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## Meat and Muscle Biology™



### Optimization of Processing Technology of Chilled Freshly Prepared Steaks Using Unfatted Beef

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## Objectives

Enhancement has been known to improve eating quality of fresh beef, in particular, with low marbled beef or from not fattened cattle. The objectives of this study was to determine the optimal enhancement processing condition to improve the eating quality of freshly prepared steaks with application of tumbling and calcium lactate.

## Materials and Methods

The *Longissimus lumborum* muscles of 12 Luxi × Simmental cattle, 18 ~ 24 mo (no fattening), were selected and aged for 48 h (pH<sub>24</sub> was 5.56 ± 0.03). The muscles were cut into steaks of 3 cm, and tumbled with a brine (1% sodium chloride, 0.4% sugar, 0.4% phosphate and different concentrations [0.016 M, 0.05 M, 0.1M, 0.15M and 0.184 M] of calcium lactate (CAL)), then tray-packaged with the PVC film and stored at 4°C for 7 d. The SF was measured according to the methods of Luo, Zhu, and Zhou (2008).

Purge loss (%) = [(tumbling weight – post storage weight) / tumbling weight] × 100

Cooking loss (%) = [(uncooked weight – cooked weight) / uncooked weight] × 100

% Yield = (final cooked weight / green steak weight) × 100

Response surface methodology was applied to optimize the processing parameters. The design consisted of 20 sets of experiments with 3 replications, and with 5 levels of each independent variable which were coded as –1.682, –1, 0, 1, and 1.682 (Table 1). The range of the experiment and its center point were based on preliminary trials. A central composite rotatable design was used to evaluate the relevance of the 3 independent variables of tumbling time (X1), marinade volumes (X2), and CAL concentration (X3). The dependent variables were purge loss (Y1), cooking loss

(Y2), yield (Y3) and shear force (Y4). Software SAS 9.2; (SAS Inst. Inc., Cary, NC) was used for data analysis.

## Results

Based on the analysis of the effects of variables on purge loss, cooking loss, yield and SF, the optimum condition was determined by superimposing the contour plots of 4 responses. The optimum condition constraints were set as purge loss < 0.6%, cooking loss < 25%, yield > 84%, 3.9 kg < SF < 4.2 kg. The results indicated that the best tumbling time was 60 to 73 min and the best CAL concentration was 0.15 M. The tumbling time 60 min and 0.15 M CAL was then put into the model which showed the best marinade volume to be 8%.

## Conclusion

The optimum process conditions for freshly prepared steaks was: tumbling for 60 min, 8% (v/w) marinade and 0.15M CAL. In these conditions, the SF was 3.94 kg, and the purge loss, cooking loss, yield was 0.40%, 22.76% and 83.56%, respectively, which are well in agreement with the values predicted by the model. The eating quality was much better that other CAL concentrations. This investigation could help meat industries to produce high quality chilled freshly prepared steak.

**Table 1.** Critical factors in Response Surface Methodology analysis.

Factors	Symbol coded	Levels				
		-1.682	-1	0	1	1.682
Tumbling time, min	X <sub>1</sub>	20	30	45	60	70
Marinade volume, %, v/w	X <sub>2</sub>	3.3	6	10	14	16.7
Calcium lactate concentration, M	X <sub>3</sub>	0.016	0.05	0.1	0.15	0.184