

THE QUALITY OF TAIWANESE-STYLE MEATBALL USED PRE-GELATINIZED PORK SKIN SLURRY AS MEAT REPLACEMENT DURING FROZEN STORAGE

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I. INTRODUCTION

Taiwanese-style meatballs (kung-wan) was a popular meat product in Taiwan. In general, local consumers prefer harder and more elastic in texture of this product (Hsu and Chung, 1998). Several researchers used food hydrocolloids such as konjac gel, carrageenan, alginate, and gums and food fibers (Liu and Chen, 1992; Lin and Lin, 2004) in Taiwanese-style meatballs to improve the texture. Gelatin had good gelation, emulsification and film-forming properties to utilize in food processing (Simon-Lukasik and Ludescher, 2004). It could be produced by heating collagen which made collagen denature to become gelatin (Toledano and Magdassi, 1998). Therefore, the objective of this study was to evaluate the quality of Taiwanese-style meatball with different level of pre-gelatinized pork skin slurry as meat replacement and stored at -20°C for 84 days.

II. MATERIALS AND METHODS

Materials

Mixture of pig skin and water (100% pork skin + 75% water) were cooked at 121°C for 30 min. After cooking, pre-gelatinized pork skin slurry (PPSS) was produced by a blender for 2 min. The raw material of control (C) was consisted of 70% pork ham and 30% pork back fat. 3 levels (15, 20 and 25%) of pre-gelatinized pork skin slurry will be used as meat replacer in this study. Therefore, 3 treatments were showed as T15-55% pork ham + 15% PPSS, T20-50% pork ham + 20% PPSS, T25-45% pork ham + 25% PPSS. The seasoning ingredients contained (w/w) 1.65% salt, 0.15% polyphosphate, 2.5% sugar, 0.15% white pepper, and 0.05% onion powder. The meat ball was manufactured according to the report of Liu and Chen (1992).

Methods

The meatballs were vacuum packaged then stored at -20°C for 84 days. The pH, TBARS, texture, color, total plate count and sensory evaluation were determined at the 0, 7th, 14th, 21st, 28th, 56th and 84th day during frozen storage, individually. Proximate compositions of the samples were determined by the AOAC (1995) methods. Gel strength of meat balls were detected by a texture analyzer (Model Compac-100, Sun Rheo Meter, Japan). TBARS values were evaluated by the method of Faustman *et al.* (1992). pH value was tested as the method of Ockerman (1981). Total plate count was detected as the method of FDA (1996). The color was showed as L, a b value and performed by a color meter (NR-300, Nippon, Japan). In this study, ten trained graduate students were constituted as a panelist team. Appearance, springiness, juiciness, off flavor and overall acceptability of meat balls were evaluated by using a 7 point of hedonic scale system. Finally, the data analyses were performed with analysis of Variance program (ANOVA) in SAS9.4

III. RESULTS AND DISCUSSION

Proximate composition, pH value and TBARS

The proximate composition of Taiwanese-style meatballs with different levels of PPSS were showed in Table 1. Moisture of meat balls were not significantly different among groups ($p > 0.05$). However, with the level of PPSS increase crude protein in meat balls were decreased, but crude fat was increased. The changes of pH value of Taiwanese-style meatballs were showed in Figure 1. All groups with PPSS had higher pH value than control at any storage period. Moreover, with level of PPSS increased pH value evaluated. The TBA value of control had the highest value compared with all treatments at any storage period.

Total plate count

Initial total plate counts of Taiwanese-style meatballs in all groups ranged among 2.21-2.87 log CFU/g. During storage, TPC in all groups increased slowly and reached 3.48-3.65 log CFU/g at the end time of storage. This result also indicated the microbial quality of all products were stable during storage.

Texture and sensory panel evaluation

The texture properties of Taiwanese-style meatballs with PPSS was showed in Table 2 and the results indicated that with % of pre-gelatinized pork skin slurry resulted in a lower gel strength textural attributes in meatballs. However, the texture of meat ball with 15%PPSS was similar to control and also got high overall acceptance in sensory panel evaluation(Table3). Furthermore, a maximum replacing level of PPSS as meat in Taiwanese-style meatballs was 20% in this study, according to the conducted results of texture and sensory panel.

CONCLUSION

Less than 20% pre-gelatinized pork skin slurry used as raw meat in Taiwanese-style meatball was available and also obtained an acceptable result by sensory panel in this research.

	Treatment			
	Control	T15	T20	T25
Moisture (%)	50.52±0.36 ^A	50.04±0.52 ^A	50.68±0.61 ^A	49.67±0.66 ^A
Crude protein (%)	15.12±0.24 ^A	14.15±0.28 ^B	13.90±0.17 ^{BC}	13.54±0.20 ^C
Crude fat (%)	30.38±0.64 ^A	31.34±0.96 ^A	30.40±0.91 ^A	32.50±0.57 ^B
Ash (%)	1.68±0.04 ^A	1.54±0.03 ^{AB}	1.35±0.14 ^B	1.40±0.28 ^{AB}

Table 1. The proximate composition of Taiwanese-style meatball replaced with varied level of PPSS

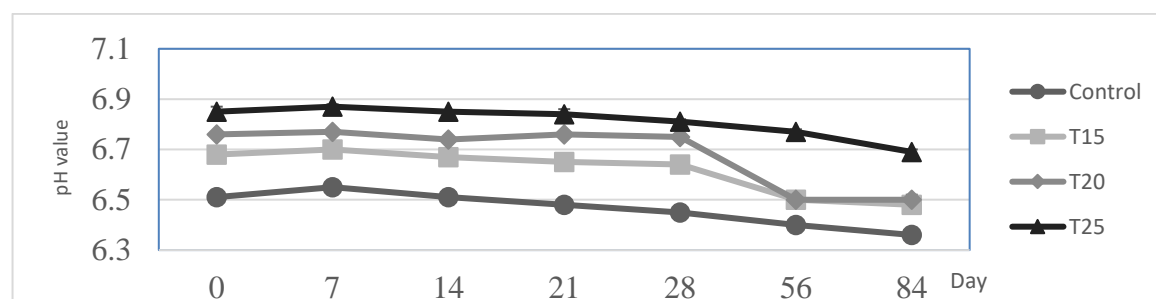


Figure 1. The changes in pH value of Taiwanese-style meatball with different level of PPSS during storage.

Table 2. The changes in gel strength Taiwanese-style meatball with different level of PPSS during storage

Time (Days)	Gel strength (kg)			
	Control	T15	T20	T25
0	4.52±0.13 ^{Ab}	4.16±0.27 ^{ABb}	3.79±0.16 ^{BCb}	3.43±0.32 ^{Cab}
7	4.91±0.11 ^{Aa}	4.88±0.07 ^{Aa}	4.53±0.20 ^{Aa}	3.77±0.23 ^{Aa}
14	4.07±0.69 ^{Ab}	4.04±0.56 ^{Ab}	3.75±0.37 ^{Ab}	3.65±0.22 ^{Aa}
21	4.21±0.27 ^{Ab}	4.03±0.17 ^{ABb}	3.79±0.05 ^{Bb}	2.92±0.18 ^{Cb}
28	4.69±0.12 ^{Ab}	4.54±0.47 ^{ABab}	3.81±0.62 ^{BCb}	3.56±0.37 ^{Ca}
56	4.93±0.35 ^{Aa}	4.23±0.24 ^{Bb}	3.95±0.15 ^{BCb}	3.56±0.36 ^{Ca}
84	4.42±0.41 ^{Ab}	3.93±0.13 ^{Bb}	3.80±0.12 ^{BCb}	3.36±0.23 ^{Cab}

ABC means within the same row without the same superscript are significantly different ($P<0.05$).

abc means within the same column without the same superscript are significantly different ($P<0.05$).

Table3. The changes in overall acceptability of Taiwanese-style meatball with various level of PPSS during storage

Time (Days)	Score			
	Control	T15	T20	T25%
0	6.40±0.70 ^{A,ab}	5.00±1.05 ^{B,ab}	4.30±1.06 ^{BC,ab}	3.40±1.35 ^{C,ab}
7	5.70±1.06 ^{A,b}	5.10±0.74 ^{A,ab}	4.70±0.95 ^{A,ab}	3.10±1.66 ^{B,b}
14	5.60±0.52 ^{A,b}	4.70±0.82 ^{B,b}	4.00±0.94 ^{BC,b}	3.20±1.23 ^{C,ab}
21	6.10±0.74 ^{A,ab}	5.60±0.52 ^{A,a}	4.20±1.14 ^{B,ab}	3.90±0.99 ^{B,ab}
28	5.90±0.57 ^{A,ab}	5.20±0.63 ^{AB,ab}	4.50±0.85 ^{B,ab}	3.60±1.07 ^{C,ab}
56	5.90±0.32 ^{A,ab}	5.40±0.70 ^{AB,ab}	5.00±0.82 ^{B,a}	4.30±0.67 ^{C,a}
84	6.10±0.32 ^{A,ab}	5.50±0.53 ^{B,a}	4.80±0.79 ^{C,ab}	3.90±0.74 ^{D,ab}

A-D:Means within the same row without the same superscript are significantly different ($P<0.05$).

a-b:Means within the same column without the same superscript are significantly different ($P<0.05$).

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