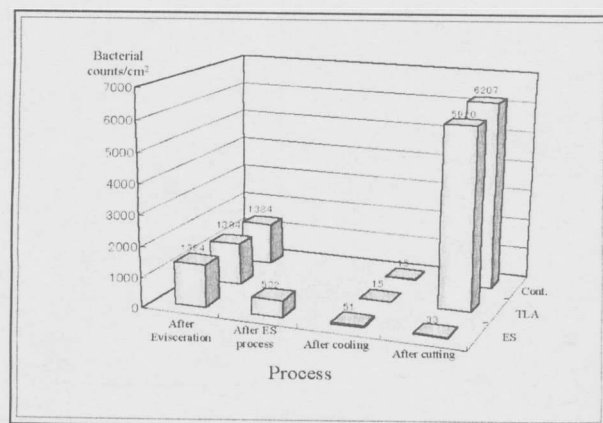


Fig. 3. Changes in bacterial count for all experimental groups.