EFFECT OF CELERY POWDER ON RESIDUAL NITRITE, COLOR AND SENSORY QUALITY OF CHINESE STYLE SAUSAGES

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I. INTRODUCTION

For centuries nitrate and nitrite have been used extensively in preserving meat products that create the distinctive cured meat color and other characteristics such as distinct flavors, decreased lipid oxidation, and inhibition of bacterial growth [1]. Chinese-style sausage was one of the most popular traditional meat products in Taiwan and worldwide for its unique flavor. This sausage remain stable for a long period of time, due to its high salt content and usually added nitrite to perform cured meat color and flavor. However, consumers have become apprehensive about the use of chemical preservatives, and it drives the producer to seek alternative ingredient. In order to produce a product with the similar characteristics seen in a conventionally cured product, scientist began using celery powder (Florida Food Product Inc., 2008) which contained high concentrations of nitrate or nitrite as an alternative to commercial nitrite [2]. The main objective of this study was to evaluate celery powder replacement of nitrite on color, residual nitrite and sensory acceptance of naturally cured Chinese style sausage.

II. MATERIALS AND METHODS

Chinese style sausages were made with fresh pork and back fat ground by Table Model Grinder, Butcher boy (UK). Treatments utilized three celery powders: (TRT 1: 0.3% celery powder added; TRT 2: 0.5% celery powder; TRT 3: 0.7% celery powder) and a sodium nitrite-added treatment as control (C). Ground meat was mix with celery powder and seasoning. The meat batter was cured for 2 days. Chinese style sausages were dried for 5 hours at 45℃. The final products were vacuum packed. Sodium nitrite residue [3], and internal color (*L*, a** and *b**) were analyzed on 0, 2, 4, 6 and 8 weeks. Sensory evaluation by a trained panel was conducted. The analysis attributes were: color, odor, texture, juiciness, saltiness, flavor and acceptability using 9-point hedonic scale varying from “I like extremely” (9) to “I dislike extremely” (1) [4]. The study was replicated two times and data were analyzed using completely randomized design (CRD) with split plot treatment arrangement and least square mean test for means comparisons (v 9.4, SAS Institute, Cary, NC, USA). The Sensory evaluation results were used the program (v 9.4, SAS Institute, Cary, NC, USA) subjected to analysis of variance (ANOVA) for means comparisons.

III. RESULTS AND DISCUSSION

The results of residual nitrate in Chinese style sausages were showed in Table 1. Higher nitrite residue contents were observed with higher celery powder addition, especially in the 0.7%, and it had higher nitrite residues ($P < 0.05$) than other treatments. For all treatments’ residual nitrite contents were decreasing during storage ($P < 0.05$). Similar results were reported by Sinderlar and others who reported that the sausages with celery powder addition, residual nitrite decreased with storage time increased, he said the celery powder could provide nitrite [5]. The color measurements were showed in Table2. No differences ($P > 0.05$) were observed among TRTs and Control for CIE *L** and *a** values. The CIE *L** value of treatments were between 37.33 to 38.75, and the CIE *a** value of all treatments were 7.02 to 8.08 ($P > 0.05$). The 0.7% celery group had significantly higher *b** value then other treatments and control ($P < 0.05$). According to Horsch et al.[1], the celery treatments affected ham color as the concentration was increased, the hams became more yellow (higher b*) than conventional treatments. This was most likely due to the particulates (fibers, carbohydrates, and minerals) that are present in the celery concentrate. And *L** and *a** values were similar for both the celery concentrate and conventional treatments at equal nitrite concentrations. The results of sensory evaluation were shown in Table 3. No significant differences in odor, texture, juiciness, saltiness, flavor and acceptability were found among treatments ($P >0.05$). However, 0.7% celery powder treatment had higher color score as compact to others and control. Sinderlar and others analyzed ham with celery powder addition, the sensory evaluation showed no

differences as compared to the traditional nitrite-added ham [6].

Table 1 Effects of celery powder addition on residual nitrite of Chinese-style sausages during storage for 8 weeks

Treatment	Storage Time (weeks)				
	0	2	4	6	8
Control	55.23^{a,w}	42.89^{b,w}	35.20^{c,w}	27.00^{d,w}	21.89^{e,w}
0.30%	26.23^{a,z}	20.31^{b,z}	18.09^{c,z}	11.09^{d,z}	11.00^{d,z}
0.50%	38.46^{a,y}	30.39^{b,y}	25.96^{c,y}	16.52^{d,y}	16.17^{d,y}
0.70%	45.41^{a,x}	37.61^{b,x}	30.98^{c,x}	21.73^{d,x}	18.74^{e,x}
SEM=0.663					

Different letters in the same row or column indicate significant difference ($p < 0.05$).

Table 2 Effects of celery powder addition on CIE b^* value of Chinese-style sausages during storage for 8 weeks

Treatment	Storage Time (weeks)				
	0	2	4	6	8
Control	7.18^{a,z}	7.34^{a,z}	7.32^{a,z}	7.33^{a,z}	7.25^{a,z}
0.30%	7.77^{a,yz}	7.53^{a,yz}	8.18^{a,y}	8.11^{a,y}	8.12^{a,y}
0.50%	8.44^{a,y}	8.42^{a,y}	8.34^{a,y}	8.52^{a,xy}	8.38^{a,y}
0.70%	9.47^{a,x}	9.42^{a,x}	9.29^{a,x}	9.11^{a,x}	9.76^{a,x}
SEM=0.272					

Different letters in the same row or column indicate significant difference ($p < 0.05$).

Table 3 Effects of celery powder addition on sensory evaluation of Chinese-style sausages

Treatment	Items						
	Color	Odor	Texture	Juiciness	Saltiness	Flavor	Acceptability
Control	5.00^{ab}	5.57^{a}	5.64^{a}	4.71^{a}	5.14^{a}	5.93^{a}	5.59^{a}
0.3%	4.29^{b}	5.07^{a}	6.14^{a}	5.00^{a}	5.06^{a}	5.57^{a}	5.50^{a}
0.5%	4.29^{b}	5.57^{a}	6.21^{a}	4.71^{a}	5.21^{a}	6.00^{a}	5.64^{a}
0.7%	5.79^{a}	5.79^{a}	5.93^{a}	5.29^{a}	6.07^{a}	5.71^{a}	5.29^{a}

Different letters in the same row indicate significant difference ($p < 0.05$).

IV. CONCLUSION

In this study, the replacement of nitrite with celery powder in Chinese style sausage, the higher celery powder addition caused higher nitrite residues and the celery powder could provide nitrite to cure Chinese style sausages. The Chinese style sausage with celery powder had no color difference except the b^* value influenced by the particulates of the plant-derived concentrate that includes plant pigments then the concentration of celery powder increased, the b^* value of Chinese style sausage increased. In sensory evaluation, the Chinese style sausage with celery powder had no sensory attributes difference except the 0.7% celery powder treatment had higher color score. In conclusion, the Chinese style sausages with celery powder added had the similar result as the traditional nitrite added products. The celery powder could be an effective replacement of sodium nitrite in making Chinese style sausage.

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