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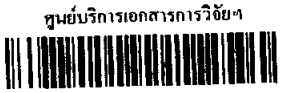

RP1970/75

Development of

village-scale beverage:

!ATIONS CHILDREN'S FUND
REW UNIVERSITY (ISRAEL)
DUCTS 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. 7
DEVELOPMENT OF VILLAGE SCALE BEVERAGE, COCO-SOYA MILK

BY
PIVAN VARANGOON
BIOTECHNOLOGY GROUP
TECHNOLOGICAL RESEARCH INSTITUTE

ASRCT, BANGKOK 1970
not for publication

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CONTENTS

F O R E W O R D

Dietary protein and calorie intakes are inadequate in many parts of the world. This causes malnutrition among people, especially infants and school children in the less-developed countries.

Surveys in Thailand have shown that there is protein malnutrition in many places.

Soybean is an important crop available in this country and a good source of protein. Coconut is popular in almost every kind of Thai dish; it gives a very good flavour.

A beverage prepared from soybean and coconut was suggested by Mr. Cyril Hunnikin of UNICEF as a beverage that may, if approved by the health and nutrition authorities, be easily prepared in rural areas. This may provide a nutritious drink for adults and children.

DEVELOPMENT OF VILLAGE SCALE BEVERAGE, COCO-SOYA MILK

By Pivan Varangoon*

SUMMARY

Two formulae of high caloric value were prepared from coconut milk and soybean. They can be made for small groups of children by simply blending dehulled boiled bean and coconut milk in the first formula and blending soybean extract with coconut milk in the second formula.

The product is boiled for 40 to 60 minutes and consumed on the day of preparation.

Coco-soya milk samples were given to children at two hospitals and an orphanage, and to ASRCT staff members for acceptability test.

The milk provides about 6 g of protein in every 200 g serving. Calculated calories are 160 in Formula I and 132 in Formula II for each 200 g serving.

INTRODUCTION

These studies originated with Mr. Cyril Hunnikin of UNICEF who envisaged the possibility of village scale processing of coco-soya milk. The experimental work has been conducted by the Food Technology Unit, ASRCT.

The objects of the study are to produce an acceptable beverage in which the flavour of soybean is masked, and to produce a nutritious drink providing both good grade protein and adequate calorie value for pre-school children. As envisaged, this will be a beverage produced at domestic or community level in the villages and requiring the minimum of technical equipment although present methods require a small electrical supply. The beverage is intended for consumption on the day of production, since it will not be suitable for storage without hermetic sealing and sterilizing, which would introduce too many complications for rural operations.

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

Soybean and coconut are widely used as foods by Asian people; they are available all over Thailand. Soybean would provide the chief source of protein in the proposed product. Soybean protein is of relatively high quality and is particularly interesting as a source of lysine to supplement rice-based diets.

In Thailand, soybean is already an important crop, produced for export as well as for domestic consumption.*

Coconut is grown throughout Thailand. Coconut milk is quite popular and commonly used in Thai cooking, both in curries and desserts. The milk is extracted from freshly grated meat; it is a source of fat calories and has a very good flavour. A preliminary estimation of fat value of coconut-soya beverage is given in Appendix I.

In view of this, ASRCT became interested in devising a beverage to be prepared daily from soybean and coconut milk for consumption by toddlers or adults. Experiments were made, resulting in two formulae of beverage. In the first formula, whole dehulled boiled beans are incorporated; in the second formula the beans are extracted by a new "boiling water grind technique", developed by the Food Technology Group at Cornell University (Bourne 1970), by which the beany flavour of soybean is eliminated.

MATERIALS AND METHODS

Soybean (fully mature), coconut, and sucrose were bought from the local market. The beans were sorted to remove foreign particles such as soil, small stones, etc. by passing them through a 5-mesh screen. The larger size particles which remained on the screen were visually removed.

Waring-type blender, model CB-5 with metal jar, one gallon capacity, was used for grinding the beans. Domestic type blender can also be used for preparing these beans.

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* "Survey of possible sources of plant proteins available in Thailand for food, feedstuffs, and industrial applications" by Julie Hill. Appraisal Report No. 5, ASRCT unpublished report.

Locally made grating and pressing machines were used for the extraction of coconut milk.

The chemical analyses were performed by the Analytical Chemistry Unit, using standard methods given by the AOAC (Horwitz 1965).

Organoleptic tests

Samples of coco-soya milk Formula I were given to the 4-5-year-old children at Ban Ratchavithi orphanage, Children's Hospital, and Ramathibodi Hospital for acceptability test.

The children in the orphanage received the milk twice, once in 100 ml bottles, sterilized at 121°C for 15 minutes, and the second time in their own cups, 100-120 ml to each, the milk having been boiled for one hour. In the hospitals, only the sterile 100 ml bottles were served. On all occasions the milk was distributed on the day of preparation.

Since the children are too young to express their preferences on any report form, their preferences were judged from the amount of milk consumed.

Coco-soya milk of both formulae was also distributed to ASRCT staff members. They were asked to express their ratings on a 9-point hedonic scale (the form is shown in Appendix II).

Method of preparation coconut milk

The coconut water was heated to boiling and mixed with grated coconut meat before pressing in order to limit bacterial problems, to improve flavour, and to lower oil viscosity for maximum yield.

The method is as follows:-

Crack fresh coconut and conserve coconut water. Pare the brown testa from the meat. Grate the meat in a grating machine. Heat coconut water until boiling, pour it over the grated meat, and press at once in a pressing machine. (The volume of coconut water added is equal to the weight of grated meat; if this is not enough, water is added to adjust the volume.) The milk is separated and filtered through cheese cloth.

Preparation of coco-soya milk

Formula I: Soak soybeans overnight. Boil for 40 minutes in the morning. Remove the hulls by hand.

Add sugar to the coconut milk and heat until boiling, filter through gauze if there is any dirt.

Blend dehulled boiled beans and coco syrup together for 5 minutes in the blender. Then adjust to volume with water. When using domestic type blenders the mixing time is limited to approximately 2 minutes.

Formula II: The beans are extracted according to the method developed at Cornell University* (Bourne 1970). Soak soybeans overnight; discard soaking water.

Grind soaked bean with boiling water in the blender (1 part of soybeans and 10 parts of boiling water). The blender should be preheated with boiling water so that the temperature during grinding will be maintained above 80°C. Filter through cheese cloth.

Add sugar to the coconut milk and heat to boiling; filter through gauze.

Mix coco syrup and soybean milk well by stirring. Coco-soya milk is then boiled for 40-60 minutes before serving.

RESULTS AND DISCUSSION

Figure 1 indicates the material balance of soybean extracted by the boiling water grind technique. One hundred grammes of soybean contains 91 g solids, and 46 g protein. Eighty-two per cent of both protein and fat is extracted into the milk, about 15 % remaining in the residue. The milk extract contains about 65 % of the solids. The loss of product is probably due to some adhering to the filter cloth.

Table 1 shows the composition of coconut milk, weight of meat per nut, and yield of milk per nut. The results indicated the range of variation of individual coconuts and the average. The variations in composition and yield are due to the age and sizes of the nuts.

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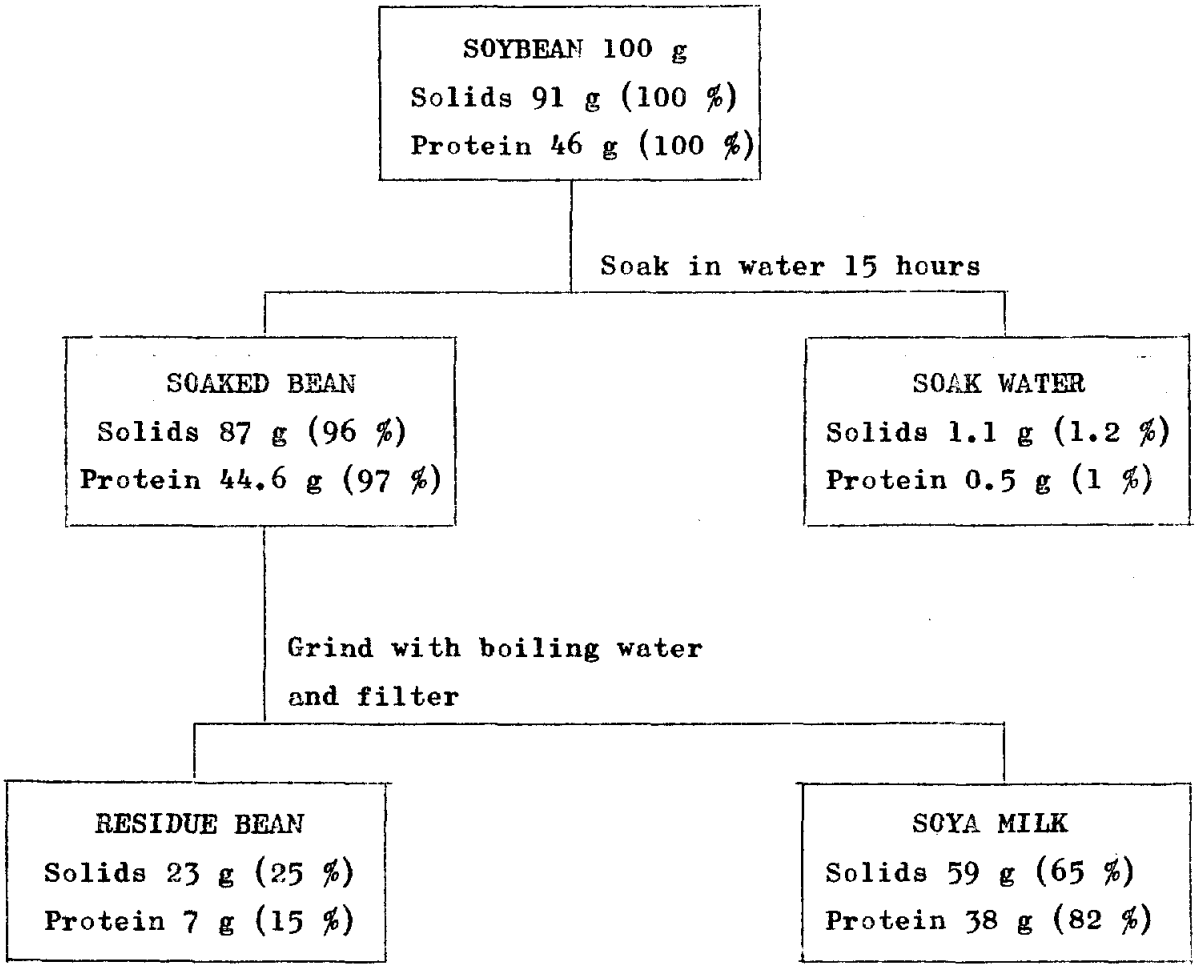
* Private communication and demonstration at ASRCT by Dr. Malcolm C. Bourne, professor of Food Science, New York State Agricultural Experiment Station, Cornell University.



(Percentage of solids and protein in the figure were calculated from the amounts originally present in raw soybeans before soaking).

Figure 1. The material balance of soybean extract. (Formula II.)

TABLE 1
AVERAGE WEIGHT OF COCONUT MEAT, YIELD OF COCONUT MILK PER NUT,
AND COMPOSITION OF COCONUT MILK

	Coconut no.												Average
	1	2	3	4	5	6	7	8	9	10	11	12	
Weight of meat per nut, g	520	255	510	415	400	360	395	380	285	325	320	380	380
Yield of milk per nut, ml	750	280	780	550	490	450	560	530	300	500	480	550	518
Composition of milk													
moisture, %	81.9	78.8	85.8	80.9	80.2	79.2	80.6	81.7	82.9	80.7	81.4	81.3	81.3
fat, %	11.7	13.8	10.2	13.0	14.1	14.9	12.9	12.5	10.2	13.4	13.1	13.5	12.8
protein, %	1.7	2.0	1.3	1.7	1.7	1.8	1.6	1.4	ND	ND[1/]	1.5	1.8	1.7

[1/] Not determined.

Note. Transferred from Laboratory Record Book No. 82/8 pages 47-48.

The average meat of one coconut weighs 380 g and yields 518 ml of coconut milk. The milk consists of 12 % fat, 1.7 % protein, 81 % moisture, and about 5 % carbohydrate. As the protein content is so low, its contribution to the protein value of the finished products is probably not significant. The coconut milk must be considered as primarily a fat calorie and flavour-bearing base.

The details of the coco-soya milk Formulae I and II are shown in Table 2. The results of analyses for both formulae are shown in Table 3. The Table also indicates the result of coco-soya milk Formula I in which the coarse particles of soybean are removed by squeezing through cheese cloth. It should be noted that protein content decreases by filtering. Evidently the protein of boiled beans is not well dispersed.

TABLE 2
COMPOSITION OF COCO-SOYA MILK FORMULAE I AND II

Ingredient	Formula I	Formula II
Soybean, g	100	100
Coconut milk, ml	250	166
Sucrose, g	67	58
Total volume, ml	1250	1165

Note. Transferred from Laboratory Record Book No. 82/10 page 16.

TABLE 3
ANALYSIS RESULTS OF COCO-SOYA MILK FORMULAE I AND II

	Formula I (unfiltered)		Formula I (filtered)		Formula II (filtered)	
	As is	Dry	As is	Dry	As is	Dry
Moisture, % w/w	84.7	-	85.9	-	86.3	-
Fat, % w/w	4.3	27.8	4.2	29.5	2.7	19.5
Fibre, % w/w	0.2	1.3	0.1	0.6	0.1	0.6
Ash, % w/w	0.4	2.7	0.4	2.5	0.5	3.3
Protein, % w/w	3.3	21.5	2.7	19.1	3.2	23.5
CHO, % w/w	7.2	46.7	6.8	48.2	7.3	53.2
Calories/100 g	80		75		66	

Note. Transferred from Laboratory Record Book No. 82/8 page 82 and 82/10 page 16.

The results of analyses of coco-soya milk Formulae I and II are not much different. Fat in Formula II is lower than that in Formula I. Protein and carbohydrate in Formula I are slightly lower than those in Formula II.

Every 100 g of coco-soya milk Formula I provides about 80 calories, whereas the same amount of Formula II milk provides only 66 calories. The difference is mainly due to less coconut fat in Formula II.

Coco-soya milk was cooked by boiling for 40-60 minutes, as it was reported by Hackler et al. (1965) that no change in nutritive value was noted for soya milk cooked at 93°C for 30 minutes or longer, after which 90 % of trypsin inhibitor was inactivated, whereas the peak of nutritional quality was reached in 5-10 minutes of heating at 121°C. On the other hand, if 10 % or less of trypsin inhibitor is retained in soya milk, there is no interference in growth, feed intake, or PER. Available lysine was not altered in the soya milk by cooking it 0-360 minutes at 93°C. Therefore boiling coco-soya milk for 40-60 minutes before serving should be enough for the destruction of trypsin inhibitor while maintaining full nutritive value.

Organoleptic evaluation

Results of the testing of milk Formula I (sterilized in bottles 121°C 15 minutes) by children are shown in Table 4. Most children at Ramathibodi Hospital liked the filtered milk, but 6 out of 7 children did not like unfiltered milk (one child refused to drink the milk because she had a sore mouth).

At the Children's Hospital all children liked filtered milk, but 5 children did not like unfiltered milk.

All children at Ban Ratchavithi orphanage liked both filtered and unfiltered milk very much. About 20 children asked for one more bottle. However, it was noticed that children took longer to finish up unfiltered milk than filtered milk. This is probably due to the coarse particles in the milk making it less palatable.

At Ban Ratchavithi orphanage 135 children consumed all the milk which was sterilized by boiling for 60 minutes. No diarrhea case was reported afterwards. Each child was given 100-120 ml of milk in his own cup.

TABLE 4
ACCEPTANCE OF COCO-SOYA MILK STERILIZED 121°C FOR 15 MINUTES
BY CHILDREN IN INSTITUTIONS

	Coco-soya milk	No. of tasters	No. of children who consumed the milk				
			100 %	75 %	50 %	25 %	0 %
Rama. Hosp.	Unfiltered	7	1	-	-	6-	-
	Filtered	5	4	-	-	1	-
	Filtered	7	3	2	1	-	1
	Filtered	7	4	2	-	-	1
	Filtered	7	4	2	-	-	1
Children's Hosp.	Filtered	50	50	-	-	-	-
	Filtered	57	57	-	-	-	-
	Unfiltered	55	50	-	5	-	-
Ban Ratchavithi orphanage	Filtered	135	135	-	-	-	-
	Unfiltered	133	133	-	-	-	-
	Unfiltered	140	140	-	-	-	-
	Unfiltered, boiled 60 min	135	135	-	-	-	-

Note. Transferred from Laboratory Record Book No. 82/8 page 92.

Table 5 shows total scores and mean scores of ASRCT tasting panel. For Formula I the scores on filtered milk are higher than on unfiltered milk. Tasters comment that unfiltered milk contains too many particles.

TABLE 5
RATING OF COCO-SOYA MILK BY ASRCT TASTERS

Coco-soya milk	No. of tasters	Total scores	Mean scores
Formula I			
unfiltered	54	277	5.1
filtered	53	347	6.6
Formula II	83	514	6.2

Note. Transferred from Laboratory Record Book No. 82/10 page 52.

Mean scores of milk Formula II are lower than of Formula I (filtered). The comments are that milk Formula II should be sweeter, so that the cereal taste will be improved.

However, the mean scores of 6.6 and 6.2 (out of a possible 9.0) show a fairly good level of acceptability by adult tasters.

INGREDIENTS COST

Formula I

For making 25 litres of milk

Materials needed		Unit cost (baht)	Ingredient cost (baht)
Soybean	2 kg	2.50	5.00
Coconut cream (prepared from 10 coconuts)	5000 ml	1.70	17.00
Sucrose	1350 g	2.50	3.40
			25.40

The cost of ingredients for Formula I milk is approximately 1 baht per 1 litre.

Formula II

For making 14 litres of milk

Materials needed		Unit cost (baht)	Ingredient cost (baht)
Soybean	1200 g	2.50	3.00
Coconut cream (prepared from 4 coconuts)	2000 ml	1.70	6.80
Sucrose	700 g	2.50	1.75
			11.55

The cost of ingredients for Formula II milk is approximately .85 baht per 1 litre.

The individual ingredient cost is based on the wholesale price in Bangkok.

It should be noted that the cost of coconut milk is about two-third of the ingredients cost of the product. Perhaps the less expensive ways may be studied to make a palatable drink.

However, in the villages, coconuts are grown at almost every home. The price of coconut may notbe high as it is in Bangkok.

The costing above excludes any assessment of nutritional caloric value of residues, which normally would be utilized as feedstuffs for animals.

CONCLUSIONS

A new combination beverage, coco-soya milk, can be prepared simply from available materials, coconut milk and soybean. Coco-soya provides high nutritive value for toddler's consumption. It should be consumed on the day of production. It has been fairly well accepted by children at two hospitals and an orphanage.

The cost of ingredients per child for 1 cup of 200 ml is about 0.20 baht, based on Bangkok wholesale prices.

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to Mr. Cyril Hunnikin for his guidance for this work; to Dr. M.C. Bourne for his demonstration of boiling water grinding technique of soybean; to Dr. C.L. Wrenshall, M.C. Kokasat Swasti, Dr. Sman Vardhanabhuti, and Mrs. Ubolsri Cheosakul for their valuable advices.

I am grateful to the staff of the Analytical Chemistry Unit for their chemical analyses, to the Directors of Ramathibodi Hospital, Children's Hospital, Ban Ratchavithi orphanage, and to ASRCT staff members for their cooperation in testing milk.

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APPENDIX I

COCONUT-SOYA BEVERAGE

PRELIMINARY ESTIMATION OF FAT VALUE*

	Coconut fat	Soya fat	Coconut: 4 parts Soybean: 3 parts	
Saturated				
C_8 Caprylic	8 %		4.5 %	
C_{10} Capric	7 %		4.0 %	
C_{12} Lauric	48 %		27.5 %	
C_{14} Myristic	17.5 %		10.0 %	
C_{16} Palmitic	9 %	6 %	8.0 %	
C_{18} Stearic	2 %	4 %	3.0 %	57 %
Mono-unsaturated				
C_{18} Oleic	6 %	28 %	15.0 %	15 %
Poly-unsaturated				
C_{18} Linoleic	2.5 %	54 %	24.0 %	
C_{18} Linolenic		8 %	4.0 %	28 %
	100 %	100 %	100 %	

* "Village scale processing——Preliminary studies conducted at the Technological Research Institute of the Applied Scientific Research Corporation of Thailand." Paper given at the first SEMES seminar on nutrition, Indonesia, 1969, by Mr. Cyril Hunnikin, UNICEF.

APPENDIX II

ORGANOLEPTIC FORM

Food Technology Unit

Date of Testing .....

Name of Tester .....

Name of Food Preparation .....

Please check one of the following items on section A and give your comments on section B

A. 1) like extremely well (9)

2) like considerably (8)

3) like (7)

4) like slightly (6)

5) neither like nor dislike (5)

6) dislike slightly (4)

7) dislike (3)

8) dislike considerably (2)

9) dislike extremely (1)

B. Comments:

1) major like (s)

2) major dislike (s)