Effects of Electrical Stimulation and Hot Boning on the Functional Characteristics of Presalted Beef Muscle Used in Sausage Manufacturing

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Summary

Presalted, hot-boned muscle has excellent emulsifying properties for sausage manufacturing. However, electrical stimulation degrades these properties. Thus, while electrical stimulation and hot boning produce acceptable steaks and roasts, the value of the trimmings used in manufactured meat products may be lowered. Presalting maintained the high pH values of the hot-boned muscle during 24 hours storage.

Introduction

Muscle pH decreases as lactic acid accumulates during rigor mortis. Before rigor, muscle can bind more fat and water than after. So high pH, prerigor muscle is desirable in finely chopped products like bologna. Adding salt to prerigor muscle (presalting) for sausage manufacturing further increases its fat and water binding capacity.

Electrical stimulation has been used to accelerate rigor mortis in hot-boned beef carcasses, producing steaks and roasts of acceptable palatability. Emulsifying capacity and emulsion stability are critical characteristics in meat used for sausage manufacture. Since large quantities of beef trimmings are produced, and may be used in sausage manufacturing, we designed this experiment to determine the effects of electrical stimulation (ES) and hot boning (HB) on those characteristics.

Experimental Procedure

Thirty cattle were slaughtered in three groups at the KSU meat laboratory. Half of each group (5 cattle) was processed in the following manner: one side of each carcass was hot boned at 1 hour postmortem (HB), and the other side was conventionally boned after chilling at 36 to 46 F for 48 hours (CB). The other 5 cattle were electrically stimulated at the time of bleeding. The electrical stimulus was applied for 2 minutes with approximately 50 volts and 60 Hertz of alternating current (1 second on; 1 second off). After ES, cattle were skinned, eviscerated, and split into sides. One side of each carcass was hot boned at 1 hour postmortem (ESHB). The other side was conventionally boned after chilling at 36 to 46 F until 48 hours postmortem (ESCB).

The Triceps brachii (TB) chuck muscle was removed, coarsely ground, presalted (3.0%), placed in a polyethylene bag, and stored at 39 F for 24 hours. The pH was measured at 3 times: 1) from the intact TB muscle, 2) after presalting, and 3) after 24 hours storage of presalted meat.

Emulsifying capacity was measured as the total volume of vegetable oil emulsified by the presalted meat. To measure thermal emulsion stability, presalted meat emulsion was weighed both before and after cooking for cooking loss, and the amount of released fat, liquid, and solid was measured.

Results and Discussion

At all measurement times, prerigor HB muscle had a higher pH than postrigor CB muscle, but ES decreased the pH in ESHB samples (Table 20.1). Presalting maintained the high pH values of HB muscle during 24 hours of storage.

Table 20.2 shows that although HB muscle had the advantage of higher emulsifying capacity and thermal emulsion stability than CB muscle, electrical stimulation destroyed that advantage, and in fact created a product with lower thermal emulsion stability than CB beef.

ES may change the protein characteristics and thus lower the heat stability of the protein-fat matrix in a meat emulsion.

Table 20.1. Means for pH of Chuck (Triceps brachii) Muscle by Carcass Treatments.

Time of pH measurement	Treatments			
	CB	HB	ESCB	ESHB
Intact muscle	5.45^a	6.37^c	5.51^a	5.77^b
After presalting	5.43^a	6.24^c	5.48^a	5.71^b
24 hr after presalting	5.43^a	5.89^c	5.46^a	5.61^b

^{abc}Means in the same row bearing different superscripts are significantly different ($P<.05$).

Table 20.2. Means for Emulsifying Capacity (EC) and Thermal Emulsion Stability of Presalted Meat after 24 Hours Storage by Carcass Treatments.

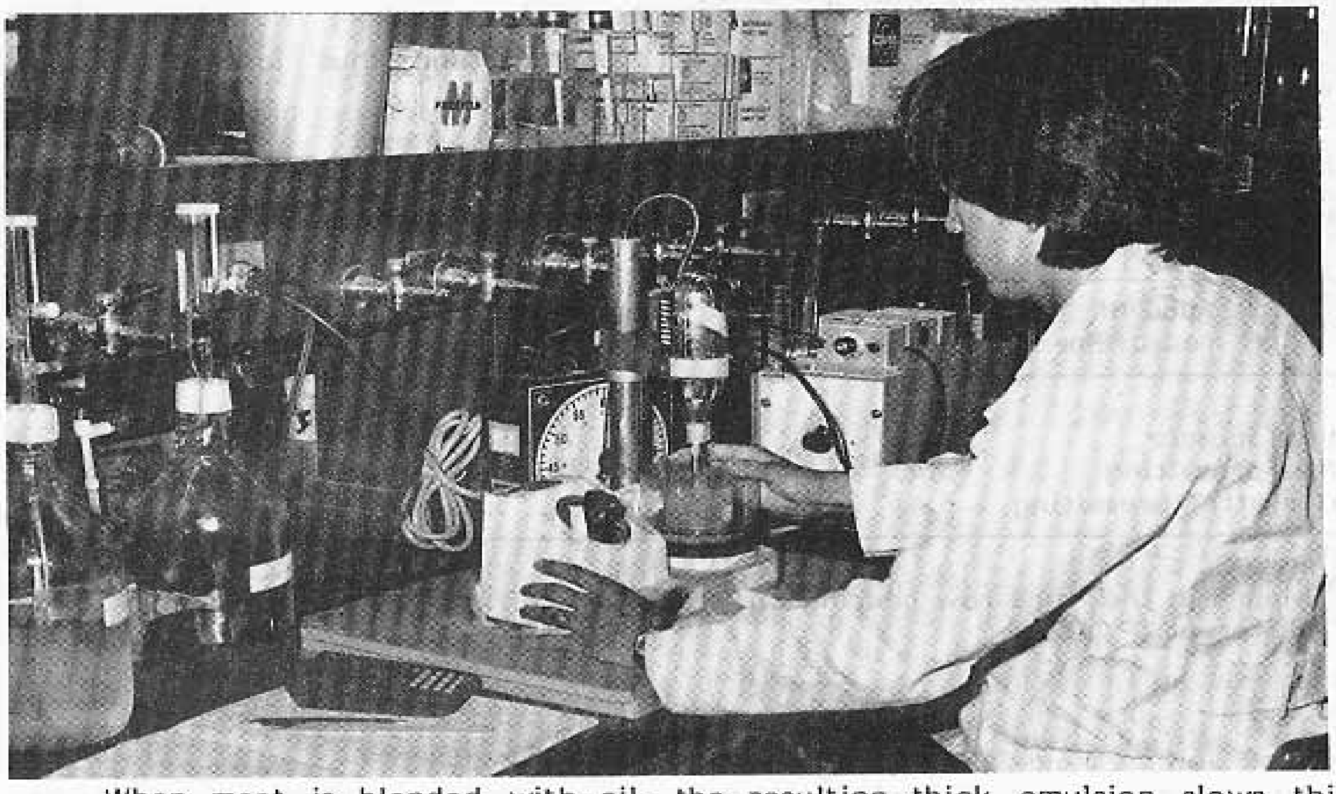
Emulsion characteristics	Treatments			
	CB	HB	ESCB	ESHB
EC (ml)[a]	77.3[e]	98.1[f]	68.3[d]	76.3[e]
Thermal Emulsion Stability				
Cooking loss (%)[b]	14.73[e]	4.47[d]	22.45[f]	19.70[f]
Fat (ml)[c]	0.01[de]	0[d]	0.17[e]	0.60[f]
Liquid (ml)[c]	11.11[e]	1.31[d]	18.31[f]	15.74[f]
Solid (ml)[c]	0.29[e]	0[d]	0.79[g]	0.61[f]

[a]Oil emulsified per 1 gram of presalted meat.

[b](Wt. of meat emulsion before cooking - wt. after cooking) ÷ wt. before cooking × 100.

[c]Amount of released fat, liquid, and solid after cooking per 100 gram of meat emulsion.

[defg]Means in the same row bearing different superscripts are significantly different (P<.05).



When meat is blended with oil, the resulting thick emulsion slows this homogenizer. But when more oil is added than the meat can emulsify, the emulsion "breaks" and the homogenizer speeds up, giving an estimate of the meat's emulsifying capacity.