

DEVELOPMENT OF SUPPLEMENTARY FOOD AT THE HOME AND COMMUNITY LEVEL

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During pre-school age, particularly one to two years, nutritionally-poor supplementary food and unhygienic environment are principal causes of protein-energy malnutrition in developing countries.

In Asia, rice is the main staple food which is bulky and low in fat. Rice-based supplementary food will adequately supply neither protein nor calories. Therefore, ways and means must be found to increase the protein and fat contents by using low-cost materials which can be locally produced.

The Institute of Nutrition, Mahidol University (INMU) has developed seven weaning food mixtures based on the Thai standard for infant foods in reference to quantity and quality of fat and protein contents. Rice is the major ingredient supplemented with protein sources such as soybean, mungbean or fish meal, and calorie sources like sesame or ground-nut. Protein and fat contents range from 13.2 – 18.5g and 9.2 – 13.2g per 100g of the food mixtures respectively, and energy content varies from 437 454 Kcal per 100 g food mixtures.

The necessary food processing includes roasting and grinding which can be done by the villagers in the community either by hand or by electric grinding machines. Nutrition education and supplementary food distribution are being carried out by village health volunteers. These

food and nutrition improvement programmes are integrated into the Primary Health Care activities.

More than one billion children living in developing countries suffer as a result of malnutrition, infection, lack of safe water, poor sanitation and inadequate health care.¹ Among these problems, protein-energy malnutrition (PEM) in infants and pre-school children is a most serious social and health problem in the developing world.

Even though Thailand is a food-exporting country, malnutrition continues to be a serious problem affecting the lives and well-being of the Thai population. Major nutritional problems are PEM and iron deficiency anaemia among infants and pre-school children, school children, pregnant women and lactating mothers. The prevalence of PEM among infants and pre-school children as reported in 1980² showed that 3.5 million out of the 6.6 million pre-school children (or 53%) were malnourished. The problem is more serious in North-East Thailand where the prevalence is estimated at 1.7 million (59.5%) as compared with 53.6 and 51.6% in the North and South respectively. The most serious form of PEM (third degree) still exists among 150,000 pre-school or 2.2%. It has also been found that PEM among school children is as high as 40 – 50%.

Since the Fourth National Development Plan (years 1977-1981) and continuing to the Fifth Plan (years 1982 – 1986), the Royal Thai Government has put strong emphasis on human resource development. Priority has been given to improving health and nutrition of the population, especially among the above-mentioned vulnerable group. research and development in the area of food and nutrition has been assigned to INMU to support the National Plan.

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In 1980, nutrition surveillance was carried out on a representative sample of 202 pre-school children in Nong Hai villages of Ubon Province, North-East Thailand.³ Based on weight for age (Gomez classification), the data showed that 55% of these children had 24-hour dietary recalls from the village mothers showed that the energy intake was about 60 – 80% of the requirement, with carbohydrate intake of about 80 – 85%, fat 4 – 8% and protein 8 – 12% of the total energy intake. The diet was also bulky and very low in fat content. About two-thirds of the protein intake was derived from rice and vegetable sources. Therefore, there is a need to increase the intake of fat and to improve the quality of protein in the supplementary diet.

Development of supplementary food by using local available raw material was developed by INMU during the Fourth Plan. The Ministry of Public Health has adopted this formula and implemented on a nationwide basis through Primary Health Care (PHC) network at the beginning of the Fifth Plan in 1982.

FORMULATION OF HOME AND VILLAGE LEVEL SUPPLEMENTARY FOOD⁴

According to the Thai Standard for Infant Foods, the protein content should not be less than 2.5 g per 100 available Kcal of standard protein. The protein quality expressed in terms of amino-acid score should not be less than 70% of the FAO/WHO reference pattern. The products should contain linoleic acid at a level not less than 300 mg per 100 available Kcal and fat at a level not less than 2 g nor more than 6 g per 100 available Kcal.

Since rice is our staple food, it was used as a major ingredient of the formula. Protein sources were derived from either soybean, mung bean or fish meal. Ground-

nuts and sesame were supplemented to the mixture to provide fat as well as protein. The nutrient composition of the seven supplementary food mixtures is shown in Table I. Protein and fat contents range from 13.2 – 18.5 and 9.2 – 13.2 g per 100 g of the food mixture respectively, and energy content varies from 437 – 454 Kcal per 100 g the food mixtures.

The formulation of these supplementary food mixtures was obtained manually by calculating the proportion of the ingredients that had to be used in the formulas to meet the content standard for protein, fat and linoleic acid. The amount and cost of individual ingredients were taken into consideration in order to obtain a product at the lowest possible cost.

Preparation of Supplementary Food

Preparation of the supplementary food mixture followed a simple technique. Beans, groundnuts and sesame had to be roasted for five to ten minutes first, in order to obtain simultaneously well-cooked ingredients. In addition, the roasting of these ingredients added an aroma to the food mixture. Rice was roasted for a shorter period of time of three to five minutes to kill contaminated organisms. Roasting of the rice reduced moisture content, hence increasing the storage time.

After roasting, each ingredient was weighed and mixed proportionally with other ingredients of the mixture. The mixture was ground with an electrical grinder capable of grinding one kilogramme of the mixture in five minutes; hand grinders can also be used in a community without access to electricity. The ground mixture was packed and sealed in small plastic bags of 100 or 250 g per package. Each 100 g package provides approximately 450 Kcal.

TABLE I
INGREDIENTS AND COMPOSITION OF SUPPLEMENTARY FOOD FORMULAE

Formula	Ingredients	Composition per 100 g		
		protein (g)	fat (g)	energy (Kcal)
I	rice, soybeans groundnuts (70-15-15)*	16.5	10.6	437
II	rice, soybeans, sesame (70-15-15)	14.8	11.0	448
III	rice, mungbeans, groundnuts (60-15-20)	14.5	11.9	443
IV	rice, mungbeans, sesame (70-10-15)	13.2	13.2	451
V	rice, fish meal, groundnuts (70-10-20)	18.5	11.8	454
VI	rice, fish meal, sesame (70-10-15)	17.2	10.4	444
VII	rice, fish meal, oil (70-10-8)	14.4	9.2	437

* Numbers in parentheses indicate the proportion of the individual ingredients.

To cook the food, the ground mixture is immersed in six times its volume of water, stirred, and then boiled at 100°C for 10 to 15 minutes. The operational flow of preparation is shown in Fig. 1.

A child who weighs 10 kg will be adequately provided with both protein (30-40 g) and energy (1,000 Kcal) from 250g of any of the food mixtures. Infants from four to six months old may be able to eat one meal of 20 – 40 g of this supplementary food.

EVALUATION AND TESTING FOR ACCEPTABILITY

Since these supplementary food mixtures were prepared from common food sources and the steps in the production of the mixtures were quite simple, these food mixtures were tested directly with infants and young children.

An evaluation of chemical analysis for composition and microbial contamination was completed with satisfactory results. The food mixtures can be kept for at

least six to eight weeks without any evidence of spoilage or overgrowth of microorganisms.

A field trial to test the acceptability of the products was carried out in infants and pre-school children of rural North-East Thailand. Their ages ranged from six months to four years. The field test revealed that the four formulae originally developed (Formula 1 to 4 in Table I) were most acceptable. Approximately 90% of the infants up to two years of age accepted the fine granule texture, while only 52% of the toddlers (two to four year old) did. A coarser texture which the child could chew and a greater variety of flavours were found to be necessary for further developments. The groundnut formula was most readily accepted. The only limitation with using groundnut is that the raw ingredients must be well stored and cleaning of the equipment was found to be critical to prevent aflatoxin contamination.

The processing method was also evaluated and found to be simple and could be performed by rural villagers. Housewives and village-based volunteers could be en-

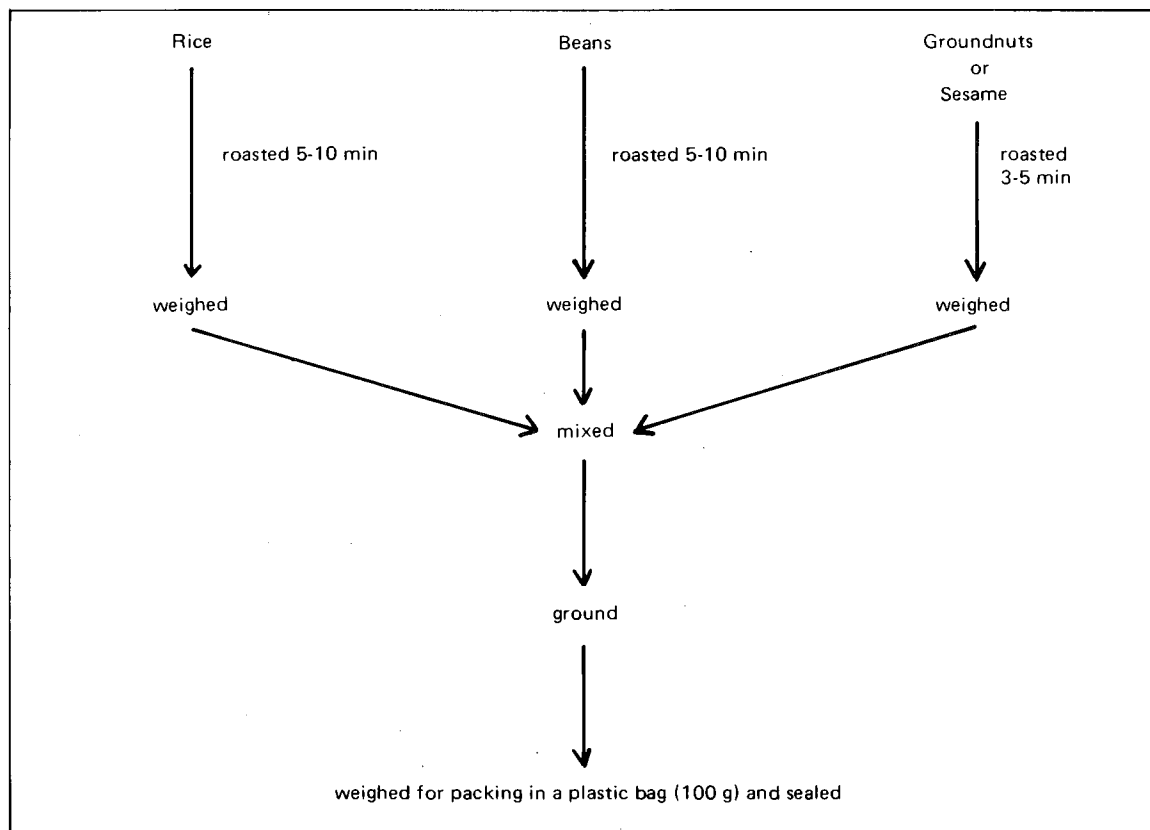


Fig. 1 Operational flow for preparation of supplementary food mixtures made from rice, beans, and groundnuts or sesame.

couraged to participate in the preparation of the mixture. Therefore, these supplementary food mixtures can be easily produced at the home and village levels.

OPERATION OF VILLAGE FOOD PRODUCTION AND OUTREACH PROGRAMME

In 1978-1980, a village food production, processing and outreach programme was initiated within villages to determine the convenience and acceptability of nutritionally adequate infant foods, based on the supplementary food formula developed by the Institute as well as other village foods. The impact on the nutritional status of the infants and pre-school children was also evaluated.

A village food processing centre (FPC) was established in Nong Hai villages, Ubon Province, North-East Thailand. There were 236 households with a total population of 1,655 and the average family size was six. All inhabitants of Nong Hai villages are rice-farmers. A representative sample of 202 pre-school children showed that 55% of the pre-school children had PEM. Hence, Nong Hai villages were suitable for the launching of a pilot project on village food production, processing and distribution.

The FPC was used to provide equipments for food processing. The equipments include: a platform balance, a metal pan for roasting, an electrical grinder, a drying pan, and a thermal impulse sealer for sealing the plastic bags. For non-electrified villages, a manual grinder can be used for grinding and candle flame for sealing the plastic bags. Villagers were encouraged to bring the raw ingre-

dients to the centre to process the infant food or family foods as needed. Mothers of second and third degree PEM children brought their children to be fed twice a week at the village centre. The food was prepared by these mothers, who took turns cooking the simple and nutritious food under the supervision of the field implementor. The village residents were trained and hired to manage the facility. The centre keeps all records and data on the project.

Infant food packages which were processed at the centre were distributed to the second and third-degree PEM children, so mothers could prepare the food and feed their children on other days of the week. First degree malnourished children could participate in the feeding programme on a voluntary basis but usually no food packages were offered to them.

By processing supplementary infant foods from locally available sources at the village level, distribution and home delivery of infant food packages reached second and third degree PEM children easily, hence improving their overall diet.

MONITORING AND EVALUATION

The nutritional status of the 202 infants and pre-school children in Nong Hai improved significantly, as shown in Table II. Within a period of eight months of supplementation, the proportion of normal, healthy children increased from 45 to 75%. The incidence of first-degree PEM decreased from 38 to 15%, second-degree PEM decreased from 16 to 6% while third-degree which had an incidence of 1% disappeared altogether.

TABLE II
NUTRITION STATUS OF CHILDREN BEFORE AND AFTER FOOD SUPPLEMENTATION IN THE INTEGRATED PROGRAMME OF NONG-HAI VILLAGE (1979-1980)

Nutrition Status*	March 1979		September 1980	
	Number	%	Number	%
Normal	92	45	145	79**
First-degree PEM	77	38	27	15**
Second-degree PEM	31	16	11	6***
Third-degree PEM	2	1	0	0
Total	202	100	183	100

*Weight for age, using modified Gomez classification for protein-energy malnutrition (PEM) on the basis of body weight as a percentage of mean reference body weight (Harvard Standard) as follows: first-degree PEM, 75-85% of mean reference body weight; second-degree PEM, 60-70% of mean reference body weight; third-degree PEM, below 60% of mean reference body weight.

** Chi-square test, $P < 0.01$.

*** Chi-square test, $P < 0.001$.

The study also demonstrates the feasibility of producing nutritionally adequate infant foods in a community or at the village level. Four of the seven supplementary food mixtures which were formulated by the Institute were accepted. These were the mixtures of rice, legume and sesame, all of which were readily available locally. The products appeared to be well accepted, especially by young infants of six to 24 months. The products could also be added to many dishes of the habitual diet and were well accepted by all ages.

The simplicity of these processing methods and facilities, which could be handled through community-based activities, were well accepted by the villagers. The resulting nutrition improvements provided a model of supplementary food formulation which is most relevant in terms of nutritional value, low cost, locally ingredient availability, high acceptability and simplicity of production or preparation, such that the food can be handled, monitored and evaluated through community-based activities. The adoption of this process as a community approach is very useful for the establishment of nutrition improvement programmes.

IMPLEMENTATION OF NUTRITION ACTIVITIES WITHIN PRIMARY HEALTH CARE

Since 1980, the supplementary food formulae developed by the Institute of Nutrition have been adopted by the Ministry of Health for a nationwide campaign. Raw materials varied according to local availability and recipes. A manual for the preparation of the supplementary foods was developed by the Division of Nutrition, Ministry of Health.

Pilot Project (1981 – 1982)

This project^{5,6} involved three provinces in the North-East in a holistic approach consisting of health, nutrition, agriculture, and income generation. Community participation was considered essential. Therefore, villagers were involved in all of the interventions. Village health volunteers (VHV), village health communicators (VHC) and other village leaders were trained to be responsible for weighing the children in their own community and interpreting the data using simple growth charts. Many mothers, especially those of the malnourished children, were also encouraged to participate. Thus the problem was identified by villagers and from this point, the village level processing of supplementary food was introduced.

The food produced was given free of charge to the moderately and severely malnourished children and excess production was sold to other children in the village as well as to nearby communities. Feeding of second and third degree malnourished children with this food on a regular basis showed substantial improvement within three to four months. This together with the

income obtained from participating in the intervention programme served as a good motivation to the villagers. In addition, agricultural production was encouraged to supply adequate raw materials.

Extension of Pilot Study (1982 – 1986)

The pilot study⁶ has been extended to a larger scale since the beginning of the National Food and Nutrition Plan in the Fifth National Economic and Social Development Plan (1982–1986). Nutrition in primary health care through its three main activities: growth monitoring using simple weighing scales and growth charts; nutrition education; and village level supplementary food processing are underway. Priority is given to the rural impoverished areas and the programmes were initiated in a similar manner to the pilot just described.

In villages where villagers are not ready to establish a food processing unit, the nutrition fund can be used to buy the food produced elsewhere to be given to second and third degree malnourished children. In any case, the village level food processing is considered a part of nutrition education given along with other nutrition information.

Village level supplementary food processing is a good model for approaching a community. Good community participation is obtained. It also serves as a model for the managerial skills necessary for community self reliance. The availability of this supplementary food to the affected population, especially the moderately and severely malnourished has proved feasible. Impact evaluation is being conducted to appraise its effects on the nutritional status of pre-school children in rural communities. Research and development are being continued because improvement of processing procedures and equipment are still necessary.

In addition, the social and economic aspects of village food processing are being investigated and impact evaluation for nationwide implementation is being conducted for future planning of the programme.

Impact on the nutritional status

Nutrition surveillance has been carried out by periodic weighing of infants and pre-school children residing in villages where nutrition intervention programme has been active. Reports from the Ministry of Health show the reduction in the incidence of PEM among Thai infants and pre-school children as seen in Table III. The percentage of normal nutritional status has overall increased from 49% in March 1981 to 70% in December 1984. The second and third degree malnutrition has been reduced from 13 and 2% in 1981 to 4 and 0.3% in 1984 respectively.

However, there have been several rural development

TABLE III
NUTRITIONAL STATUS OF RURAL PRE-SCHOOL CHILDREN BEFORE AND AFTER NUTRITION INTERVENTION PROGRAMME

Regions	January 1979 – March 1982					October to December 1984				
	Total subjects examined	Percentage of subjects with different nutritional status				Total subjects examined	Percentage of subjects with different nutritional status			
		Normal	1 ^o mal	2 ^o mal	3 ^o mal		Normal	1 ^o mal	2 ^o mal	3 ^o mal
North-East	586,743	43.29	39.12	15.20	2.39	613,503	61.82	31.48	6.26	0.44
North	115,159	49.10	34.76	13.38	2.67	331,307	73.23	23.18	3.43	0.16
Central	137,833	63.34	28.40	7.22	1.04	224,294	82.71	16.12	1.14	0.03
South	105,859	56.44	31.29	10.49	1.78	195,947	73.38	22.29	4.05	0.28
East	54,406	63.22	27.14	7.97	1.67	102,648	81.79	16.09	2.01	0.11
Total	1,000,000	49.21	35.66	13.00	2.13	1,467,699	70.53	24.95	4.25	0.27

Source : Nutrition Division, Department of Health, Ministry of Health, 1985.

and health improvement activities being launched during the Fifth National Development Plan. In addition to the nutrition intervention programme, other programmes including family planning, primary health care, poverty eradication and community development have also been implemented. Anyhow, it is our belief that the availability of supplementary food at the house and village levels, and effective nutrition education have played an important role in the promotion of nutrition status among infants and pre-school children of rural Thailand.

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