Physicochemical Properties and Sensory Evaluation of the Formulated Reduced Calorie Satay Sauce

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Abstract

Satay sauce or peanut sauce is the various parts, which acts for dipping satay in order to give color, odor, and flavor. According to the busy life style of consumers in worldwide was fulfilled the demand for convenience, safety and less of calorie excess in the foods they choose. Consequently, the research aimed to develop a canned reduced calorie satay sauce by the replacement of skim milk instead of coconut milk in order to reduce the calories. The objective was to study on the physicochemical properties and sensory evaluation on the formulations of canned reduced calorie satay sauce for the guideline of the contribution of those sensory properties. Results indicated that the selected formulation of canned reduced calorie satay sauce could be replaced coconut milk with skim milk in the ratio of 35%, or it is said that coconut milk decreased to 28% from 63%, which reflecting that the lower amount of skim milk in canned satay sauce affected to the decreasing of color values, texture values on consistency and firmness, adhesiveness and oil separation. While the mean liking scores on all sensory attributes of the selected canned reduced calorie satay sauce were range between 5.62 to 7.35 or 'neither like or dislike' to 'like moderately'. From JAR results affected that the selected reduced calorie satay sauce should improve for more acceptance by increasing color, viscosity and hot of the product.

Keywords: physicochemical, sensory evaluation, formulated, reduced, calories, satay sauce

1. Introduction

Sauces are the necessary parts of food due to they play an important role in the sensory perception and acceptance of meals (Paulsen *et al.*, 2012). As well as, sauces are acted as filling, toppings, or marinates. Somes are for dipping and using as glazes and others for application on pasta, meat or vegetables (Kuntz, 1994). An application of sauces shows that sauces enrich food to improve its flavor and aroma (Krystyjan, *et al.*, 2012), and it is one group of food that consumer would like to have in their supermarket as commercial product (Grommet and Jemmott, 1993). Another sauce called satay sauce or peanut sauce characterizes as a semi-solid food for used on meat in satay meal, one of the top ten favorite Thai food (Noparatnapaporn, 2000; Chotigunta *et al.*, 2000). Satay sauce is important as same as other sauces because it enhances the sensory appeal of satay by adding richness of flavor and /or enhancing the mouth feel (Jones, 2000). Satay sauce is classified into fresh satay sauce and instant satay sauce in the patterns of ready to use or ready to eat satay sauce.

According to fresh satay sauce has a short shelf life, whereas instant satay sauce has a long shelf life. Besides, the consumers are increasingly better informed about diet, and health, and as a result that the reduced or low calorie foods have been considered one of an important tool for l owing the risk of obesity and overweight (Carillo *et al.*, 2012). Reflected with the reduced calorie foods are important for the choices of consumer demand, based on the food energy per portion or serving is substantially less (Altschul, 1993). Therefore, to develop on formulation of canned reduced calorie satay sauce was focused. Nevertheless, to reformulate satay sauce product, those are, ingredient changes must be studied on quality changes by determination on physicochemical measurements and sensory evaluation on the formulations of the canned reduced calorie satay sauce compared with the canned satay sauce using original formulation as control.

2. Materials and mehods

2.1 Raw materials preparation

2.1.1 Ground peanuts

Unblanched shelled medium Tinan9 (Khaothong®, Thai Food Industry (1964) Co., Ltd., Bangkok, Thailand) were purchased, and visually sorted for defective, damaged and bruised kernels. Raw peanuts were roasted at 170°C for 20 min, and cooled (applied from Haruthaithanasan, 1997; Tangpradist, 2002). Blanched peanuts were peeled to

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remove the red skin, and were grounded in a blender machine (Moulinex 6667, Wirasu company Ltd, Bangkok, Thailand). Then they were sieved using ASTM sieve No. 10 (10 mesh, Retsch GmbH test sieve, Haan, Germany). If some of the peanut sample did not pass the sieve, it should be ground and sieved again. The ground peanuts were stored in 4°C until using.

2.1.2 Ready to use chili paste preparation

Chili and lemon grass were washed, blanched at 100°C for 2 min and cut into 5 mm pieces. While the other ingredients, consisting of fresh garlic, fresh galangal, fresh shallot, and fresh kefir lime peel were cleaned, peeled, and blanched at 100° C for 2 min and cut into 5x5 mm pieces. Based on the formulation of fresh chili paste, which consisted of 40% chili; 20% lemongrass; 10% garlic; 8% galangal; 6% shallot; 3% kefir lime peel; 9% salt; 3.5% shrimp paste; and 0.5 % cumin powder (applied from Globo Food , ltd.) Cumin powder, shrimp paste, salt, and first six ingredients as described above were mixed and grinded until smooth in a blender (Moulinex 6667, Wirasu company Ltd, Bangkok, Thailand). Then the mixing of fresh chili paste and vegetable oil in the ratio of 1:2 were evaporated at 90° C for 60 min. After that the hot evaporated chili paste with oil were filled in PP plastic bag and boiled for 10 min. Finally, cooling and packaging in aluminum foil bag were done.

2.2 Experiment design

The completely randomized design (CRD) as shown in Table 1 consisted of 5 treatment of canned reduced calorie satay sauce, and 1 treatment as control (canned orginal satay sauce).

TABLE 1 THE FORMULATION OF CANNED REDUCED CALORIE AND CONTROL SATAY SAUCE

% Ingredients	TRT1	TRT 2	TRT 3	TRT 4	TRT 5	Control
Coconut milk	16.00	19.00	22.00	25.00	28.00	63.00
Skim milk	47.00	44.00	41.00	38.00	35.00	0.00
Water	10.00	10.00	10.00	10.00	10.00	10.00
Ground peanut	10.00	10.00	10.00	10.00	10.00	10.00
Sucrose	9.45	9.45	9.45	9.45	9.45	9.45
RCPO	5.20	5.20	5.20	5.20	5.20	5.20
Tamarind juice	2.35	2.35	2.35	2.35	2.35	2.35

2.3 Canned satay sauce process

Canned satay sauce samples were prepared from the formulations as shown above. The process for canned satay sauce preparation was heated to 90°C, then stirred continuously, and heated at 90°C in a oil bath jacketed kettle for 45 min. After that filling 180 g of satay sauce samples in can size 307×113, exhausting 10 min seeming suddenly. Then the sterilization 121°C for 30 min and cooling process were done. Satay sauce samples were determined by physicochemical measurements and sensory evaluation on consumer acceptance test.

2.4 Determination of canned satay sauce quality

Six samples of canned satay sauce samples were measured in physicochemical measurements including proximate analysis and they were also evaluated with sensory evaluation using consumer acceptance test. Each of the determination was described below.

2.4.1 Physicochemical measurements

Six samples of canned satay sauce samples were measured in physicochemical measurements including proximate analysis and they were also evaluated with sensory evaluation using consumer acceptance test. Each of the determination was described below.

Color Color was measured in L*(lightness), a*(redness) and b*(yellowness) with a hand-held Minolta Instrument (Chroma meter, Model CR-200, Minolta, Osaka, Japan). The instrument was calibrated 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 of sample (Sihsobhon *et al.*, 2011) evenly in a 35X10 mm petri dish (Model 08-757-11 y, Fisher Scientific, Fairlawn, NJ, USA). Results were reported as L*, a*, b*.

Texture Texture was analyzed using 2 equipments. A Texture Analyzer (Texture Analyzer (TA XT plus, Stable Micro system, Charpa Techcenter Co. Ltd., Thailand) (Stable Micro Systems Ltd, 2000), calibrated with 5 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) was measured for g max force. Approximately 100 g. of each satay sauce was measured at 30°C and placed in the sample container of the Texture Analyzer for measuring maximum g force as firmness values. A Bostwick Consistometer was measured on mean distance as consistency values. Approximately 100 g. of each satay sauce was measured at 30°C and placed in the sample container of the Bostwick Consistometer for measuring 3 points of the diameter, which satay sauce samples were flowed.

pH pH was measured using a pH meter (model.200 Series, Orion Laboratory Products Group, Boston, MA, USA).

%Peanut quantity Peanut quantity was measured by weighing 50 g of satay sauce and 100 ml of water and placed in the beaker. Stirring the mixture continuously and pouring with sieve diameter 8 cm were used. The peanut quantity was weighted after the water in the mixture was drained about 15 min. The pictures to show on peanut size were taken.

%Adhesive Adhesive test was measured by weighting 50 g of satay sauce in a petridish. Dipping with paddle shape wood stick 12.5 cm long was used. The wood stick was weighed before and after dipping. The percentage of adhesive of satay sauce was calculated from the equation as shown below.

$$Adhesive(\%) = \frac{Weight\ of\ dipped\ satay\ sauce}{Weight\ of\ satay\ sauce} \times 100$$

%Oil separation. Oil separation test according to the method applied from burned chili paste analysis (Ministy of Industry, 1993) was prepared by placing 50 ml of satay sauce in a 50 ml cylinder for 24 hr in room temperature until the separated oil was appeared on the top. Reading the volume of oil separation from satay sauce was recorded and then reported in percentage of values. The percentage of oil separation was calculated from the equation below.

$$Oil\ separation(\%) = \frac{Volume\ of\ oil\ separation}{Volume\ of\ satay\ sauce} \times 100$$

Specific gravity. Specific gravity measurement was measured by pouring 100 ml of satay sauce in 100 ml cylinder. A cylinder was weight before and after pouring satay sauce. The specific gravity was calculated from the equation below.

$$Specific\ gravity = \frac{Weight\ of\ satay\ sauce}{Volume\ of\ satay\ sauce} \times 100$$

Proximate analysis Proximate analysis was measured for calculation the energy of each satay sauce samples.

2.4.2 Sensory evaluation

Sensory evaluation by consumer acceptance test was conducted using ninety consumers, which were recruited from Kasetsart University, Ramkamhaeng University, King Mongkut Institute of Technology Ladkrabang and population in Bangkok, Thailand. Panelists were between the age 18-65 years old, had ever eaten satay sauce. The experimental design was BIB augmented with control (Gacula, 1993). Each panelist evaluated 4 satay sauce samples, including 3 samples of reduced calorie satay sauce and a sample of control satay sauce. The samples were presented to panelists in a laminated plastic tray with approximately 30 g sample of satay sauce in pre-labeled 2 oz sample cups covered with lids and coded with three digit random numbers. Cups with lids for expectoration, spoons and drinking water were also provided on the tray. Water was used as palate cleansers between samples and toasted bread size 3×4 cm. was used as a carrier for the evaluation of the satay sauce (Sihsobhon, 2008). The ballots consisted of 11 questions asking the panelists to rate the feelings about the products. Panelists rated 11 attributes consisted of color, separation, peanut size, viscosity, peanut odor, adhesiveness, texture in mouth, sweet, hot, overall flavor and overall liking using 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 and 9= like extremely (Resurreccion, 1998; Chompreeda, 2007). Besides, the ballots consisted of 7 questions to rate just about right (JAR) on color, viscosity, peanut odor, adhesiveness, texture in mouth, sweet, and hot using 3 scales with the following: not enough, just about right, and too much (Prinyawiwatkul, 2010).

2.5 Statistical analysis

The qualities on physicochemical measurements were analyzed the variance and compare the significance among samples (Jangchud, 2006). The analysis of variance for the experimental design of BIB augmented with control was used to analyze and compare the significance of mean liking scores (Gacula, 1993; Gacula *et al.*, 2009). The comparison of their qualities could answer that which reduced calorie satay sauce was suitable to be the selected canned reduced calorie satay sauce.

In addition, JAR results of all treatments on 7 attributes were analyzed based on the normal percentage of JAR equal 70% was established. If some data had the percentage of JAR less than 70%, then binomial test was used to analyze (Prinyawiwatkul, 2010). The results of the analysis were the guideline to explain the directions to improve the products, especially the selected canned reduced calorie satay sauce prepared from suitable formulation in this study.

3. Results and discussions

3.1 Physicochemical properties of canned satay sauce

The six samples of canned satay sauce consisted of canned satay sauce (control) and 5 canned reduced calorie satay sauce are shown in Figure 1. The physicochemical values of all canned satay sauce were shown in Table 2.

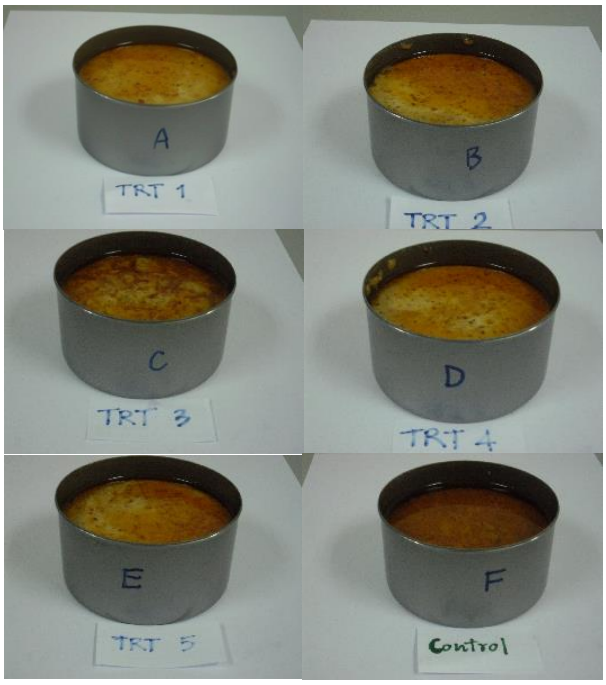

Figure 1 Canned reduced calorie (TRT 1-5) and canned satay (control)

Depending on skim milk was used to replace coconut milk in canned reduced calorie satay sauce at different ratio from 47, 44, 41, 38 and 35 from TRT 1 to TRT 5, respectively. Results from Table 2 indicated that the color values of all canned satay sauce samples were significantly (P≤ 0.05) different on L* value, but they were not significantly (P>0.05) different on a* and b* values. Results also represented that the lower amount of skim milk in canned satay sauce affected to the decreasing of L* value, a* value, and b* value. All of the texture values on firmness and consistency of canned satay sauce was significantly (P≤ 0.05) different. It explained that the decreasing of skim milk quantity from TRT 1 to TRT 5 affected to lower consistency and firmness of satay sauce samples. pH values, specific gravity and peanut quantities of all canned reduced calorie satay sauce samples were not significantly (P>0.05) different, but the adhesiveness and oil separation properties were significantly (P=0.05) different as expected because the formulations were different. Among satay sauce's ingredients, coconut milk is the main ingredient that contains high amount of fats, especially, saturated fatty acids and also high of calorie (Aukanitr, 1996). According to skim milk are lower fat content than coconut milk, and due to fat represented as the rich of creamy, taste and flavor. From this reason resulted that canned reduced calorie satay sauce less oil separation than the canned satay sauce. Besides, the comparison of all of canned reduced calorie satay sauce samples with canned satay sauce (control) found that trend of the qualities of canned reduced calorie satay sauce samples were lower of color values, texture values, oil separation and higher of adhesiveness than control canned satay sauce

TABLE 2 THE QUALITIES1 OF CANNED REDUCED CALORIE SATAY SAUCE 5 TREATMENT AND CANNED SATAY SAUCE

Qualities	TRT 1	TRT 2	TRT 3	TRT 4	TRT 5	Control
L*	32.19±0.26^{a}	32.05±0.45^{a}	31.76±0.36^{ab}	31.67±0.41^{b}	31.64±0.31^{b}	32.88±0.30^{a}
a*^{ns}	+8.70±0.28	+8.74±0.34	+8.67±0.21	+8.80±0.19	+8.82±0.28	+8.97±0.36
b*^{ns}	+11.92±0.46	+11.99±0.33	+12.07±0.50	12.11±0.35	+12.05±0.24	+11.95±0.29
Consistency (cm)	11.20±0.27^{b}	10.93±0.32^{bc}	10.84±0.38^{c}	10.86±0.46^{c}	10.84±0.30^{c}	13.18±0.39^{a}
Firmness(g)	96.24±0.35^{a}	92.15±0.36^{a}	91.38±0.33^{ab}	89.91±0.31^{b}	88.82±0.30^{b}	88.76±0.46^{b}
pH	5.43±0.01^{a}	5.40±0.01^{a}	5.35±0.02^{ab}	5.33±0.01^{ab}	5.30±0.02^{b}	5.46±0.02^{a}
%adhesiveness	2.96±0.32^{b}	3.02±0.36^{ab}	3.38±0.33^{a}	3.28±0.35^{a}	2.94±031^{b}	2.88±0.38^{b}
%oil separation	4.00±0.16^{c}	5.00±0.10^{b}	4.50±0.24^{bc}	5.25±0.20^{b}	4.00±0.22^{c}	12.0±0.29^{a}
Specific gravity^{ns}	1.08±0.01	1.09±0.01	1.09±0.02	1.09±0.03	1.08±0.03	1.09±0.02
%peanut quanitity^{ns}	51.68±0.10	51.89±0.11	52.13±0.13	52.05±0.16	51.91±0.19	52.32±0.21

[1] Mean values within row not followed by the same letters are significantly different in statistic (P <0.05

Besides, the energy of canned satay sauce samples TRT 1 to TRT 5 from proximate analysis were 213.24, 224.75, 229.96, 232.02, 233.18 kcal per 100 g , while the control canned satay sauce was 319.17 kcal per 100 g. The estimated percentage fewer calorie of TRT 1 to TRT compared with the control canned satay sauce were 33.19, 29.58, 27.95, 27.31 and 26.94%. It indicated that all canned reduced calorie satay sauce could be called correctly as "reduced calories" satay sauce according to the definition of reduced calorie that contains 25% fewer calorie than a reference as Virotai (2002) mentioned.

3.2 Sensory evaluation of canned satay sauce

To select which reduced calorie formulation to be the suitable formulation of canned reduced calorie satay sauce should correlate the consumer acceptance of all canned satay sauce samples to evaluate the results as shown in Table 3. The results as shown in Table 3 represented that the canned reduced calorie satay sauce TRT 5 was got the results in maximum mean consumer liking scores on peanut size, viscosity, sweet, hot, overall flavor and overall liking. It explained that the decreasing of skim milk quantity from TRT 1 to TRT 5 affected higher mean liking scores on hot, sweet and also overall flavor because less skim milk consists less lactose, which occurred more liking scores on sweet of the canned reduced calorie satay sauce compared with the control canned satay sauce. This is realized that satay sauce using skim milk to instead of coconut milk affected to increase the likings on hot, sweet and overall flavor of the product. Although mean liking scores of reduced calorie satay sauce TRT 5 were significantly (P≤0.05) different from control canned satay sauce except peanut size, but they were higher scores on all sensory attributes than control canned satay sauce. The mean liking scores of canned reduced calorie satay sauce TRT 5 on texture ratings (adhesiveness, texture in mouth) with a mean range of 6.50 to 7.35 or 'like slightly' to 'like moderately' were compared to appearance ratings (color, separation, peanut size, viscosity) with a mean range of 6.16 to 6.53 or 'like slightly' and flavor ratings (peanut odor, sweet, hot, overall flavor) with a mean range of 5.62 to 6.74 or 'neither like or dislike' to ' like moderately.' The overall liking scores of this product was 6.67 or 'like slightly'. This results demonstrated that the suitable canned reduced calorie satay sauce from this study were TRT 5, which was lowest in skim milk among all canned reduced calorie satay sauce formulations in this study.

TABLE 3 MEAN LIKING SCORES1OF CANNED REDUCED CALORIE AND CONTROL SATAY SAUCE

Qualities	TRT 1	TRT 2	TRT 3	TRT 4	TRT 5	Control
Color	6.38±0.41a	6.00±0.60ab	6.06±0.56ab	6.28±0.60a	6.25±0.65a	5.93±0.66b
Separation	6.17±0.46a	6.35±0.56a	6.30±0.71a	6.33±0.66a	6.16±0.69a	5.31±0.60b
Peanut size[ns]	6.28±0.61	6.20±0.49	6.28±0.46	6.28±0.62	6.53±0.46	6.21±0.61
Viscosity	6.19±0.65b	6.20±0.48b	6.09±0.46b	6.44±0.49a	6.52±0.55a	5.76±0.70c
Peanut odor	6.50±0.66a	6.20±0.48b	6.11±0.47b	6.46±0.48a	6.48±0.56a	5.73±0.66c
Adhesiveness	6.69±0.76b	6.33±0.56a	6.01±0.61c	7.05±0.66b	7.35±0.62a	5.76±0.60c
Texture in mouth	6.65±0.56a	6.44±0.48ab	6.26±0.46b	6.49±0.45a	6.50±0.56a	6.17±0.49b
Sweet	6.07±0.56c	6.41±0.58b	6.26±0.59bc	6.56±0.49b	6.74±0.69a	5.69±0.71d
Hot	5.53±0.55a	5.51±0.56a	5.53±0.59a	5.61±0.49a	5.62±0.47a	4.98±0.52b
Overall flavor	6.28±0.76b	6.35±0.71b	6.13±0.72b	6.74±0.71a	6.76±0.64a	5.76±0.60c
Overall liking	6.24±0.56b	6.35±0.55b	6.16±0.59b	6.50±0.56a	6.67±0.58a	5.63±0.64c

[1] Mean values within row not followed by the same letters are significantly different in statistic ($P < 0.05$)

Thus, the suitable canned reduced calorie satay sauce from this study was TRT 5. Its formulation consisted of 28% coconut milk, 35% skim milk, 10% water, 10% ground peanut, 9.45% sucrose, 5.20% RCPO, and 2.35% tamarind juice. According to the trend for healthy food of global population are fueled of more convenience, higher quality and better tasting, fresher and more natural, healthier or high nutrition value (Chinnabutr, 2012). There is a good potential to develop this canned reduced calorie satay sauce for the demand of Thai consumer**.** However, JAR results of this sample and other canned satay sauce samples on 7 attributes must be analyzed based on the establishment of normal percentage of JAR equal 70% as shown in Table 4.

TABLE 4 PERCENTAGE OF JAR FOR SENSORY ATTRIBUTES FROM 5 FORMULATIONS OF CANNED REDUCED CALORIE SATAY SAUCE AND CONTROL SATAY SAUCE

Sensory attribute	TRT 1	TRT 2	TRT 3	TRT 4	TRT 5	Control
Color						
%not enough	37.03	40.74	59.26	42.59	51.85	30.00
%JAR	62.96	51.85	40.74	40.00	48.15	51.11
%Too much	0.00	7.41	0.00	7.41	0.00	18.89
Viscosity						
%not enough	33.33	25.93	22.22	33.33	31.48	44.44
%JAR	64.82	62.96	40.74	64.82	68.52	55.56
%Too much	1.85	11.11	37.04	1.85	0.00	0.00
Peanut odor						
%not enough	12.96	24.08	22.22	20.37	16.67	24.44
%JAR	64.82	50.00	50.00	61.11	68.52	47.78
%Too much	22.22	25.92	27.78	18.52	14.81	38.88
Adhesiveness						
%not enough	38.89	27.78	48.15	18.52	11.12	47.78
%JAR	61.11	64.81	58.15	77.78	88.88	50.00
%Too much	0.00	7.41	0.00	3.70	0.00	2.22
Texture in mouth						
%not enough	16.67	40.74	44.44	16.67	22.22	21.11
%JAR	74.07	59.26	53.70	74.07	74.07	67.78
%Too much	9.26	0.00	1.86	9.26	3.71	11.11
Sweet						
%not enough	29.63	12.96	24.07	12.96	3.71	30.00
%JAR	51.85	61.11	55.56	61.11	92.58	44.44
%Too much	18.52	25.93	20.37	25.93	3.71	25.56
Hot						
%not enough	77.78	77.78	77.78	77.78	77.78	67.78
%JAR	22.22	22.22	22.22	22.22	22.22	32.22
%Too much	0.00	0.00	0.00	0.00	0.00	0.00

Due to JAR is used for product development to understand how products attributes need to have the direction to improve due to the acceptance responses always do not allow (Prinyawiwatkul, 2010). When focused on JAR results as shown in Table 4 found that JAR on color, with a percentage of 40.74 to 62.96 and canned satay sauce TRT1 was the highest (62.96%). JAR on viscosity, with a percentage of 40.74 to 68.52 and canned satay sauce TRT5 was the highest (68.52%). JAR on peanut odor, with a percentage of 47.78 to 68.52 and canned satay sauce TRT5 was the highest (68.52%). JAR on adhesiveness, with a percentage of 58.15 to 88.88 and satay sauce TRT5 was the highest (88.88%). JAR on texture in mouth, with a percentage of 53.70 to 74.07 and canned satay sauce TRT5, TRT1and TRT4 were the highest (68.52%). JAR on sweet, with a percentage of 51.85 to 92.58 and satay sauce TRT5 was the highest (92.58%). JAR on hot, with a percentage of 22.22 to 32.22 and control canned satay sauce was the highest (68.52%). From overall results of mean liking scores on all sensory attributes as the conclusions from the previous table indicated that the canned satay sauce TRT5 was the most suitable among the canned satay sauce samples. This finding supported with the responses that the canned reduced calorie satay sauce TRT5 was the highest of the overall JAR results, although the JAR on the color of this sample was not the highest. Thus this sample was selected and should be focused on its response for interpretations.

Based on the norm JAR 70% is established as mentioned in Prinyawiwatkul (2010) and Tipganont (2011) that if the observed JAR is ≥ the norm JAR, no further analysis. On the other hand, if the observed JAR is<the norm JAR, a binomial test with the critical value 0.05 was used to determine if the percentage of non JAR responses between not enough and too much are significantly different**.** As mentioned on the descriptions, the sensory attributes of canned reduced calorie satay sauce TRT5 on adhesiveness, texture in mouth and sweet were no need to analyze, but the residue sensory attributes were need to have further analysis using the binomial test as shown in Table 5.

Table 5 Binomial test of the non-JAR responses of sensory attributes for the selected canned reduced calorie satay sauce TRT 5 (n=54)

Sensory attributes	JAR	Below JAR	Above JAR	Sum	Max	0.05 critical value	Directions to improve
Color	26	28	0	28	28	20	Increasing the color
Viscosity	38	17	0	17	17	13	Increasing viscosity
Peanut odor	37	9	8	17	9	13	No
Hot	12	42	0	42	42	28	Increasing hot

When using binomial test on non JAR responses of the selected canned reduced calorie satay sauce as shown in Table 5, results showed that only peanut odor was not significantly (P>0.05) different**,** because the percentage of non JAR responses between not enough and too much are not significantly different. While color, viscosity and hot were significantly (P≤ 0.05) different. This demonstrated that in the next study, the directions to improve the quality of this sample were to increasing color, viscosity and hot by improvement the process of satay sauce preparation and also development the process and formulation of RCPO to use in canned reduced calorie satay sauce preparation.

However this product (233.18 kcal), which was lower than control canned satay sauce (319.17 kcal) in the estimated percentage of 26.94% reduced calorie.

4. Conclusion

From this research is the part of product optimization on formulation development, which is referred to measure the sensory and physicochemical measurements of the overall canned reduced caloriesatay sauce products and to identify the contribution of those sensory properties of the selected product using the just about right (JAR) as a product guidance to adjust how to develop the product for more acceptance. It is said that this studies were supported and designed for the guidelines to develop the optimized product of canned reduced caloriesatay sauce, which should be available for the product development step.

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