

Development of Candied Pumpkin Kanom Ping Kaset

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ABSTRACT

This research aimed to use pumpkin as a source of β -carotene in Kanom Ping Kaset (KK), a kind of hard cookie. Candied pumpkin with different degree of Brix content (50°, 60° and 70°) were prepared and were separately added to KK recipe at four levels : 15%, 30%, 45% and 60% of flour weight. Sensory evaluation was also performed. The results showed that KK added with 60% of 60° Brix candied pumpkin had the highest acceptance score. Shelf life period of this candied pumpkin Kanom Ping Kaset (CPKK) was investigated by packing in laminated (OPP/PE/Al.foil/LLDPE) bag and polypropylene (PP) bag and kept at room temperature for six months. It was found that shelf life of the CPKK in laminated bag was six months and PP bag was three months. The results also showed that when the candied pumpkin was added to KK, the level of β -carotene increased 2 times. After storage for six months, the β -carotene decreased by 50% in laminated bag and 75% in PP bag.

Key words: cookie, candied pumpkin, Kanom Ping Kaset, β -carotene

INTRODUCTION

Kanom Ping Kaset (KK) is a kind of cookie produced by Institute of Food Research and Product Development, Kasetsart University. To improve nutritional value of cookies product, many kinds of cereals, fruits and vegetables were added.

Deep-yellow vegetables and fruits are reported to be rich in carotene and could be a source of β -carotene (Robinson, 1975). As known, vitamin A precursor is β -carotene which presences as carotenoid form in plant foods. Its chemical structure had a conjugated double bonds which make it highly susceptible to oxidation. Factors affect the destruction of vitamin A are temperature, access of air, heat, light, traces of iron and especially traces of copper, rancidity (oxidation)

of fats (Bender, 1978; Luke, 1984). However, its stability varies with food particularly in the absence of reducing agents or other stabilizers. When vitamin A is with natural antioxidants in an oil-rich food, it showed less destruction (Olson, 1991).

Pumpkin is one of the plentiful and economical sources of vitamin A. When it is candied, it gives a great taste and good texture and can be incorporated into the cookies recipe to improve taste, texture and nutritional values in term of pro vitamin A to the cookies. Hence, the production of CPKK was investigated.

MATERIALS AND METHODS

Raw materials

The Srimuang pumpkin was bought from

a local market. All purpose wheat flour, sugar, egg, margarine, baking powder, baking soda, salt were also purchased from supermarket. The full fat soy flour was bought from the Royal Project Foundation.

Candied pumpkin preparation

The pumpkin was peeled, sliced lengthwise with 1 cm thick and soaked in 1% calcium chloride solution for 30 minutes. Then it was washed and steamed for 8 minutes and put into the glass jar. The 35° Brix sugar syrup containing 0.1% citric acid was prepared and boiled slightly for 2 minutes. When the syrup was cooled to 80°C, 0.1% potassium metabisulphite was added and mixed well and then poured into the jar to cover the pumpkin. The glass jar was closed with cover tightly. The strength of the syrup was raised by 10° Brix every day until it reached 50°, 60°, 70° Brix by pouring the syrup, adding sugar, boiling and pouring over the pumpkin. When it reached the specified Brix content, the drained pumpkin was dipped in boiling water for 10 seconds. Finally, it was spread on perforated tray and dried at 60°C for 2 hours and cut into small pieces.

Kanom Ping Kaset (KK) preparation

The composition of KK is 450 g wheat flour, 19.2 g full fat soy flour, 202.5 g margarine, 60 g egg, 202.5 g granulated sugar, 12 g baking powder, 0.6 g baking soda and 0.75 g salt. By varying 4 levels (15%, 30%, 45% and 60%) of each Brix content (50°, 60° and 70°) of candied pumpkin, the amount added was based on the mixture of wheat flour and full fat soy flour. The wheat flour, full fat soy flour, baking powder, baking soda and salt were sifted together and then mixed with candied pumpkin. The margarine and sugar were mixed together for 5 minutes. The egg was added and mixed until creamy. The dry ingredients were added and mixed well. The dough was brought to rotary molding then baked in

Electric Pipe Heated Chain Conveyor Tunnel Oven at 425°F for 5 min. then cooled and packed.

Quality evaluation of candied pumpkin Kanom Ping Kaset (CPKK)

The CPKK with candied pumpkin at various level (15%, 30%, 45% and 60%) of each Brix content (50°, 60° and 70°) were sensory evaluated. The cookie with the highest overall acceptance score was selected for six months shelf life study at room temperature. It was packed in 2 different packaging, laminated bag (OPP/PE/Al.foil/LLDPE) and polypropylene bag (PP). The quality change was investigated each month.

Chemical analysis

Moisture (AOAC, 2000) and β -carotene (Edelenbos et al., 2001) were carried out on fresh pumpkin, candied pumpkin, KK (Control) and CPKK. Candied pumpkin, KK (Control) and CPKK were determined for A_w (Novasina EEJA-3). TBA values (Pearson, 1976) was investigated for the shelf life stability of CPKK.

Physical measurement

Color analysis was carried out on fresh pumpkin, candied pumpkin, KK (Control) and CPKK using Data Color[®] to obtain the color values (CIE L*, a* and b* values). L* represents lightness, a* represents greenness (-) to redness (+), b* represents blueness (-) to yellowness (+) values. The width and height of KK (Control) and CPKK was determined by using Vernier Caliper and calculated as cookie spread according to the following equation.

$$\text{cookie spread} = \text{width} / \text{height}$$

Texture measurement

Textural characteristic as hardness of KK (Control) and CPKK were carried out on a Texture Analyzer Model TAXT2i. Mode : Measure Force in Compression, Pre-Test Speed : 3.0 mm/s, Test Speed : 2.0 mm/s, Post -Test Speed : 10.0 mm/s, Accessory : Knife Edge with Slotted Insert (HDP/BS) Blade Set using 25 kg load cell.

Microbiological test

The CPKK was examined for Total Plate Count, Coliform Bacteria, *Escherichia coli* and *Staphylococcus aureus* (FDA/BAM Online 2001).

Sensory evaluation

The CPKK was evaluated by 24 panelists using 9 point hedonic scale (9 = like extremely, 8 = like very much, 7 = like moderately, 6 = like slightly, 5 = neither like nor dislike, 4 = dislike slightly, 3 = dislike moderately, 2 = dislike very much, 1 = dislike extremely). Data collected from the sensory were analyzed by using ANOVA. Duncan's New Multiple Range Test (DMRT) was used to detect mean differences. Randomized Complete Block Design (RCBD) was used as an experimental design.

RESULTS AND DISCUSSION

The CPKK with different Brix content of candied pumpkin was measured for hardness and separately sensory evaluated (Table 1). It was shown that the amount and the sweetness level of the candied pumpkin affected the hardness of

CPKK. The highest hardness (52.38 N) was found in the cookie added with 50°Brix candied pumpkin at 60% of total flour weight. The lowest was 18.89 N for the CPKK with 60% of 70°Brix candied pumpkin. It can be noticed that hardness of all the cookie, except the one added with 50°Brix candied pumpkin, tended to decrease as the amount of candied pumpkin increased. The more candied pumpkin in the product, the more dispersible among the flour molecule which might cause less binding capacity for the flour. According to the highest overall acceptance, it has shown obviously that 60% of candied pumpkin in the recipe has always given a very satisfactory result, regardless of °Brix of candied pumpkin so they were selected for shelf life study.

Fresh pumpkin had high b* value (bright yellow color) while the candied pumpkin had low b* value (darker yellow color) (Table 2). The KK (Control) had bright yellow color with 1.38% moisture and A_w 0.05. The CPKK also had bright yellow color with 2.42 – 2.93% moisture and A_w 0.15 – 0.19. The CPKK with 50°Brix candied pumpkin had the highest hardness value which was

Table 1 Hardness and sensory scores of candied pumpkin Kanom Ping Kaset in various Brix content and levels.

Candied pumpkin		Hardness (Newton)*	Sensory scores				
°Brix	%		Color	Odor	Flavor	Texture	Overall acceptance
50	15	31.86 ^c	6.90 ^{ab}	6.23 ^a	6.67 ^a	6.33 ^b	5.83 ^b
	30	32.19 ^c	7.00 ^{ab}	6.47 ^a	6.73 ^a	6.50 ^b	6.50 ^a
	45	44.35 ^b	7.17 ^a	6.40 ^a	6.50 ^a	5.00 ^c	4.97 ^c
	60	52.38 ^a	6.53 ^b	6.37 ^a	6.80 ^a	7.13 ^a	6.68 ^a
60	15	32.24 ^c	6.80 ^a	6.53 ^a	6.80 ^a	6.87 ^a	6.40 ^b
	30	30.79 ^{cd}	7.10 ^a	6.53 ^a	6.67 ^a	6.00 ^b	5.80 ^c
	45	21.18 ^{ef}	6.73 ^a	6.53 ^a	6.77 ^a	6.73 ^a	6.40 ^b
	60	22.59 ^{def}	5.97 ^b	6.53 ^a	7.03 ^a	7.07 ^a	6.98 ^a
70	15	29.71 ^{cde}	6.77 ^a	6.57 ^a	6.70 ^a	6.73 ^a	6.23 ^{ab}
	30	22.47 ^{def}	6.70 ^a	6.80 ^a	6.40 ^a	6.33 ^{ab}	5.95 ^{bc}
	45	22.19 ^{def}	6.87 ^a	6.53 ^a	6.43 ^a	5.93 ^b	5.37 ^c
	60	18.89 ^f	6.83 ^a	6.67 ^a	6.73 ^a	6.90 ^a	6.77 ^a

* Averages are based on 10 measurements of each sample

In a column, means in each Brix content, except hardness, followed by the same superscript are not significantly different ($P \geq 0.05$) by DMRT

significantly different from the other samples (Table 3).

The sensory evaluation for the cookie with different Brix content of candied pumpkin showed that the cookie yielded the best results of all measured parameters with statistically significant difference. Among the 60% CPKK, the

CPKK with 60°Brix candied pumpkin had the high flavor and overall acceptance so this sample was selected for the shelf life study (Table 4).

About 86% of β -carotene of CPKK with 60°Brix candied pumpkin lost during candying process (Table 5). The loss might be from air-drying, exposure to light while remaining in the

Table 2 Chemical and Physical properties of candied pumpkin.

Pumpkin	Moisture (%)	A_w	Color value		
			L*	a*	b*
Fresh pumpkin	88.17	-	67.47	13.67	52.71
50°Brix candied pumpkin	22.10	0.76	49.70	16.96	27.28
60°Brix candied pumpkin	23.00	0.78	53.16	16.07	32.85
70°Brix candied pumpkin	20.68	0.75	53.58	16.04	30.77

Table 3 Chemical and Physical properties of 60% candied pumpkin Kanom Ping Kaset.

Candied pumpkin (°Brix)	Moisture (%)	A_w	Color value			Cookie Spread ¹	Hardness ² (Newton)
			L*	a*	b*		
Control (no candied pumpkin)	1.38	0.05	72.71	8.92	26.30	2.78	19.20 ^b
50	2.79	0.17	65.95	11.13	28.80	2.91	24.01 ^a
60	2.42	0.15	68.79	10.70	30.28	3.13	19.90 ^b
70	2.93	0.19	68.18	10.79	30.03	2.86	18.00 ^b

¹ Averages are based on 3 measurements of each sample

² Averages are based on 15 measurements of each sample

Table 4 Sensory scores of 60% candied pumpkin Kanom Ping Kaset.

Candied pumpkin (°Brix)	Color	Odor	Flavor	Texture	Overall acceptance
Control	7.19 ^a	6.74 ^a	7.07 ^a	7.29 ^a	7.26 ^a
50	4.78 ^c	6.61 ^a	6.52 ^{ab}	6.82 ^{ab}	6.00 ^b
60	6.07 ^b	6.13 ^a	6.52 ^{ab}	6.54 ^b	6.17 ^b
70	6.19 ^b	6.68 ^a	6.19 ^b	6.50 ^b	5.96 ^b

In a column, means followed by the same superscript are not significantly different ($P \geq 0.05$) by DMRT

Table 5 β -carotene contents in different products.

Product	β -carotene ($\mu\text{g}/100 \text{ g}$)*
Fresh pumpkin	7458.01
60°Brix candied pumpkin	997.25
Kanom Ping Kaset (KK,Control)	283.83
CPKK with 60% of 60°Brix candied pumpkin	463.08
kept in laminated bag for 6 months	247.84
kept in PP bag for 6 months	114.98

*Expressed as dry basis

syrup (Bender, 1978; Olson, 1991). By adding 60% of 60°Brix candied pumpkin to the KK, the β -carotene increased 1.5 times from 283.83 to 463.08 $\mu\text{g}/100\text{ g}$. On the contrary, when the CPKK with 60% of 60°Brix candied pumpkin was stored at room temperature in laminated bag and PP bag for six months, the β -carotene content reduced about 50% and 75% compared to when it was freshly baked. During the shelf life study, the β -carotene of CPKK in the PP bag might be destroyed by oxidation since it was exposed to light more than those in the laminated bag (Bender, 1978; Luke, 1984; Olson, 1991).

Sensory evaluation for the CPKK with 60% of 60°Brix candied pumpkin kept in laminated and PP bag for 6 months at room temperature was shown in Table 6 and 7, respectively. The CPKK in laminated bag had no significant difference for the overall acceptance score during 6 months storage (6.88 – 6.85). The CPKK in PP bag also had no significant difference for the overall acceptance during the 1 - 3 month

(6.17 - 5.63). It was concluded that the CPKK with 60% of 60°Brix candied pumpkin could be kept in laminated bag for 6 months and kept in PP bag for 3 months.

Table 8 showed that after 6 months storage, the moisture of cookie in laminated bags was lower than from PP bags because the aluminium foil in laminated bags had very low water vapour permeability, 0.00006 $\text{g}\cdot\text{mm}/\text{m}^2\cdot\text{mm Hg}\cdot\text{day}$ (Gontard and Guilbert, 1994). The β -carotene of cookie in PP bag decreased more than those in laminated bag because it was destroyed by oxidation of fats (Luke, 1984). Since the TBA value of cookie from PP bag was higher than that in laminated bag, the fat in PP bag was oxidized more than that in the laminated bag. The more oxidation of fat, the less amount of vitamin A was left. Besides, the PP bag was exposed to the light so oxidation occurred more than in laminated bag. The microbiological properties of the cookie met the Microbiological Quality Standard for the non-specific control food set by the Notification of

Table 6 Sensory scores of CPKK with 60% of 60°Brix candied pumpkin in laminated bag for 6 months.

Attribute	Month						
	0	1	2	3	4	5	6
Appearance	7.29 ^a	6.98 ^a	7.06 ^a	7.04 ^a	7.04 ^a	7.17 ^a	7.10 ^a
Color	7.46 ^a	7.23 ^a	7.19 ^a	7.17 ^a	7.10 ^a	7.33 ^a	7.23 ^a
Odor	7.17 ^a	7.13 ^a	6.69 ^a	7.04 ^a	7.04 ^a	6.71 ^a	6.65 ^a
Flavor	7.00 ^a	6.79 ^a	7.08 ^a	6.94 ^a	7.04 ^a	6.94 ^a	6.75 ^a
Texture	6.33 ^{abc}	6.17 ^{abc}	5.71 ^c	5.98 ^{bc}	6.38 ^{ab}	6.50 ^{ab}	6.71 ^a
Overall acceptance	6.88 ^a	6.35 ^{ab}	6.06 ^b	6.29 ^{ab}	6.67 ^a	6.44 ^{ab}	6.85 ^a

In a row, means followed by the same superscript are not significantly different ($P \geq 0.05$) by DMRT

Table 7 Sensory scores of CPKK with 60% of 60°Brix candied pumpkin in PP bag for 6 months.

Attribute	Month						
	0	1	2	3	4	5	6
Appearance	7.29 ^a	7.00 ^{ab}	7.08 ^{ab}	6.79 ^b	7.31 ^a	7.17 ^{ab}	7.04 ^{ab}
Color	7.46 ^a	7.29 ^a	7.13 ^a	7.08 ^a	7.33 ^a	7.10 ^a	7.13 ^a
Odor	7.17 ^a	6.73 ^{ab}	6.19 ^{bc}	6.42 ^{bc}	6.21 ^{bc}	5.89 ^c	6.02 ^c
Flavor	7.00 ^a	6.92 ^a	6.60 ^{ab}	6.67 ^{ab}	6.21 ^{bc}	5.92 ^c	6.00 ^c
Texture	6.33 ^a	5.96 ^{ab}	5.83 ^{abc}	5.58 ^{bcd}	5.33 ^{cd}	5.13 ^d	5.27 ^{cd}
Overall acceptance	6.88 ^a	6.17 ^b	5.92 ^{bc}	5.63 ^{bcd}	5.29 ^{cd}	5.25 ^d	5.35 ^{cd}

In a row, means followed by the same superscript are not significantly different ($P \geq 0.05$) by DMRT

Table 8 Chemical and microbiological properties of CPKK with 60% of 60°Brix candied pumpkin in laminated bag and PP bag during 6 month storage.

	Laminated bag				PP bag			
	Month				Month			
	0	2	4	6	0	2	4	6
Moisture, %	2.63	3.48	3.80	3.06	2.63	3.94	4.19	4.87
TBA, mg malonaldehyde/kg	0.09	1.44	1.24	1.25	0.09	0.79	1.32	1.74
β -carotene, $\mu\text{g}/100\text{g}$	463.08	-	-	247.84	463.08	-	-	114.98
Total plate count, cfu/g	1.7×10^2	None	75	<10	1.7×10^2	None	2×10^2	2.2×10^2
Coliform bacteria, MPN/g	<3	<3	<3	<3	<3	<3	<3	<3
<i>E.coli</i> , MPN/g	<3	<3	<3	<3	<3	<3	<3	<3
<i>S. aureus</i> /0.1 g	None	None	None	None	None	None	None	None

- = not determined

Department of Medical Science 1993 : Total plate count less than 10^6 cfu/g , Coliform Bacteria less than 500 MPN/g , *Escherichia coli* less than 3 MPN/g , *Staphylococcus aureus* less than 100 cfu/g.

CONCLUSION

Kanom Ping Kaset which were added with 60% of 60°Brix candied pumpkin could be improved the nutritional value as β -carotene for 2 times. The product's shelf life was six months in laminated bag and three months in PP bag. However, the process including the size of candied pumpkin should be studied in more details in order to improve consumer acceptance.

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