Kasetsart J. (Nat. Sci.) 42 : 117 - 128 (2008)

American Consumer Acceptance of Satay Sauce as Affected by Different Peanut Grinding Methods, the Multi-step and One-step Processes, and Processing Times

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ABSTRACT

Satay is one of the ten most popular foods for US consumers visiting Thailand. American consumer acceptance for the convenience products resulted in the development of a process for ready to eat satay sauce. The objectives of this research were to determine the consumer acceptance and texture measurements of satay sauce as affected by peanut grinding methods, the one-step and multi-step process, and processing time, using consumer tests. Results showed that there were no significant differences in the overall acceptance from two replications (p >0.05), two processes (p >0.10) and two peanut grinding methods (p >0.10). There were significant differences in the overall acceptance (p <0.10) from three processing times because the effect of consumer liking scores of appearance and overall flavor were significant when increasing processing time. The significance of processing times and convenience of peanut grinding method and suitability of process indicated that satay sauce should be prepared using a one-step process and processed for 45 min, and peanuts should be ground in a peanut butter machine.

Key words: consumer acceptance, satay sauce, grinding, process, time

INTRODUCTION

Thai food has become popular in the USA in recent years reflected by the increased number of Thai restaurants in USA from 2000 in 2000 (Sriwattana, 2002) to 3,811 in 2006 (Thai town USA news, 2006). The most famous Thai food throughout the world are Tom Yam Kung (hot and sour shrimp soup) and Pad-Thai (fried noodle Thai style). Satay is one of Thai food which is one of the top ten Thai popular menus for foreign consumer (Noparatnaraporn, 2000; Chotigunta *et al.*, 2000 and Thaiways, 2006).

The satay dish consists of 2 parts, meat poured with marinade and the satay sauce or peanut based sauce. Satay must be served with a satay sauce, which is a thick sauce composed of coconut milk, curry paste, sugar and ground roasted peanut (Chompreeda and Karnchanaburapipop, 1987).

To develop a satay sauce for American consumers' acceptance was studied to create the other Thai food product to be acceptable. Consumer testing is one of the most important activities in product development (Resurreccion, 1998). Therefore, consumer acceptance test

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Received date : 09/04/07 Accepted date : 29/08/07

should be used to determine the acceptance of the consumers toward the developed satay sauce.

The objectives of this study were to determine the consumer acceptance and texture values of satay sauce as affected by: (1) peanut grinding methods, (2) a one-step and multi-step process, and processing time, using consumer affective tests.

MATERIALS AND METHODS

Materials

Unblanched shelled medium Georgia Green peanuts were purchased from McCleskey Mills, Smithville, Georgia, USA, for ground peanuts preparation. Coconut milk, sucrose, tamarind paste were purchased from International market in Griffin, Georgia, USA. Condensed chili paste with oil (CCPO) and condensed chili with oil (CCO) were prepared from Thailand.

Methods

Ground peanuts preparation

Raw peanuts were roasted at 177°C for 18 min to get an endpoint "lightness" L value of roasted peanuts equal to 50±1.0 (Plemmon and Resurreccion, 1998). Then roasted peanut was ground using 2 methods; 1) as grounded using Oskar machine (Model 4817 previous 14181, Oskar Food Processor, USA) for 20 second and sieved using U.S.A. standard testing sieve No. 14 (14 mesh, The Fisher Scientific Company, USA) and 2) using peanut butter mill (Old Tyme Food Products Corporations, East Longmeadow, MA, USA). The samples from 2 methods of ground peanut were stored at 4°C.

Quality measurements of peanuts and ground peanuts

Raw peanuts were visually sorted for defective, damaged and bruised kernels. Raw peanuts were blanched manually to remove the testa, ground in an Oskar machine (Model 4817 previous 14181, Oskar Food Processor, Elpaso, Texas, USA). Then they were analyzed for physicochemical properties of color, water activity, and moisture, fat, and protein contents as described below. Roasted peanuts were prepared for physicochemical analysis of color, water activity, and moisture content the same as raw peanuts.

Physical properties: Color was measured in L*(lightness), a*(redness) and b*(yellowness) with a hand-held Minolta Instrument (Chroma meter, CIE, Model CR-200, Minolta, Osaka, Japan). The instrument was calibrated (Chu, 2003) against a white standard and brown reference (L*=58.73, a*=10.72, b*=12.59) standard tile. Samples for analysis were prepared by spreading approximately 10 g samples evenly in a 35X10 mm petri dish (Model 08-757-11 y, Fisher Scientific, Fairlawn, NJ, USA). Three readings were taken directly and averaged. Results were reported as L*, a*, b*. Chroma and hue angle were calculated from a* and b* values. The following equations were used: Chroma = $[(a^*)^2 + (b^*)^2]^{1/2}$ and Hue angle = $\tan^{-1}(b^*/a^*)$. Water activity was measured using a water activity instrument (Aqualab LITE, Decagon Devices, Inc., and Pullman, WA, USA) according to the method of Decagon Devices (Anonymous, 2005). Three consecutive readings were obtained from the same sample and the average of the three readings was calculated.

Chemical composition: Moisture content was analyzed using the AACC official method (2000) No. 44-40 , using a vacuum oven (Model J466004, General Electric, Louisville, KY, USA) at 98-100°C at 25 mm Hg, for 5 h to reach constant weight, generally difference A0.008 g for a 2 g sample intervals at 1 hr (Pameranz and Meloan, 1971). Fat content was determined by extraction of oil with petroleum ether using the Goldfisch Fat Extraction Apparatus (Model 35001, Labconco Corporation, Kansas, MO, USA) according to AACC official method (2000) No. 30-25. Three analyses were conducted and the

average of three values was reported. Protein content was determined using the Dumas combustion method for analyzing nitrogen. Nitrogen was analyzed using the LECO nitrogen protein determinator (Model FP-2000, LECO Corporation, St. Joseph, MI, USA). Percent nitrogen content was converted to protein values using protein factor of 6.25 (Bicsak, 1993; Simmonne *et al*., 1997) according to method 992.23 of the AOAC (2000).

Satay sauce preparation

A 2 X 2 X 3 full factorial experiment was used consisting of 3 factors: two peanut grinding methods, two processes, and three processing times for satay sauce preparation. The experimental design consisted of 12 treatments and 2 replications or a total of 24 samples. Two peanut grinding methods were used consisting of either a food processor and sieve, or a peanut butter machine. The two processes studied were the multi-step and one-step process for satay sauce preparation. Three different processing times were 45 min, 60 min and 75 min.

Twenty –four satay sauce samples were prepared from basic formulation as shown in Table 1 according to the experiment design as described below. The multi-step process consisted of 3 steps. First, coconut milk was heated and stirred 90°C for 5 min in a steam jacketed kettle. Second, CCPO, CCO and water were added to the coconut milk and stirred continuously for another 10 min at 90°C. Third, sugar, tamarind paste and ground peanut were added to the mixture and stirred continuously at 90°C for a processing time of 30, 45 or 60 min. The one-step process consisted of combining all ingredients initially, then stirring continuously at 90°C for a processing time of 45, 60 or 75 min. Satay sauce samples were stored at 2-3°C approximately 1-2 days until needed for texture measurements and consumer acceptance test as described below.

Texture measurements of satay sauce: Texture was analyzed using a Texture Analyzer (TA XT-plus, Texture technologies Corp, Searsdale, NY, USA) (Stable Micro Systems Ltd, 2000), calibrated with 2 kg load cell and with a back extrusion attachment, consisting of a sample container, 50 mm i.d., a back extrustion fixture and a compression disc 35 mm i.d., (Model set TA 94, Texture technologies Corp, Searsdale, NY, USA). Approximately 100 g. of each satay sauce was measured at 30°C and placed in the sample container of the Texture Analyzer for measuring

Table 1 Satay sauce formulation.

Ingredients	Gram	%
Condensed chili paste with oil[1]	240.27	4.81
Condensed chili with oil	41.00	0.82
Coconut milk[2]	3163.00	63.26
Ground peanut[3]	790.73	15.81
Sucrose[4]	450.00	9.00
Tamarind paste[5]	119.00	2.38
Water[6]	196.00	3.92
Total	5,000.00	100.00

1 prepared from fresh chili paste (chili in chili paste=14.29% of total chili paste)

2 Coconut milk, canned “Chao-Koh” Theppadungporn, Nakhorn-pathom, Thailand

3 Georgia green, medium size 2004 crop

4 Sugar, “Domino”, carden Foods, Inc., Griffin, GA, USA

5 Tamarind paste “Garden Queen”, Siam Worakit Food Import Export, Bangkok,Thailand

6 Water needed

firmness, N; consistency, Nsec; cohesiveness, N; viscosity, Nsec. The average of three readings of texture values was calculated.

Consumer acceptance test of satay sauce: Fifty American consumers from Griffin, Georgia were recruited from a database of consumers who had previously participated in tests at the FST department, The University of Georgia, Griffin Campus. Panelists were between the ages of 18-70 years old, had no food allergies, liked to eat peanuts, and must consume food products containing peanut not less than twice a month. Approximately 50% males and 50% females in specific age groups were recruited. A randomized complete block design was used during the evaluation. Twenty-five of panelists evaluated replication one, while the other twenty-five panelists evaluated the second replication. Four samples were served to each panelist, monadically, in each session spaced by a minute between samples. Consumers participated in four sessions, each separated by two compulsory five minute breaks. Each person evaluated a total of 12 samples in one day. Consumers received an honorarium of $10 for each day they participated.

The evaluations were held in five sessions at 9.00 am, 11.00 am, 1.00 pm, 3.00 pm, and 5.00 pm. On the day of the test, consumers were greeted and given a brief overview, then oriented on how to use the signal light buttons in the booths. After completing the consent form, panelists were asked by the greeter if they had any food allergies to verify this recruitment criterion, and he or she recorded their answers.

Panelists evaluated the samples in environmentally-controlled partitioned booths in a sensory evaluation laboratory illuminated with two 50-watt indoor reflector flood lamps (738 lux). Samples were presented to panelists in a sequential monadic balanced order. Samples were randomized over three sessions for each panelist. Samples were presented to panelists in a stainless steel tray with approximately 30 g sample of satay sauce in pre-labeled 2 oz sample cups (No. B200, Solo cup company, Urbana, IL, USA) covered with lids and coded with three digit random numbers generated by computer (Compusense *Five* version 2.2, Compusense, Inc., Guelph, Canada). Cups with lids for expectoration, spoons and drinking water were also provided on the tray, lined with white paper.

Unsalted crackers (Kroger, Kroger Co., Cincinnati, OH, USA) and water were used as palate cleansers between samples (Allison and Work, 2004). Grilled chicken on a skewer was used as a carrier for the evaluation of the satay sauce. These were prepared by cutting raw chicken breast in 2×2cm pieces and two pieces of chicken were skewered together and was cooked using a clamshell grill (The George Foreman, Salton, Inc, CA, USA) approximately 10 min. After cooking each skewer was wrapped with aluminum foil and stored in a refrigerator. Before serving, satay sauce and grilled chicken were warmed at 40°C in a steam table warmer (Model DHT3-120 , Metal Masters Food Service Equipment Co, Inc., Clayton, DE, USA) for 5 minutes under medium heat.

Compusense *Five* (version 2.2, Compusense, Inc., Guelph, Canada) was used to design a computerized ballot. The ballots consisted of ten questions asking the panelists to rate their feelings about the products. Panelists rated appearance, color, texture/appearance, aroma, texture/mouthfeel, texture/smoothness, sweetness, spiciness, overall flavor, and overall acceptability using a 9-point hedonic scale with the following categories: 1= dislike extremely, 2=dislike very much, 3=dislike moderately, 4= dislike slightly, 5= neither like nor dislike, 6= like slightly, 7= like moderately, 8= like very much, 9= like extremely.

Panelists were asked to fill out a demographic questionnaire during the two breaks between sessions. The demographic questionnaire consisted of questions on demographic

characteristics and the consumer's food habits and eating patterns. Questions on demographic characteristics asked were about who buys and cooks the food in the household, age, gender, race, marital status, household size, education, employment, and income and the job of the head of household. Panelists' food habits such as frequency of consumption of spicy food, chili sauce /hot sauce, barbecue sauce and satay sauce were likewise asked. In addition, consumers were asked about their eating patterns whether they eat out/take home and eat low calorie food / snacks to determine the demand for reduced calories satay sauce for US consumers.

Statistical analysis: Analysis of variance, the general linear model procedure (PROC GLM) was used to determine significant differences between replications , three effects and their interaction from factorial experiment consisting two peanut grinding methods, the multi-step and one-step process, and three processing time for each texture values and sensory ratings, using the Statistical Analysis System Version 9.1 (SAS, 2001). Fisher's Least Significant difference (LSD) test was performed to determine which sample means were significantly different (/ =0.10 and/or / ·=0.05) for each texture values and sensory ratings.

RESULTS AND DISCUSSION

Quality of raw peanuts and ground peanuts

Quality of the raw peanuts and the ground peanuts using for satay sauce preparation were shown in Table 2.

Physical properties of raw peanuts and ground peanuts: Physical properties on color showed that when peanut were roasted, the color changed. The color of roasted peanuts was generally measured (Plemmoms and Resurreccion, 1998; Lee and Resurreccion, 2006). Roasted peanuts with 'lightness', endpoint L, value of 50±1.0 (Plemmons and Resurreccion, 1998) was desired for use. Ground peanuts using 177°C for 18 min for roasting had an suitable L value (49.56). The raw peanuts had color lightness, L, value was

Table 2 Physicochemical qualites of peanut and ground peanut roasted at 177°C 18 min.

Quality	Raw peanut	Ground peanut roasted at 177°C 18 min
Color[1]		
L	59.30	49.56
L*	65.90	56.60
a*	+11.54	+5.81
b*	+22.09	+29.98
Chroma[2]	24.92	30.43
Hue angle[3]	62.47	80.14
Water activity(a_w)	0.65	0.63
Fat(%)[4]	54.75	NA
Protein(%)5	27.37	NA
Moisture(%)[6]	6.96	1.97

NA=not analyzed

1 L= Lightness, L*= lightness in CIELAB color scale90=black, 100=white), +a*= redness, -a*= greenness, +b*=yellowness, -b*= blueness

2 Chroma=$[(a^*)^2+(b^*)^2]^{1/2}$

3 Hue angle= ($\tan^{-1}$ b*/a*)

4 %fat= weight of fat/weight of sample x100(dry basis)

5 %protein = %crude protein =%Nx6.25 (wet basis)

6 %moisture= loss of moisture/weight of sample x100(dry basis)

higher (59.30), lighter color, in the raw peanuts compared to the roasted ground peanuts. In addition, the chroma of raw peanuts was lower than in the ground peanuts, but the hue was higher. The lower of chroma indicated lower in saturation of color (Sentronic GmbH, 2004) and the increasing hue angle suggested a shift from red to yellow (Yeh, *et al*., 2002). The color of the roasted ground peanut was brown; the higher in chroma but the lower of hue angle, more yellow and redder while the raw peanut was light yellow.

The water activity values of ground peanuts changed very slightly after roasting of the raw peanuts. Their medium in water activity (0.63-0.65) protects peanuts from most of micro-organisms such as bacteria, yeast and mold which maintain a water activity of above 0.91, above 0.87 and above 0.80, respectively to maintain growth (Chaplin, 2005). Shelf life of roasted peanut was depended on storage temperature and water activities conditions and affected to consumer acceptance. Lee and Resurreccion (2006) found that the shelf life of roasted peanuts stored at 23°C between 0.33 and 0.75 a_w was limited by overall acceptance and decreased by approximately 50% with each 0.1 a_w increase. At accelerated temperature of 30, 35 and 40°C, shelf life of roasted peanuts decreased by 50% or more with each 0.1 a_w increase.

Chemical composition of raw peanuts and ground peanuts: Moisture content of the raw peanuts was higher than the ground peanuts due to the roasting process. This generally agreed with data from (United Department of Agriculture, 2005b) that raw peanuts and the dry roasted peanuts had moisture content that range from 4.26-6.91% and 1.78-2.17 %, respectively.

The fat content of raw peanuts was similar to published values (United Department of Agriculture, 2005a) for peanuts of 52.5% fat (United Department of Agriculture, 2005a) and 50-55% fat (Grosso and Resurreccion, 2002). The fat content of peanuts falls in the moderate range for the group of legumes and makes them susceptible to becoming rancid for prolonged exposure to heat, light and humidity (WholeHealthmd.com, 2000).

The protein content of raw peanuts was similar to published values for peanuts of 25-28% protein (Grosso and Resurreccion, 2002) and 28.03% protein (United Department of Agriculture, 2005a).

Effect of different peanut grinding methods, the multi-step and one-step processes, and processing times on texture measurements of satay sauce

Analysis of variance results indicated that replications of mean texture values of satay sauce were not significantly different at $/ <0.05$. The reason for the lack of differences in the replications is that the same treatment was prepared in both replications. Therefore, texture values were pooled over two replications. Mean texture values of satay sauce from three effects were shown in Table 3 as described below.

Grinding method of peanuts: Analysis of variance results between the satay sauce using Oskar machine & sieve and using peanut butter machine for ground peanut preparation are shown in Table 3. There were significant differences at $/ <0.10$ in firmness and consistency values of ground peanuts using the Oskar machine and sieve and the peanut butter machine, but no significant difference at $/ <0.05$. Using peanut butter machine compared to the Oskar machine and sieve showed that all of texture values were lower in satay sauce.

Multi-step vs one-step process: Analysis of variance results between the satay sauces prepared using the multi-step and one-step process are shown in Table 3. There were significant differences at $/ <0.10$, in firmness, consistency and viscosity values of satay sauces prepared using the multi-step and one-step processes, whereas there were no significant differences at $/ <0.05$.

Table 3 Mean[1] texture values of satay sauce using a Texture Analyzer (n=24).

Processing effect	Texture Values[2]			
	Firmness (N)	Consistency (Nsec)	Cohesiveness (N)	Viscosity (Nsec)
Peanuts grinding method				
Oskar machine	0.79[a]	16.58[a]	0.53[a]	1.32[a]
Peanut butter machine	0.74[b]	15.39[b]	0.48[b]	1.24[b]
Processing step				
Multi-steps	0.80[a]	16.58[a]	0.53[a]	1.34[a]
One-Step	0.73[b]	15.38[b]	0.48[b]	1.21[b]
Processing time				
45 min	0.70[c]	14.50[c]	0.41[c]	1.08[c]
60 min	0.77[b]	16.09[b]	0.51[b]	1.29[b]
75 min	0.83[a]	17.37[a]	0.59[a]	1.44[a]

[1] mean values of each effect on process development within column not followed by the same letters are significantly different in statistic (· <0.10) and standard division of mean values are lower than 0.05

[2] Texture values were Firmness (N)= max force in compression samples, Consistency(Nsec)= the area of compression, Cohesiveness(N)= max force in back extrusion , and Viscosity(Nsec)= the area of back extrusion

Processing times: Analysis of variance results of mean texture values of satay sauces as affected by processing time for 45, 60 or 75 min are shown in Table 3. There were significant differences at ⁄ <0.10. As expected, the texture values on firmness, N; consistency, Nsec; cohesiveness, N; viscosity, Nsec; of satay sauce increased as more process time increased. Increasing the time of heat treatment resulted in greater evaporation from the product affecting the texture of satay sauce.

Effect of different peanut grinding methods, the multi-step and one-step processes, and processing times on consumer acceptance test of satay sauce

Demographic characteristics of the 50 consumers participating in the consumer acceptance tests showed that 64% of participants buy and cook food in their household. In 86% of households, the person who buys and cooks food is the female head of the household. This finding was similar to that of Chu (2003) and Plemmons (1997) who found that in 80 and 75% of households, respectively, the female head was the primary food preparer and shopper. The numbers of consumers below 25 years and above 64 years of age were 14% each. Among the remaining 4 age groups, the number of participants ranged from 16-20%, as a result of equal allocation of recruitment quotas of 18% over the four age groups, with a small discrepancy due to replacement of non-showing consumers during the day of the test. Both mean and median of consumers' age groups fell within the 45-54 years old category. The genders of participants recruited were equal in number, but as a result of non-showing recruits, there were slightly more female than male participants.

The majority of the participants (82%) classified themselves white. More than half of the panelists (64%) were married and the remaining were never married, divorced and widowed. Due to the marital status is not specified in the criteria of the consumers. Most of the households of participants were composed of 2-3 persons (68%).

The education of the participants showed that ninety-two percent of the participants completed high school or higher education. Fifty

percent of panelists were either employed full or part-time. Those who were unemployed constituted only 8% of participants. There were a large number of 28% retired consumers, although the consumers over 64 years of the participants were only 14%. Results indicated that some may have retired before they were 64 years old. The remaining 14% were homemakers, students or disabled. The income range for the entire households ranged from below $15,000 to more than $105,000. The mean household income was $45,000-54,999. However, the median household income for the panelists was between $35,000-44,999. Fifty-eight percent of the heads of households of participants were the skilled , semi-skilled and unskilled worker and the rest were the owner of little business establishment, the clerical sales work or technician, the manager of proprietor of medium concern, the administrative personnel of large concern or owner of small independent business and the executive or proprietor of large concern.

Consumers' consumption patterns results indicated that 66% of participating consumers consumed spicy food every week (four times per month). Sixty-three percent of the consumers consumed chili sauce/hot sauce at least twice per month, whereas a large number of the participating consumers (88%) consumed barbecue sauce at least twice per month. Most of the participating consumers have rarely consumed or never eaten satay sauce according to the product is not spreadable in the restaurant or the supermarket in their area.

Sixty-eight percent of participating consumers ate at restaurants or purchase "take-out" meals greater than four times per month. The participating consumers (66%) consumed low calorie food and snacks more than once per week.

There is a good potential for developing satay sauce for restaurant and supermarket shelf in USA. Due to Asian sauces are right on trend with the growing demand for more diverse savory Asian flavors (Slan, 2004).

Results on consumer acceptance test of satay sauce showed that the replications of mean consumer liking scores of satay sauce were not significantly different. Therefore, liking scores were pooled over two replications. Mean consumer liking scores of satay sauce from three effects were shown in Table 4 as described below.

Grinding method for peanuts: Results from Table 4 showed that consumer liking scores of appearance, color and texture appearance were significantly higher ($p < 0.10$), while consumer liking scores of aroma, sweetness, spiciness and overall flavor were not significantly different ($p > 0.10$), using the Oskar machine and sieve compared to the peanut butter machine. This is expected because the same formulations were used in both methods as described above. Consumer liking scores of texture /mouthfeel and texture/ smoothness, using the Oskar machine and sieve compared to the peanut butter machine were significantly lower ($p < 0.10$). Flavor ratings (aroma, sweetness, spiciness and overall flavor) were the highest, with a mean range of 5.39 to 5.87 or 'neither like nor dislike', compared to appearance ratings (appearance, color, and texture appearance) with a mean range of 4.28 to 5.12 or 'dislike slightly' to 'neither like nor dislike and texture ratings (texture/mouthfeel and texture/ smoothness) with a mean range of 5.04 to 5.62 or 'neither like nor dislike.'

Although there were no significant differences ($p > 0.10$) in the overall liking score of satay sauce with a mean range of 5.43 to 5.62 or 'neither like nor dislike', prepared using different methods of grinding peanuts. The peanut butter machine was more suitable to use as the peanut grinding method due to ease of use in preparing ground peanuts.

Multi-step vs one-step process: Results from Table 4 showed that consumer liking scores of appearance, color and texture/appearance, aroma, sweetness, spiciness and overall flavor

Table 4 Mean[1] consumer liking scores for various attributes of satay sauce (n=50).

Processing effect	Sensory liking scores[2]									
	Appearance	Color appearance	Texture	Aroma mouthfeel	Texture smoothness	Texture	Sweetness	Spiciness flavor	Overall liking	Overall
Peanut grinding method										
Oskar machine	4.65[a]	4.82[a]	5.12[a]	5.47[a]	5.13[b]	5.04[b]	5.63[a]	5.76[a]	5.61[a]	5.43[a]
	(0.85)	(0.68)	(1.23)	(0.36)	(0.44)	(0.29)	(0.91)	(0.70)	(0.81)	(0.51)
Peanut butter	4.28[b]	4.47[b]	4.74[b]	5.39[a]	5.59[a]	5.62[a]	5.87[a]	5.84[a]	5.81[a]	5.62[a]
machine	(0.86)	(0.72)	(1.19)	(0.41)	(0.39)	(0.34)	(0.88)	(1.07)	(0.79)	(0.48)
Processing step										
One-step	4.34[a]	4.52[a]	4.82[a]	5.34[a]	5.24[b]	5.18[b]	5.69[a]	5.71[a]	5.62[a]	5.42[a]
	(0.64)	(0.57)	(1.02)	(0.54)	(0.53)	(0.31)	(0.64)	(0.79)	(0.87)	(0.65)
Muti-step	4.58[a]	4.77[a]	5.04[a]	5.52[a]	5.48[a]	5.48[a]	5.82[a]	5.89[a]	5.81[a]	5.63[a]
	(0.62)	(0.67)	(1.09)	(0.49)	(0.56)	(0.36)	(0.68)	(0.69)	(0.64)	(0.78)
Processing time										
45 min	4.98[a]	5.02[a]	5.48[a]	5.54[a]	5.48[a]	5.42[a]	5.89[a]	5.93[a]	.90[a]	5.70[a]
	(0.86)	(0.72)	(1.39)	(0.41)	(0.90)	(0.34)	(0.65)	(1.11)	(0.79)	(0.84)
60 mim	4.33[b]	4.52[b]	4.93[b]	5.47[a]	5.32[a]	5.30[a]	5.71[a]	5.74[a]	5.68[b]	5.54[b]
	(0.98)	(0.87)	(1.25)	(0.54)	(0.99)	(0.38)	(0.77)	(1.23)	(0.79)	(0.85)
75 mim	4.08[b]	4.41[b]	4.38[c]	5.29[a]	5.29[a]	5.28[a]	5.65[a]	5.74[a]	5.56[b]	5.34[b]
	(0.87)	(1.22)	(1.09)	(0.48)	(0.88)	(0.47)	(0.86)	(0.97)	(0.79)	(0.78)

[1] Mean values of each effect on process development within column not followed by the same letters are significantly different in statistic (α <0.10)

[2] Scores are based on 9-point hedonic scale with 1= dislike extremely, 2=dislike very much, 3=dislike moderately, 4= dislike slightly, 5= neither like nor dislike, 6= like slightly, 7= like moderately, 8= like very much, 9= like extremely

were not significantly (/ >0.10), using the multi-step process compared to the one-step process. This is expected because the same formulations were used in both processes as described above. Consumer liking scores of texture /mouthfeel and texture/smoothness using the multi-step process compared to the one-step process were significantly lower (/ <0.10). Flavor ratings (aroma, sweetness, spiciness and overall flavor) were the highest, with a mean range from 5.34 to 5.89 or 'neither like nor dislike', compared to appearance ratings (appearance, color, and texture appearance) with a mean range of 4.34 to 5.04 or 'dislike slightly' to 'neither like nor dislike' and texture ratings (texture/mouthfeel and texture/smoothness) with a mean range of 5.24 to 5.48 or 'neither like nor dislike.'

Although, there were no significant differences (/ >0.10) in the overall liking of satay sauce with a mean range 5.42 to 5.63 (neither like nor dislike), prepared using different processes. The one-step process is more convenience than the multi-step process. Thus, the one step process was more suitable to be used as the process due to ease of use in satay sauce preparation.

Processing times: Results from Table 4 showed that consumer liking scores of appearance, color and texture appearance were significantly lowest (/ <0.10) when increasing processing time from 45min to 60 min and 75 min, respectively. Consumer liking scores of aroma, sweetness, spiciness and overall flavor were not significantly different (/ >0.10), using the processing time for 45 min compared to the processing time 60 min and 75 min. This is expected because the same formulations were used. Similar to the results of consumer liking scores of texture /mouthfeel and texture/smoothness were not significantly different (/ >0.10) using the processing time for 45, 60 or 75 min. Flavor ratings (aroma, sweetness, spiciness and overall flavor) were the highest, with a mean range from 5.29 to 5.93 or 'neither like nor dislike', compared to appearance ratings (appearance, color, and texture appearance) with a mean range of 4.08 to 5.48 or 'dislike slightly' to 'neither like nor dislike' and texture ratings (texture/mouthfeel and texture/smoothness) with a mean range of 5.28 to 5.48 or 'neither like nor dislike.'

There were significant differences at / <0.10 in the overall liking scores of the satay sauce with a mean rating of 5.70, 5.54 and 5.34 or 'neither like nor dislike', using the processing time for 45, 60 or 75 min, respectively. Satay sauce using the processing time for 45 min with the highest rating for overall liking had the highest mean ratings of appearance, color, texture/ appearance, texture/mouthfeel, texture/ smoothness, sweetness, spiciness, and overall flavor. This is expected and realized that satay sauce should be processed for 45 min in order to get the maximum consumer acceptance.

CONCLUSION

Texture measurements and consumer acceptance test of satay sauce were used to determine the effect of peanut grinding methods, a one-step and multi-step processes, and processing times on texture values and American consumer liking scores. Results from texture measurement showed that all of texture values were not significantly different at/ <0.05 from two peanut grinding methods and two processes, while all of texture values were highly significant highest at / <0.10 when processing time increased from 45min to 60 min and 75 min, respectively. Consumer acceptance test results showed that there were no significant differences in the overall liking score of satay sauce from two peanut grinding methods(/ >0.10) and two processes (/ >0.10). When processing time increased from 45min to 60 min and 75 min, there were highly significant differences at/ <0.10 in the overall liking scores. Due to the convenience, the peanut grinding methods, suitable processing of satay sauce and

the significant difference of the processing time, satay sauce should be prepared using peanuts ground in a peanut butter machine and processed for 45 min using a one-step process.

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