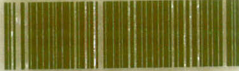


SCIENT. ED.

COPY FOR REVISION

ศูนย์ความรู้ (ศคร.)



RP1969/77-2

UNITED NATIONS CHILDREN'S FUND

THE HEBREW UNIVERSITY (ISRAEL)

TROPICAL PRODUCTS INSTITUTE (ENGLAND)

APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

COOPERATIVE RESEARCH PROGRAMME NO. 38

PROTEIN FOODS

RESEARCH PROJECT NO. 38/9

FORMULATION OF PROTEIN FOODS

REPORT NO. 3

PREPARATION OF

CRISPY EXPANDED PROTEIN FOOD RESEMBLING KHAOKRIAP

BY

PIVAN VARANGOON

RUJIRA SRISUTHEP

BIO-TECHNOLOGY GROUP

TECHNOLOGICAL RESEARCH INSTITUTE

ASRCT, BANGKOK 1969

not for publication

UNITED NATIONS CHILDREN'S FUND
THE HEBREW UNIVERSITY (ISRAEL)
TROPICAL PRODUCTS INSTITUTE (ENGLAND)
APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

COOPERATIVE RESEARCH PROGRAMME NO. 38
PROTEIN FOODS

RESEARCH PROJECT NO. 38/9
FORMULATION OF PROTEIN FOODS

REPORT NO. 3
PREPARATION OF
CRISPY EXPANDED PROTEIN FOOD RESEMBLING KHAOKRIAP

BY
PIVAN VARANGOON
RUJIRA SRISUTHEP
BIO-TECHNOLOGY GROUP
TECHNOLOGICAL RESEARCH INSTITUTE

ASRCT, BANGKOK 1969

not for publication

F O R E W O R D

Many authorities have drawn attention to the critical deficiency in protein foods throughout the world. Protein deficiencies occur in Thai diets in many parts of the country, especially in certain groups of the population. Accordingly, ASRCT decided to attempt to formulate cheap, nutritious protein foods. In particular, it was concluded after a survey of available protein sources that attention should be given to foods based on soya beans and mung beans, and that as part of the agreed strategy such foods might simulate traditional foods thus overcoming one problem in acceptability.

Puff food snacks are familiar and widely acceptable in this country. The present report deals with the development of a protein-rich version of the traditional puff food, *khaokriap*.

PREPARATION OF CRISPY EXPANDED PROTEIN FOOD RESEMBLING KHAOKRIAP

By Pivan Varangoon* and Rujira Srisuthep*

SUMMARY

This paper presents the results of the preparation of a crispy, expanded protein food product similar in appearance to the traditional food, khaokriap. This product is prepared from soya bean protein, incorporated with tapioca flour, wheat flour, and flavouring materials. The resulting mixture is made into a dough and steamed, then sliced thinly and the resultant chips dried at a low temperature (40-45°C) in an oven or in the sun.

The dried chips expand readily when deep fried in oil at about 180-185°C.

Protein content of the dried chips is 22 per cent, and for fried chips, on dry basis, is 16 per cent.

Three similar formulae of chips are developed. Statistical analysis shows a highly significant difference between Formulas I and II, but not among the others. The tasters give highest scores to the chips prepared by Formula I.

INTRODUCTION

Many kinds of crispy products, either imported or locally made are already on the market as snack foods, including prawn crackers (imported from Japan), khaokriap (locally made with prawn or fish flavour), Indonesian fish chips etc. These are not designed as protein foods, but are bought widely because of their pleasant taste.

Khaokriap is a snack food which has been popular for a long time among adults and children in Thailand. It is made of tapioca flour and a small amount of shrimp or fish which is added only for flavouring.

In developing ASRCT research on cheap nutritious foods it was decided to attempt to produce protein-rich versions of traditional foods

* Bio-Technology Group, Technological Research Institute, ASRCT.

following experiments such as those of Rusoff *et al.* (1964). It had been concluded that soya bean, known as an economical source of high quality protein (Bentley 1967), should be used as the proteinaceous ingredient.

The present study was undertaken with the object of incorporating the protein extracted from soya bean into the Thai snack food, *khaokriap*. This report describes the method of preparation of such a protein-rich food. It can be eaten alone or dipped into some kind of sauce, such as tamarind sauce.

MATERIALS AND METHOD

Soya beans, obtained from the local market, were heated in an oven at 60°C for 20 minutes, and the protein was extracted by the modified method of Anson and Pader (1957). The hulls were separated from the beans by cracking in an old-type stone mill and removed by air blowing. The beans were then soaked in water for half an hour and ground in a Waring blender, model 2002, with boiling solution of 0.003 molar calcium hydroxide. The suspension was stirred on a hot plate and kept at 70°C for fifteen minutes. The insoluble matter was removed by filtering through cheese cloth. The pH of the extract was adjusted to 4.8-5.0 with hydrochloric acid using a Beckman pH meter Model 72, and the protein precipitated. The suspension was poured into a cheese cloth bag, the bag hung up to remove the water, and left until the protein contains not more than 71 per cent moisture.

Tapioca, wheat flour, and Ribotide* were purchased locally. Hydrolyzed vegetable protein sample (HVP) was received from Hercules Powder Company, Wilmington, U.S.A.

Vegetable oil, Lion brand, purchased from Lever Brothers Co. was used to fry the chips.

Starmix blender, type KMX 3, from Karl Kolb, was used for mixing the ingredients.

Analyses of moisture and fat content were made by methods given by the AOAC (Horwitz 1965).

* Ribotide - A 50-50 mixture of disodium inosinate and disodium guanylate, Takeda Chemical Industries Ltd., Osaka, Japan.

Protein analyses were determined by macro Kjeldahl method given by the AOAC (Horwitz 1965), using the factor 6.25 to convert N to protein.

Chemical analyses were performed by the Analytical Unit, Industrial Chemistry Group.

Formulation procedure

Soya protein cake was neutralized with sodium hydroxide solution (about 16 ml of 10 per cent sodium hydroxide solution per protein extracted from soya bean 500 g) and placed in the mixture with salt, sugar, and the other ingredients (see Table 1) except flour (garlic and coriander root were ground in the mortar before mixing). After the mixture was well stirred, a combination of tapioca flour and wheat flour were gradually added to form a dough, water being added if the dough was too dry. The mixing bowl was removed from the mixer and the dough was kneaded by hand until it was soft and not sticky. Then it was rolled into cylindrical shapes about 1-1.5 inches in diameter, 8-10 inches long, wrapped in aluminium foil and steamed for 1 hour.

After the cooked product was cooled and the foil stripped off, it was sliced thinly into chips about 1/16 in thick. The chips were dried in an oven at 45°C or in a room having a circulating air supply, or sun dried. The dried chips can be kept for a long period of time.

When the dried chips were fried in vegetable oil at 180-185°C they expanded rapidly within approximately 7-10 seconds and floated on the surface. They were then removed from the oil and drained.

Organoleptic evaluation

The samples were given to a panel of forty-two tasters drawn from ASRCT staff members. They were asked to evaluate the samples on a 9 point hedonic scale. Descriptive terms used are as follows:-

- 9 - like extremely well
- 8 - like considerably
- 7 - like
- 6 - like slightly
- 5 - neither like nor dislike

- 4 - dislike slightly
- 3 - dislike
- 2 - dislike considerably
- 1 - dislike extremely

The data were analysed by analysis of variance, and differences between means were compared by the method of T.W. Tukey (quoted on page 252 of "Statistical Method" by G.W. Snedecor, Iowa State University press 1956).

RESULTS AND DISCUSSION

Many experiments have been done to incorporate various amounts of soya protein into the formula of the chip and these included the addition of defatted white sesame and black sesame flour. However, there are technical difficulties in incorporating a large amount of protein into the formula and at the same time maintaining a desirable appearance and texture. Sesame flour gives an unattractive colour while the addition of a large amount of soya protein imparts a rough texture and beany flavour to the chips.

After several preliminary experiments involving informal taste tests by members of the Food Technology Unit, other staff members of ASRCT, and also some outside people, three similar formulas were adopted, differing only slightly in flavour as shown in Table 1. Formula I contains HVP but Formulas II and III contain none. Garlic and more pepper in Formula III give a stronger flavour to the chips. Coriander root in Formula II also gives an attractive flavour.

Table 2 shows the weight of precipitated protein cake extracted from soya bean; the moisture content of the cake and the percentage yields of protein on wet and dry basis varied slightly. It is noticed from the experiments that if the protein cake has a moisture content of more than seventy-one per cent, the dough will be too soft and very sticky. This causes difficulty in rolling into cylindrical shape.

TABLE 1

COMPOSITION OF CHIPS PREPARED FROM 1000 GRAMME^s OF SOYA BEAN

Ingredients	Formula I (g)	Formula II (g)	Formula III (g)
Soya bean	1000	1000	1000
Wheat flour	150	150	150
Tapioca flour	850	850	850
MSG	120	120	120
Sucrose	90	90	90
Salt	36	40	40
Ribotide	6	6	6
HVP	10	-	-
Pepper powder 100 %	10	16	20
Garlic	-	10	10
Fresh coriander root	-	2	-

TABLE 2

WEIGHT OF PRECIPITATED PROTEIN FROM SOYA BEAN AND
YIELD OF PROTEIN IN PRECIPITATE

Sample	Soya bean (g)	Weight of protein cake (g)	Moisture of protein cake (%)	Protein content in the cake (%)	
				Wet	Dry
1	100	141	71.04	18.80	64.91
2	100	130	70.07	21.04	70.29
3	100	127	71.55	18.46	64.88
4	100	125	65.31	22.34	64.39
5	100	129	71.63	19.91	70.17

Table 3 gives the results of the chemical analysis of dried and fried chips. Protein and fat contents in all formulas of both forms of chips are nearly the same. The average protein level from all formulas of dried chips is 22 per cent, and 16 per cent for the fried chips on dry basis.

Table 4 shows the average yield of dried chips prepared from one kilogramme of soya bean.

It is noticed that if the chips are fried in a good grade of stabilized vegetable oil such as Lion brand oil or pure corn oil (mazola), the product remains non-rancid for about 1-2 months. If Tip vegetable oil is used, it becomes rancid within a few days.

Organoleptic evaluation

The total scores and mean scores of the tasting panel are shown in Table 5. The tasters scored the chips prepared by Formula I higher than the others, and that prepared by Formula II is ranked lowest. Their major like is that these chips from all formulas are of good flavour and crispness. Some of the tasters commented that the chips prepared by Formula III were slightly salty, a few suggested more pepper and garlic in Formula I and some of them felt that the chips in Formula II were spicy.

The analysis of variance summarized in Table 6 shows highly significant difference between the formulas.

There is a statistically significant difference at the 5 per cent level between the means of Formulas I and II but no significant differences were found between Formulas I and III, and between Formulas II and III.

TABLE 3
COMPOSITION OF SOME IMPORTANT CONSTITUENTS
OF DRIED AND FRIED CHIPS

Formula\$	Moisture (%)	Protein (%)		Fat (%)	
		Wet	Dry	Wet	Dry
<u>Dried chip</u>					
I	7.75	19.49	21.12	1.16	1.25
II	8.83	20.79	22.70	3.13	3.43
III	9.72	19.88	22.01	2.49	2.75
<u>Fried chip</u>					
I	4.30	15.82	16.42	33.13	34.62
II	4.24	15.94	16.40	34.87	36.41
III	5.52	14.79	15.60	30.22	31.88

TABLE 4
YIELD OF DRIED CHIPS PREPARED FROM SOYA BEAN

Soya bean (g)	Formula\$	Yield of dried chip (g)
1000	I	1298
1000	I	1606
1000	I	1556
1000	II	1528
1000	III	1478
	Average	1493

TABLE 5

TOTAL SCORES AND MEAN SCORES GIVEN BY A PANEL OF 42 TASTERS

Formula ^s	Total score ^s	Mean score ^s
I	335.5	7.99
II	302	7.19
III	318.5	7.58

TABLE 6

SUMMARY OF ANALYSIS OF VARIANCE FOR THE SCORES GIVEN
BY TASTERS

Sources of variation	DF	SS	MS	VR
Formulas	2	13.36	6.68	5.43*
Error	123	151.68	1.23	
Total	125	165.04		

* Highly significant difference.

Economic evaluation

Table 7 shows the prices in baht per kilogramme of the ingredients, and total costs of the chips in Formulas I, II, and III prepared from 1 kilogramme of soya bean.

The following cost estimate is prepared for the production of 15 kg dried chip, the chips being sun-dried.

Cost of chip Formula I from 10 kg soya bean	152	baht
Labour cost (based on two persons being needed)	40	"
Other costs	<u>8</u>	"
Total cost	<u>200</u>	"

10 kg of soya bean yields 15 kg of dried chips.

Therefore the cost of 1 kg of dried chips is approximately 13.50 baht.

The retail price and protein content of other commercial chips from the market are shown in Table 8.

From the economic point these protein-rich chips appear to be attractive as a commercial product.

CONCLUSIONS

A crispy expanded protein-rich food has been prepared from soya bean, tapioca flour, wheat flour, and flavouring ingredients which is similar in appearance to the traditional food, *khaokriap*. The product has good flavour and crispness and is well accepted by the panel tasters.

The protein content of the product is higher than commercial *khaokriap* prepared with fish or shrimp flavour. From the economic aspect it is attractive to produce on a commercial scale.

ACKNOWLEDGEMENTS

The valuable advice given by Dr. J.L. Wrenshall is gratefully acknowledged. We express our sincere appreciation to Mrs. Yuk-Hang Sombatpanit and her staff for their chemical analyses, to Mrs. Suparn Chamswasdi for her statistical work, and to the staff members of ASRCT in giving their kind cooperation of tasting the product.

TABLE 7
TOTAL COST OF THE FORMULAS OF CHIPS

Ingredients	Price of materials (baht/kg)	Cost of formulas (baht)		
		I	II	III
Soya bean	2	2	2	2
Wheat flour	4.80	0.72	0.72	0.72
Tapioca flour	1.60	1.36	1.36	1.36
MSG	36	4.32	4.32	4.32
Sucrose	4	0.36	0.36	0.36
Salt	2	0.07	0.08	0.08
Ribotide	900	5.40	5.40	5.40
HVP	40	0.40	-	-
Pepper powder 100%	50	0.50	0.80	1.00
Garlic	5	-	0.05	0.05
Fresh coriander root	-	-	0.05	-
Total cost		15.13	15.14	15.29

TABLE 8
PRICES OF COMMERCIAL CHIPS AND PROTEIN CONTENTS

Brand	Price (baht/kg)	Protein content (%)	
		Wet	Dry
Best quality khakriap	60*	3.23	3.39
Khakriap Songkhla	50*	11.20	11.56
Khakriap phan thai norasing	40+	not determined	
Indonesian fish chip	50+	11.25 (as is)	

* - Fried chip

+ - Dried chip

REFERENCES

- ANSON, M.L., and PADER M. (1957).—U.S. Patent 2,802,737.
- BENTLEY, O.G. (1967).—Soy bean production in the world—limitations and potentials. Proceedings of International Conference on Soy Bean Protein Foods held at Peoria, Illinois, October 17–19, 1966, p. 2–17 (Agricultural Research Service, U.S. Department of Agriculture.)
- HORWITZ, W., ed. (1965).—"Official Methods of Analysis of the Association of Official Agricultural Chemists." 10th ed. (Association of Official Agricultural Chemists: Washington, D.C.)
- RUSOFF, Irving I., GOODMAN, A.H., SOMMER, J., and CANTOR, Sidney M. (1964).—Protein fortification of doughnuts. Fd Technol., Champaign 18(11): 131–134.

RP 1969/77-2

