INFLUENCE OF SUCROSE ON PHYSICO-CHEMICAL PROPERTIES AND SENSORY EVALUATION IN CHINESE-STYLE PORK JERKY

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Background:

Most of Chinese-style processed meats are formulated with significantly higher level of sucrose compared to western style processed meats. In Taiwan, sucrose also has long been used as a sweeter in traditional processed meat products such as sausage, dry pork, etc. The sucrose amount of Chinese style dried meat product is approximately 20% (Wang and Leistner, 1994), according to the different regions had variations in China area.

Non-enzymatic browning involving amino groups (such as ε-NH2 groups of lysine residues and α-NH2 groups of protein) and reducing sugars (such as fructose, glucose, etc) is an important cause of functionality loss of stored proteins (Cerami, 1994). Since sucrose is a non-reducing disaccharide and would not involve non-enzymatic browning. Some studies showed that sucrose may be hydrolyzed during freezing, dehydration and storage (Karel and Labuza, 1968; Schoebel *et al*., 1969), such procedure may lead sucrose to hydrolyze into glucose and fructose, and induced non-enzymatic browning in meat system. No systematic study has been reported to evaluate the usage level of sucrose on the quality of Chinese-style pork jerky.

Objective

The objective of this study was to investigate the physico-chemical characteristics of high level of sucrose in the manufacture of Chinese-style pork jerky.

Materials and methods

The formula of curing ingredients (based on raw meat weight) included 1% sodium chloride, 1% monosodium glutamate, 5% soybean sauce, 0.3% sodium tripolyphosphate, 0.2% sorbic acid, 0.1% cinnamon, 0.05% ascorbic acid, 0.01% sodium nitrite, 0.01% sodium nitrate, 0.1% five-spices powder and different level (0, 12, 15, 18 and 21%) of sucrose.

The pork jerky was processed by the following procedure: (1) removal of subcutaneous fat and connective tissue from pork legs. (2) slice meat to 4 mm thickness by a slicer. (3) mixed curing ingredients with sliced pork chops. (4) cured at 4 ℃ for 48 hr. (5) dried at 55℃ for 80 min. (6) roasted at 180℃ for 5 min and (7) final product was packaged in polyethylene bag without vacuum, stored at room temperature (28℃) for measurement of physico-chemical properties. The moisture content was determined by the method of AOAC (1980). Water activity (a_w) of the sample was determined by using a hygrometer (TH/RTD 523, Novasina, Swiss). Non-enzymatic browning was followed by the procedure of Resnik and Chirife (1979). The protein solubility of pork jerky was measured by the method of Xiong and Brekke (1989). The hedonic test was used to evaluate the chewiness, hardness, sweetness and the overall acceptability of the samples. A score of 1 indicates very low desirability in chewiness, hardness, sweetness and the overall acceptability and a score of 7 indicates very high desirability in chewiness, hardness, sweetness and the overall acceptability (Huffman et al., 1981). All data were analyzed by the SAS system (SAS, 1988).

Results and discussion

The result of this study showed that moisture content ranged from 22.1-32.5% and water activity (a_w) ranged from 0.84-0.75 (Table 1). The moisture content and water activity (a_w) of pork jerky reduced with the level of sucrose increasing ($p<0.05$). High level of sucrose was more effective than low level of sucrose in lowering moisture content and a_w.

Generally, the color function metric saturation (S_{uv}) was chosen as the most suitable function to describe the development of color (Petriella *et al*., 1985). In present study, a absorbance value at 420 nm (non-enzymatic browning) was used as an indicator for detecting color change of pork jerky instead of the S_{uv}. As Table 1 showed that the absorbance value of the pork jerky with 12, 15, 18 and 21% sucrose were higher than the control ($p<0.05$). Among treatments, the pork jerky with 12% sucrose had lower absorbance value than the others ($p<0.05$). As expected, the rate of color development of pork jerky with sucrose was much higher than that of the same pork jerky without sucrose. This result was similar to Buera *et al*. (1987), who pointed out that during non-enzymatic browning, sucrose was browned faster than other sugars.

The result of protein solubility showed that the pork jerky without sucrose had higher protein solubility than pork jerky with sucrose ($p<0.05$). These results indicated that higher level of sucrose caused non-enzymatic browning which is a major deteriorative reaction in intermediate moisture foods (Labuza, 1972). Reyes *et al*. (1982) stated that the sucrose system has a potential reducing sugar concentration twice that of the monosaccharide system and accounts for that system greater degree of browning during the later stages of experiment.

The results of Table 2 showed that the chewiness score of pork jerky with different levels of sucrose were not significant differences compared to the control. The hardness score of pork jerky with 21% sucrose was significantly higher than the control ($p<0.05$). The sweetness score of pork jerky with 21% sucrose also was significantly higher than the samples with 12%, 15% and the control group ($p<0.05$). The overall acceptability score of pork jerky with 18% and 21% of sucrose were higher than 12%, 15% and the control ($p<0.05$). However, the pork jerky with 21% sucrose had the best sensory properties in this study.

Conclusion

The pork jerky with higher level of sucrose seems to be more acceptable by the panelists in hardness, sweetness and overall acceptability. However, pork jerky with higher level of sucrose had significantly negative effect on protein solubility of pork jerky due to the non-enzymatic browning.

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Table 1. Effects of sucrose on moisture content, water activity, absorbance at 420 mm and protein solubility of pork jerky

	Sucrose level, %				
Items	0	12	15	18	21
Moisture content, %	32.5 ± 1.2^a	26.4 ± 1.2^b	24.6 ± 1.1^c	22.7 ± 1.5^d	22.1 ± 1.4^d
Water activity	0.84 ± 0.01^a	0.79 ± 0.02^b	0.77 ± 0.01^c	0.76 ± 0.01^d	0.75 ± 0.01^d
Absorbance at 420 mm	0.158 ± 0.01^a	0.121 ± 0.006^b	0.106 ± 0.01^c	0.106 ± 0.012^c	0.105 ± 0.009^c
Protein solubility, %	14.7 ± 1.1^a	11.0 ± 0.7^b	10.7 ± 0.7^b	10.6 ± 0.5^b	10.5 ± 0.6^b

^{a,b,c}Means at the same row without the same superscript are significantly different ($p<0.05$).

Table 2. Effect of different levels of sucrose (%) on the sensory evaluation of pork jerky

	Sucrose level, %				
Items	0	12	15	18	21
Chewiness desirability	3.97 ± 1.13	4.88 ± 1.22	4.64 ± 1.30	4.88 ± 1.02	5.01 ± 0.75
Hardness desirability	3.96 ± 1.13^b	4.78 ± 0.82^{ab}	4.30 ± 1.10^{ab}	4.78 ± 0.82^{ab}	5.14 ± 0.61^a
Sweetnees desirability	2.55 ± 0.69^c	4.67 ± 0.71^b	4.59 ± 0.70^b	5.21 ± 0.59^{ab}	5.37 ± 0.46^a
Overall acceptability	2.81 ± 0.61^c	4.66 ± 0.60^b	4.40 ± 0.82^b	5.36 ± 0.74^a	5.55 ± 0.48^a

^{a,b,c,d}Means at the same row without the same superscript are significantly different ($p<0.05$).