

Short Communication

Development of a new product by adding spinach into soft peanut tofu

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Abstract

The raw materials used in this research were Li peanut and spinach, to determine the potential for production of peanut tofu at the laboratory scale. The investigation also included the effect of spinach addition on the sensory evaluation of tofu products.

Results from the experiment are as follows: soaking time 4.5 hours; heating time 3 minutes from boiling; coagulant additive was CaSO_4 2.5% (compared with the raw peanut weight, w/w) and juice of spinach after filtering slurry was 20% (compared with the raw peanut weight, w/w). New product achieved high overall acceptability score.

Keywords: *Spinacia oleracea* L., peanut milk, coagulant, soybean, Vietnam.

Introduction

Peanut is planted widely in the world in general and particularly in Vietnam. Peanuts have high nutrition and consist of acid folic, acid oleic, manganese, tryptophan, vitamin B₃ and niacin. Properties of peanut are similar to soybean. For this reason, peanut is used for making soft tofu with the addition of spinach for creating characteristic flavour because spinach is rich in vitamin A, B₉, E, K, fibre, minerals, chlorophyll and omega-3 fatty acids [1]. Tofu from soybean is a popular addition in many vegetarian dishes. Protein deficiency in the world today requires research using peanuts, which provide both oil and protein. Producing spinach peanut tofu can diversify and create new products to serve the needs of consumers. With the preeminent and unprecedented properties of the product, this study was therefore carried out to research a tofu production process from peanuts and spinach.

Materials and Methods

Materials

Li peanuts were obtained from Tay Ninh province in Vietnam. Average weight of 1000 seeds is 420g, diameter 7-8 mm. Seeds do not have insects and have characteristic odor.

Spinach (*Flat-leaf spinach*) was purchased in a local market in Ho Chi Minh City, green, no insects, characteristic odor.

CaSO₄.2H₂O was from Xilong Chemical Company (China).

Water was treated and had pH = 6.7 from Green Solution Company (Vietnam)

Equipment

The grinding apparatus Philips (Volume of tank: 2000 ml, 500W, 15000 r/m, China). The heating machine Midea model MI-SV19EH (1900W, China). The wooden mould was 6x10 cm.

Methods

Soft tofu processing

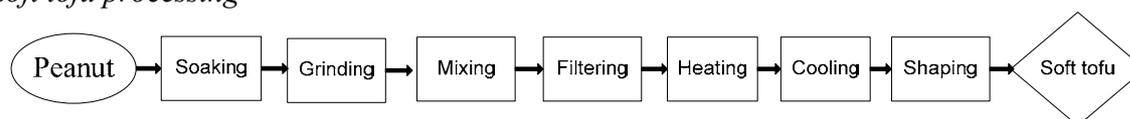


Figure 1. Process for developing soft tofu.

Peanut tofu was produced by traditional methods with slight modifications. Peanut grains (80g) were soaked in 200 ml (1:2.5, w/v) of tap water and stored under normal conditions (28-30°C) for 4.5 hour. The soaked peanut was ground with 800 ml water for 5 min at a high speed in Philips Blender (China). Peanut and spinach was ground and mixed together, the slurry was filtered through a muslin cloth and squeezed by hand to obtain peanut milk. The peanut milk was heated to boiling point at 100°C, maintained for 3 minutes (standard level) while stirring and cooled to 80°C. Tofu was prepared by coagulating the peanut milk using the coagulants CaSO₄ 2.5% (w/w). The prepared coagulant was added to the milk and the mixture was vigorously stirred for 30 seconds. The mixture was allowed to stand for 5 minutes when the curd was separated from the whey and transferred to a wooden mould for pressing. The bean curd was pressed for 30 min and 35N. After pressing, tofu samples were taken out from the mould and analyzed [2]. Each test used in this study using 80g peanuts was conducted three times to get average results.

The sensory evaluation of consumers was used for the spinach peanut tofu. Sensory evaluation was done on freshly made tofu. Sixty panelists evaluated the sensory attributes of the fresh tofu. Panelists were given no time limit for the evaluation, though most panelists took 10-15 min to complete the rating of all the samples. Tofu was cut into cubic samples and placed on a plastic plate with a random number. The attributes evaluated were colour, odor, structure and overall acceptability. The Friedman Test was the method of evaluation used. To assess the likely results of three spinach forms, the sixty panelists are each asked to rank each form in the order of their preference (1= least preferred, 3= most preferred).

In addition, for each sample, panelists scored their liking of these characteristics using the seven-point hedonic scale (1 = dislike extremely, 2 = dislike very much, 3 = dislike slightly, 4 = neither like nor dislike, 5 = like slightly, 6 = like very much and 7 = like extremely). Each sample size was 1.5x1.5x1.5 cm.

Statistical analysis

Data were analyzed in triplicate and subjected to the analysis of variance (ANOVA) using the Statgraphics Centurion XV software package. Significant differences ($P < 0.05$) among group means were calculated with the LSD's multiple range test [3].

Results and Discussion

The peanut milk was mixed with several spinach forms. All samples were 30%, w/w (compared with the raw peanut weight). Spinach was ground in water with the ratio spinach/water 1/2 (w/w) and is described in Table 1 below.

Table 1. Effect of spinach on soft peanut tofu ($\chi^2_{\text{cri}}=5.99$).

Sample	Colour			Odor			Taste			Structure			Overall acceptability score		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Sum score	100	157	103	115	138	107	109	149	102	109	152	99	108	153	99
χ^2	34.3			8.63			21.43			26.43			27.9		
$ R_A - R_B $	57*			23*			40*			41*			45*		
$ R_A - R_C $	3			8			7			10			9		
$ R_B - R_C $	54*			31*			47*			53*			54*		

The least significant rank difference, LSRD=21.47

*: Value of $|R_1 - R_2| > \text{LSRD}$ indicate significant difference ($P \leq 5\%$) in the same row between two sample

A: Slurry and juice of spinach in tofu

B: Juice of spinach in tofu

C: Slurry of spinach in tofu



Figure 2. Slurry and juice of spinach.

$\chi^2 > \chi^2_{\text{cri}}$ (using methods of Friedman test) showed that sample A, samples B and sample C were different significantly regarding all properties of tofu, for instance: colour, taste, odor, structure and overall acceptability score. Furthermore, sample B achieved the best score in three test samples. Sample B had the homogeneous green colour, characteristic odor, no acrid taste, smooth, elastic and soft structure. There are more similarities between the two samples A and C. They did not differ significantly with $p_{\text{value}}=5\%$. Sample A and C had a lot of fibre, acrid taste and rough structure.

Thus, the optimal result in this case is the sample B which used juice of spinach and this is the best choice for the next experiment.



Figure 3. Tofu from three spinach forms (A, B and C).

The next step was to add juice of spinach into peanut milk with a few different proportions. Coding samples B1, B2, B3, B4 and B5 are 10%, 20%, 30%, 40% and 50% (juice of spinach compared with the raw peanut weight, w/w).



Figure 4. Tofu from five proportions B1, B2, B3, B4 and B5.

Table 2. Effect of juice of spinach on properties of soft peanut tofu.

Average score	Colour					Odor				
	B1	B2	B3	B4	B5	B1	B2	B3	B4	B5
	4.1 ± 1.3 ^a	4.7 ± 1.7 ^b	5.3 ± 0.9 ^c	4.5 ± 1.2 ^{abd}	4.4 ± 1.4 ^{abde}	4.6 ± 1.1 ^a	5.0 ± 1.0 ^b	4.5 ± 1.2 ^{ac}	4.2 ± 1.0 ^{acd}	4.5 ± 1.2 ^{acde}
	Taste					Structure				
	B1	B2	B3	B4	B5	B1	B2	B3	B4	B5
	4.9 ± 1.0 ^a	5.2 ± 1.1 ^{ab}	5.1 ± 1.2 ^{abc}	4.3 ± 1.1 ^d	4.3 ± 1.3 ^{de}	4.8 ± 1.0 ^a	4.8 ± 1.2 ^{ab}	5.0 ± 1.1 ^{abc}	4.8 ± 1.3 ^{abcd}	4.7 ± 1.1 ^{abcde}

Different superscript characters indicate significant difference ($p_{value} \leq 5\%$) in the same row.

Table 3. Properties of soft peanut tofu.

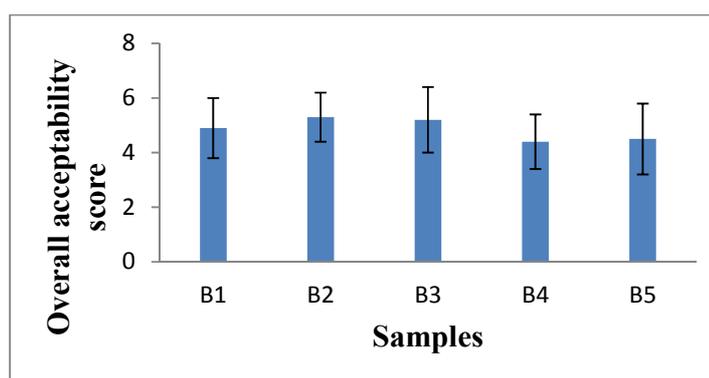
Samples	B1	B2	B3	B4	B5
Colour	Very slight green	Slight green	Green	Dark green.	
Odor	Characteristic peanut odour				
	Characteristic spinach odor		Acrid odor		
Taste	Greasy	Little greasy and characteristic spinach taste	Not greasy and a little tart		
Structure	Soft, elastic and smooth				

Based on Tables 2 and 3, samples B2 and B3 have higher scores than the rest of the samples for colour and taste of curd. Odor of sample B2 was the best in five samples and structure of five samples was similar, with no significant difference. However, Table 4 shows that sample B2 has the higher score than sample B3 regarding overall acceptability, although there was no significant difference. Properties of sample B2 consisted of slight green colour, characteristic spinach odor, little greasy taste, characteristic spinach taste, soft, elastic and smooth.

Table 4. Effect of juice of spinach on overall acceptability score.

Average score	Overall acceptability score				
	B1	B2	B3	B4	B5
	4.9 ± 1.1 ^a	5.3 ± 0.9 ^a	5.2 ± 1.2 ^a	4.4 ± 1.0 ^b	4.5 ± 1.3 ^b

Different superscript characters indicate significant difference ($p_{\text{value}} \leq 5\%$) in the same row.

**Figure 5. Effect of juice of spinach on overall acceptability score.**

Conclusion

Tofu is a traditional food product of Asian countries made from soybeans and has been consumed for over a thousand years. Based on the results of the present study, soymilk was replaced by using materials such as peanuts and the juice from spinach to create new products. This product is attractive for consumers due to high nutritional value, uniqueness, cheap, easy to make and suitable to the taste of Vietnam. It was evaluated by panelists and it is recommended that tofu from spinach peanut milk as a viable possibility in Vietnam and some other countries.

References

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