PROCEEDINGS

FIRST ASIAN

HOUSEHOLD NUTRITION APPROPRIATE TECHNOLOGY CONFERENCE

Colombo, Sri Lanka
July 12-17, 1981

Sponsored by:

- Ministry of Colombo Hospitals and Family Health 3692
- International Union of Nutritional Sciences (IUNS) 3693
- United States Agency for International Development (U.S.A.I.D.) 189
- United Nations Children's Fund (UNICEF) 2336
- International Nutrition Communication Service (INCS) 65M

EXECUTIVE SUMMARY

Household nutrition-appropriate technology refers to "improved" methods for growing, handling and using food in the home. Included are techniques for small-scale food production, household storage, food processing and preparation, culinary technology, serving, and nutritional sanitation. (See "Household Nutrition Appropriate Technology Table," p. iii, for a listing of specific technologies and practical examples.)

The significance of these technologies in the Third World should not be underestimated. First, they have an important role to play in shaping dietary behavior and influencing nutritional status. Second, household nutrition technologies contribute to a reduction in women's workloads. Third, appropriate technology at the household level involves resource-saving and influences the ability of a family, a community and a nation to be self-reliant.

Surprisingly, despite its importance, household nutrition-appropriate technology has not been a subject of concern for policy-makers, nutrition planners, educators, and nutritionists. Consideration has been given to weaning foods, to household storage, fuel and environmental sanitation as discreet problems of development; but few have tried to systematically think through the inter-connectedness of household technologies and their combined effect on the lifestyle of vulnerable groups. It might be accurate to say that not only was this the first Asian Conference, but also the first Conference anywhere on the subject.*

The Conference brought together representatives of community groups in nine Asian countries with projects that develop, promote or utilize appropriate technologies in the home to improve nutrition. Included were the Appropriate Technology Development Institute (New Guinea), Consumers Association of Penang/Institute Masyarakat Berhad (Malaysia), Department of Agriculture Home Gardening Project (Sri Lanka), Farm Women's Agricultural Extension Programme (Sri Lanka), Food and Nutrition Research Institute (Philippines), Food Technology Development Center (Indonesia), Gannoruwa Soya Bean Food Research Center (Sri Lanka), Home and Village Level Soya Bean Utilization Training Programme (Sri Lanka), Lalitpur Community Health Programme (Nepal), Lembaga Ekologi (Indonesia), Nutrition Centre of the Philippines, Nutrition Intervention Pilot Project (Indonesia), Pilot Experimental Training Course for Rural Women in Home Processing and Preservation of Fruits and Vegetables (Bangladesh), Sarvodaya (Nepal), Save the Children (Indonesia), Save the Grain Programme (Nepal), Small Farmers Development Programme (Nepal), South Pacific Appropriate Technology Foundation (Papua New Guinea), South Pacific Commission Community Education Training Centre (Fiji), Sri Avinashilingam Home Science College (India).

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* The other major effort to date has been an Appropriate Technology Center in Nairobi, Kenya sponsored by UNICEF.

The format for the Conference involved the presentation of technical papers, an exchange of specific methods that promote support for household nutrition-appropriate technologies, and the development of recommendations. The recommendations are directed at international agencies, government ministries, and non-government organizations.

The plenary address entitled "Appropriate Technology in Policies and Programs for Dealing with Malnourishment" is by Jim McDowell, who helped develop the UNICEF Appropriate Technology Center in Kenya. The problem of technological needs assessment is taken up in three separate papers: "Task Analysis and Priorities in Programmes to Improve Infant Feeding" by Dr. Derrick B. Jelliffe and Mrs. E.F. Patrice Jelliffe, "Nutrition Appropriate Technology Task Analysis: A Case Study in Bangladesh" by Dr. Najma Rizvi, and "The Relationship of Children's Circumstances in Nutritional Problems, As Observed in Lalitpur District, Nepal" by Miriam E. Krantz. Three different approaches to home gardening are discussed by V. Sathianathan, "Home Gardening", Dr. Y.H. Yang, "A Neglected Food Resource: Home Gardens", and Paul Sommers, "Traditional Home Gardens and Nutritional Improvement, the Role of the Non-Government Organization." FAO's successful food storage program in Nepal gets expanded treatment in Dr. S.K. Bhalla's paper "Rural Save the Grain Programme in Nepal". Malaysian food preservation techniques are described in "Household Food Preservation and Processing in Malaysia" by Narinder Kaur. The art and science of efficient and nutritious food preparation is considered by Mrs. M. Lakshmi in "Food Preparation and Nutrition." Three ways of using appropriate technology to prepare home-based weaning foods are detailed by T.D.W. Sirawardena, "A Feasibility Study of the Development of a Low Cost High Calorie/High Protein Weaning Food," Dr. Rajammal Devadas' "Appropriate Technology with Reference to Infant Weaning Food and Food Supplements" and Dr. F.G. Winarno and Bharat Bushan's "Development of Appropriate Technologies for the Manufacture of Weaning Foods and Food Supplements." Dr. Raja V.W. Amarasekera, Director of the Food and Nutrition Division of Sri Lanka's Ministry of Plan Implementation, argues for "A Need for an Applied Approach as Well in Food and Nutrition Policy Planning." Finally, Mr. McDowell considers the "Evaluation of Nutritionally-Oriented Appropriate Technology Programmes.

The Conference Recommendations (pp.) are both substantive and technical. Standing committees developed recommendations on policies and programs, training, information exchange and networking. Suggestions also were made for technological improvement and research in the areas of family food gardens, food storage, food processing, food preparation, preservation and culinary technology, weaning foods and appropriate supplementation technology and food sanitation. A statement on "Connecting the Technologies," by Ron Israel and Paul Sommers argues for a systematic, holistic approach toward technological innovation at the household level.

Most participants concluded that the ultimate success/failure of the Conference depends on how well the recommendations and proceedings and information are marketed to national governments, international agencies and community groups. The Conference message is that household nutrition-appropriate technologies are important and deserve attention.

Ron Israel, Director
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HOUSEHOLD NUTRITION APPROPRIATE TECHNOLOGY TABLE

Technologies	Practical Examples
Small Scale Food Production	Home gardens Composting Fish ponds Domestic animals
Food Storage and Preservation	Raised storage cribs Rat baffles Fermentation Solar drying Polyethelyne bags Salting Iceless refrigeration
Household Processing and Culinary Technologies	Oil extractors Dehuskers Hand grinders Coconut graters
Food Preparation and Culinary Technologies	Fuel-efficient stoves Hay boxes Solar cookers Biogas Propane boilers Pressure cookers
Weaning Foods and Appropriate Supplemenatation	Multi-mix weaning foods Complementary protein Breast feeding Serving methods
Food Sanitation	Rainwater catchments Basket-lined cement containers Slow-sand filters Small wells Pit latrines Soak pits

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INTRODUCTION

This conference was first conceived in the minds of two members of the International Union of Nutrition Sciences (IUNS), Professor and Mrs. Derrick B. Jelliffe. But the idea had many months of gestation before far-sighted agencies like INCS/USAID/UNICEF contributed to "deliver" the thought into reality.

No longer can one hope that the problems of malnutrition that beset the world can be solved solely in biochemical research within laboratory walls or hospital clinics. Even though it is a socioeconomic problem, there is no magic wand that can solve global malnutrition in one sweep.

Women and children in developing countries undeniably bear the brunt of poverty. Research done on the Status of Women in Sri Lanka and throughout the world since the International Women's Year, has revealed the heavy work burden on both rural and urban women. In the end, it is they who have to face their malnourished children. Therefore, they are the ones who are most conscious of their children's needs and the most motivated to respond to any possible solution to their problems. Capital-intensive high technology will not help them. It is the community control over local resources which must be nurtured to give women self-reliance.

Thus, policies and programmes seeking to improve the nutrition status of the world's poor must acknowledge the significant role that is played, and can be played, by women at the domestic level.

The first step to relieve women of their heavy work burden is by the introduction of conveniently located clean water sources, home gardens, more efficient cooking stoves, cheaper fuel, and adequate food storage and preservation. It is when "Cinderella evolves from her ashes" that, being freed from her household drudgery, she can have better access to education, health, nutrition, and family planning.

Sri Lanka was chosen as the venue of this meeting for several reasons. There are no massive laboratories nor a "city palace" of an Institute of Nutrition. There are no showpieces but the hard work of a pragmatic and simple band of workers who for many years have continued a flow of thoughts and ideas which have stimulated those working far out in the provinces and villages.

Sri Lanka is one of the few countries with a functioning food and nutrition policy planning unit. We have programmes that have stemmed and contained acute malnutrition of the population. But there is much more to do to solve the large problem of chronic malnutrition; that will take more than a generation to erase completely. The most important ingredient in Sri Lanka is the high level of literacy among women which has not yet been totally exploited.

There are examples of appropriate technology at household level practised by governmental and non-governmental organizations like the Farm Women's Extension Division and the Home Gardening project of the Ministry of Agriculture, the Soya bean Research Centre and home-level training programme, Sarvodhaya, and the many voluntary programmes.

This conference is an historic one in that it is the first time that household nutrition-appropriate technology has been elevated to conference level -- not only in Asia, but perhaps in the world. We hope that the conference will influence planners, policy-makers, and field project managers to make greater use of household appropriate technology in their efforts to end malnutrition.

Dr. Priyani E. Soysa
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SCIENTIFIC NUTRITION AND THE HOUSEHOLD

Scientific nutrition is often incorrectly conceived as being a branch of biochemistry. Nothing, of course, could be further from the truth--although no one would deny that biochemistry and a knowledge of metabolic processes are integral and vital aspects of the field.

Much more neglected and with much less prestige is the understanding that the nutritional status of families, particularly young children and pregnant women, needs to be improved by the application of modern scientific knowledge to the realities of village or slum life--that is, by applied nutrition.

Also, if science implies "knowledge based on tested facts", then customary, traditional methods of food production and preparation are also scientific in that they have been time-tested over centuries.

Recent years have shown increasingly that many long-established practices in rural communities have benefits which have been under-appreciated. For example, the traditional rather unkempt-looking multi-dimensional gardens in many tropical areas represent not only important sources of many additional nutrients to the family diet, but also can help with income generation, can be self-sustaining as regards soil fertilization, can supply some food for domestic animals and can help improve the attractiveness of the surroundings. They are, in fact, self-sustaining scientific systems based on hundreds of years of practical experience.

At the same time, it is apparent that many prematurely acclaimed scientific "breakthroughs" in, for example, food production have really been based on false assumptions concerning the cost, availability and dependency on such items as chemical fertilizers, pesticides and mechanical irrigation.

What is being groped towards nowadays is a blend of "traditional science" and "modern science", realizing that this process can only be one of sharing and exchanging knowledge--and not merely introducing inherently superior Western-style technology to "ignorant" villagers.

In other words, modern science and traditional science are complementary and have much to learn from one another. This is certainly the case with regard to what has been termed "household appropriate technology"--that is the technology needed to improve the small-scale production of foods in home gardens, for the storage, preparation, cooking and serving of foods at the family level. For example, the huge losses of cereal grains and legumes to rats and insects after harvesting can be greatly diminished by modern, scientific, low-cost improvements to small, traditional home granaries--the effects of which can then be tested out scientifically.

In addition, domestic "task analysis" can employ the scientific methods used previously by industry and cultural anthropologists to assess a village mother's activities, especially time and hard labor, in the complex sequence that goes into collecting, preparing, cooking and serving food for the family, and, even more, the selection, feeding and storage of appropriate food mixtures for young children in such circumstances.

Too often, this practical applied part of the scientific nutritional spectrum is regarded as low in prestige and status compared with the laboratory aspects of the subject. This unfortunate delusion needs disspelling forcefully and it is hoped that the interest and concern of the International Union of Nutritional

Sciences (IUNS) in household appropriate technology may help in this much needed readjustment of emphasis.

Scientific knowledge needs exploring, testing, and probing both in the laboratory and at the household level. Both are of the highest importance, although in terms of the desperate plight of much of the world's population, scientific application in the village and slum household to improve the nutrition of mothers and young children has the most outstanding priority.

Derrick B. Jelliffe, MD
Chairman, IUNS Committee II/9:
Nutrition and Primary Health Care

E. F. Patrice Jelliffe, MPH
Chairman, IUNS Committee V/11:
Education of Nurses, Auxiliaries and
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RECOMMENDATIONS OF THE STANDING COMMITTEES

Policy and Program

Training

Information Exchange and Networking

Three Standing Committees were entrusted with the task of making recommendations for program and policy, training and information exchange and networking activities. Each participant was a member of one committee. The Standing Committee recommendations, coupled with those of the Technology Exchange Groups that follow, constitute an agenda for action. Implementing agencies and institutions include national ministries, international agencies, NGOs, nutrition planners, educators and appropriate technology specialists. Each is requested to review the recommendations and proceedings in light of their own activities.

COMMITTEES

Programme and Policy Committee

Coordinators: Dr. Raja Amarasekera, Mrs. Mercedes Solon, Mr. Jim McDowell

Dr. Warren Berggren, Dr. S.K. Bhalla, Ms. Marilyn Carr, Mr. Tissa Devendra, Dr. V.D.T. deSilva, Mrs. Ellen Jayawardene, Dr. Sanath Gunasekera, Dr. Derrick B. Jelliffe, Mr. Ganesh Ram Shrestha, Dr. Otto Soemarwoto, Mr. Paul Warpeha.

Training Committee

Coordinators: Dr. T. Munasinghe, Ms. M. Lakshmi, Mrs. E.F. Patrice Jelliffe

Mr. Fauzi Ali Amin, Dr. R.P. Devadas, Mrs. P. Dissanayake, Ms. Miriam Krantz, Mr. Sita Rajasuriya, Dr. Najma Rizvi, Ms. Mee Kwain Sue, Prof. Priyani Soysa, Dr. Y.H. Yang.

Information Exchange and Network Committee

Coordinators: Dr. H. Wijemanne, Mr. Paul Sommers

Dr. (Mrs.) B.V. De Mel, Mr. Tom Fricke, Mrs. Meherunnessa Islam, Ms. Narinder Kaur, Dr. W.D.A. Perera, Mr. T.D.P. Siriwardena, Ms. Kellin Vatnabar, Dr. Winarno, Mr. Ron Israel.

RECOMMENDATIONS ON POLICIES AND PROGRAMS

All technologies conducted in the household, pertaining to family maintenance, have an impact on nutrition. Technologies appropriate for low income groups in the Third World must be no/low-cost, simple to construct, operate and maintain, and environmentally safe. Traditional technologies, specifically designed and developed over centuries to address local needs, meet these criteria. By blending these traditions with scientific methods, small culturally acceptable improvements often can be made, which can have significant and immediate impact on nutritional status.

1.) Planners and policy-makers should adopt the goal of improving the effectiveness of household nutrition-appropriate technologies to alleviate nutrition problems.

2.) National governments should fund household nutrition-appropriate technology projects. Countries with food and nutrition planning agencies should consider establishing a sub-unit to coordinate the planning, implementation, and evaluation of household nutrition-appropriate technology activities. Elsewhere, planning can be coordinated through the Ministry of Health, the Ministry of Agriculture, etc.

3.) International agencies also should provide funding for household nutrition-appropriate technology programs; promote the establishment of demonstration and training centers; and support relevant scientific exchange.

4.) The International Union of Nutritional Sciences should consider establishing a special Task Force on household nutrition-appropriate technology. This Task Force would promote appropriate technology among food and nutrition planners and policy-makers, develop position papers and resource guides, and offer consultations to national governments.

5.) Household nutrition-appropriate technology policy and programs should be developed with the use of practical experts supported by inter-disciplinary professional expertise, including nutritionists, engineers, appropriate technologists, public health specialists, anthropologists, marketing experts, educators.

6.) Household nutrition-appropriate technology programs should be developed with the active help and participation of target community groups. The community should be involved in all phases of each project, including planning, research and development, implementation, and evaluation.

7.) Wherever possible, projects should be designed and implemented in a manner that permits evaluation of their nutritional impact.

RECOMMENDATIONS ON INFORMATION EXCHANGE AND NETWORKING

The Information Exchange and Network Committee concluded that there is a lack of information on existing technologies and Asian projects related to household nutrition-appropriate technology. To rectify this situation, the Committee made recommendations for:

1.) An Asian information center which would collect and disseminate household nutrition-appropriate technology information to all concerned.

2.) The production of a catalogue of existing nutrition technologies relevant to the Asian household.

3.) Publication of a newsletter devoted to an exchange of information about technologies and projects; Dr. Winarno, Secretary General of the FANS (Federation of Asian Nutrition Societies) newsletter, has agreed to incorporate this kind of information into the FANS newsletter.

4.) The establishment of a regional and/or national nutrition-appropriate technology demonstration/training unit (similar to one already established in Kenya by UNICEF).

5.) A personnel exchange program between Asian countries involving those currently working on household nutrition-appropriate technology projects.

6.) The development of nutrition educational programs and materials geared towards the diffusion of technological innovations.

RECOMMENDATIONS ON TRAINING*

Training is the key to the success of introducing innovations in household nutrition-appropriate technology. Training should be simple and task-oriented, planned jointly with the trainees, culturally relevant to conditions of the target communities, and given at schedules convenient to those being trained.

1.) Priority groups for training are: farm women and farmers, at a community level; extension officers from different agencies, at an intermediate level.

2.) New curricula need to be developed to teach technological needs assessment and evaluation and skills such as home gardening, food storage, preservation, processing, preparation, sanitation and culinary technology. These curricula should be in the form of modules, which can either be integrated into existing training programs or taught as discrete units of a course.

3.) Each country should form a panel to provide technical advice on the development of curricula. The panel should be composed of practical experts in local technologies supported by nutritionists, engineers, public health specialists, anthropologists, marketing experts, educators, and others.

4.) The outcome of training should be ultimately reflected in a change in the health status of the nutritionally high risk groups in the community.

5.) Training demonstration centers should be established. If possible, each country should have one center near its capital (to sensitize policy-makers) and one in an area accessible to rural target community members.

6.) All training materials should be pre- and post-tested with members of the target community.

7.) The training of farm women on improved storage technologies is a priority.

8.) Curricula in household nutrition-appropriate technology should be developed for nutrition planners and educators, nutritionists, public health specialists and others concerned with Third World nutrition problems.

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*For more detailed suggestions on course outline, see Appendix I.

PROCEEDINGS AND RECOMMENDATIONS OF THE TECHNOLOGY EXCHANGE GROUPS

Family Food Gardens

Food Storage

Food Processing

Food Preparation, Preservation and Culinary Technology

Weaning Foods and Appropriate Supplementation Technology

Food Sanitation

Connecting the Technologies

Two sessions of the Conference were devoted to small group technology exchange meetings. Each meeting was attended by experts on a particular topic--family food gardens, food storage, processing, preparation, preservation, culinary technology and food sanitation. The groups exchanged information on the state-of-the-art of specific technologies and made recommendations for technology development and research.

FAMILY FOOD GARDENS

TECHNOLOGY EXCHANGE GROUP

Speakers: Mr. V. Sathianathan, Mr. P. Sommers, Dr. Y.H. Yang

Rapporteur: Mr. P. Sommers

1) What is the "state-of-the-art" of family food gardens in the represented countries?

Gardens were described in Sri Lanka, the Philippines and Hawaii.

Mr. V. Sathanathan described the Sri Lankan government's efforts in promoting family food gardens. Their demonstration gardens are usually 1/8 acre and consist of 20 different fruits and vegetables selected for a particular agro-climatic zone. Crops are grown in raised beds with composted materials as a regular crop input.

Dr. Y. H. Yang wed the terms "intensive", "inter", "mixed" and "catch-cropping" to describe the East-West Center Garden in Honolulu. The garden is 18.5 square meters. It provides a continuous supply source of vitamin A value and ascorbic acid for a family of five. This is done by using a combination of long yield crops (kang-kong, edible hibiscus, sweet potato, chives and dandelion green) and succession crops (pechay, mustard greens, Swiss chard and leaf lettuce). Approximately 25 minutes per day are needed to maintain the 18.5 square meter garden.

Paul Sommers described his study of the centuries-old traditional mixed garden in the Philippines and Indonesia. Typically, plants are grown in a continuous self-regenerating, multi-store, vertical-cropping system which results in high crop output in a small growing area. Mixed-gardening is a low cost or no cost farming system as material and technical resources are produced in the local environment. The garden is usually of high nutritional value as 30 to 50 crops are grown together including leaf and fruit vegetables, legumes, grains, root crops and fruit trees.

2) How do these gardens affect food and nutrition behavior status?

The East-West Center garden consisting mostly of green leafy vegetables and some legumes can make a significant contribution to vitamin A value and ascorbic acid needs. Iron and calcium contributions are also important. The traditional mixed garden makes sizeable contributions to the major food groups of carbohydrates, proteins and vitamins and minerals.

3) What socio-cultural constraints impede successful use of family food garden technology?

These constraints include:

a) lack of available land (village patterns)

b) legal rights to land
c) theft of crops
d) lack of government support in research and extension
e) lack of community motivation and action
f) lack and cost of water
g) distribution of plant materials

4) How can the effectiveness of family garden technology for nutritional improvement be evaluated?

The pre-test/post-test method:

a) assess land availability
b) assess nutritional needs and present household diet
c) introduce and/or intensify family food production
d) measure the increased food supply from the garden into the household's daily diet (quality and quantity)

5) What are the research needs in family gardens?

The establishment of an all Asian action program to:

a) document existing food production practices (standardized questionnaire)
b) assess existing home gardening technology
c) establish pilot gardens throughout the region and test for their nutritional significance
d) evaluate for suitability and develop general guidelines for adaptation to local conditions

RESOURCES

Attifield, Harlan. Gardening with All Seasons. V.I.T.A., 1979.

Martin, Franklin. Edible Leaves of the Tropics. Mayguez Institute of Tropical Agriculture, Puerto Rico, 1975.

Pacey, Arnold. Gardening for Better Nutrition. ITDG, 1978.

Sommers, Paul. Mixed-gardens: A Programmer's Handbook for Sustainable Food Production in the Humid Tropics. New York: UNICEF/Nutrition, 1981.

Yang, Y. H. A Neglected Food Source: Home Garden. Honolulu: East-West Center, 1981.

FOOD STORAGE

TECHNOLOGY EXCHANGE GROUP

Participants: Dr. S. K. Bhalla (Rapporteur/Coordinator), Mr. J. McDowell, Mrs. E. F. Patrice Jelliffe, Dr. Najma Rizvi, Dr. F. G. Winarno, Mr. G. R. Shrestha, Mr. P. Warpeha, Mrs. Padma Kumarasinghe, and Ms. Mee Kwrain Sue.

The group considered that the present losses of foodgrains, in developing countries, are estimated to be 10 to 15% or more, which is quite substantial. However, with available technology, these losses could be reduced considerably. The group also considered that the prevention of food losses by proper methods of storage, in the household or community stores, directly affects the total quantity of foodgrain available either for increased household consumption (thereby improving nutrition and working capacity) or for sale to increase household cash income (thereby enhancing purchasing power for items needed for improved standard of living). At present in the developing countries it is the woman who is largely responsible for the drying and storage of foodgrains, and therefore she should be encouraged to participate in this program.

The group discussed the various factors responsible for losses in foodgrains such as drying, insects, birds, rats and micro-organisms. The committee's view was that:

1) Traditional and existing practices of storage of foodgrains be further investigated and needed improvements/modifications suggested which would not only minimize the losses but also be acceptable to the community with respect to social and cultural standards. The modifications/improvements should be such that storage structures can be rat/bird proof and allow fumigation for insect control.

2) Existing storage practices such as use of salts and local materials like sand, ash, grasses, termeric, oil, smoke, etc. should be investigated systematically to ascertain their usefulness and whether their adoption should be urged.

3) Testing/evaluation and thereafter adoption of new and suitable foodgrain storage structures/containers/bins at the village level is recommended. These should be low in cost, made from easily available material and easily fabricated by local artisans and people of the village themselves.

4) Losses in foodgrains due to insects and rodents are quite heavy. The suitable control measures like spraying, fumigation and use of rat poisons in villages should be standardized, and thereafter extended for adoption by the villagers with due caution/advice as to their possible toxicity. It would be necessary to make the pesticides etc. available for use by the farmers thereafter.

5) In view of women's responsibility for proper storage of foodgrains in houses, it will be necessary for greater involvement of women. Necessary arrangements should be made for training at various levels in methodology

of storage, rat-control and control of other factors responsible for losses in foodgrains.

6) Along with the above measures, and within the parameters of existing financial resources, efforts should also be made to undertake loss-assessment studies of foodgrains at various levels in order to learn precise magnitudes of losses and to consider investments at each level.

7) In view of the lack of facilities of cold storage, freezing, freeze-drying, canning, dehydration, fermentation using chemicals, eradication, etc., there are considerable losses of fresh fruits and vegetables. The group, after consideration of various aspects, recommends extension/propagation of locally and easily adoptable methods in villages for preservation of vegetables and fruits, viz., keeping in polyethylene bags (with holes), coating with suitable wax (wherever possible), sun-drying (after cutting/ treatment or as pulp in mango) and preservation of vegetables in pieces by dipping and steeping and other locally developed methods.

8) The group also recommends suitable measures for preservation of animal foods like fish, meat, eggs, etc. by adoption of locally available methods. These include salting, drying, smoking, pickling, etc. Propagation and extension of these activities should be intensified to avoid wastage.

TECHNOLOGY EXCHANGE: FOOD PROCESSING

Participants: Mrs. Jayawardene, Mrs. Dissamayake, Mrs. Islam, Mrs. Devadas, Mrs. Lakskmi, Ms. Kaur, Ms. Krantz, Ms. Payumo, Mr. Berggren and Ms. Carr.

1) The group concentrated on the following issues:

a) who is doing what and which food technologies are available
b) which are the most important technologies
c) which areas of food technology require more research

2) The group decided to concentrate on cereals, legumes, vegetables, fruits and spices. However, only cereals and legumes were discussed in the time provided.

3) Village level processing appropriate for rural families was discussed instead of urban-oriented small scale food processing.

4) Technologies discussed in relation to individual countries included:

India:

a) an improved parboiler from the Central Food Technological Institute
b) a dehusker which removes only the husk and not the bran.
c) improved machines for beating rice and for puffing rice (from KVIC)
d) an improved steamer for rice
e) a small electric powered grinder costing Rs 500 to Rs 1000
f) a haybox
g) an evaporative cooler
h) an oil extractor (from KVIC)

Sri Lanka:

a) manioc graters
b) iceless refrigerators
c) pot covers

Bangladesh:

a) hand-operated grinding mills
b) small paddy huskers

Nepal:

a) mustard seed oil extraction
b) a paddy husker
c) methods of roasting and grinding cereals and soy to produce snack foods

5) Several issues arose during the discussion of these technologies:

a) Improved machines can alter the taste of food and sometimes reduce the nutritional value. In developing technologies the implications of this should be noted.
b) In many areas and for some processes there is no alternative between the labor-intensive traditional technology and the large-scale commercial processing techniques. This is often unacceptable because the large-scale technology can be too expensive. Also, in Sri Lanka, women continue to parboil rice at home even though the miller would do this for them. However, this tends to spoil the food.
c) Some food processing technologies have put women out of work and deprived poor families of much needed income. This in turn has implications for nutrition. This occurred with the introduction of custom rice mills in Bangladesh.
d) Shortages and increased costs for fuel in many areas is changing food habits and reducing the number of meals prepared each day. This problem can be approached in two ways:
    —quicker cooking methods: for example, the roasting and grinding techniques developed in Nepal; the method developed in the Philippines for soaking rice to allow faster cooking.
    —fuel conserving stoves: for example, the hay box which is used widely in India. This uses no fuel and costs almost nothing.
e) More attention should be given to developing very low cost technologies so that the poorest families can take advantage of the developments in the food processing field.
f) Many of the technologies discussed have not been disseminated in the rural areas. More research is needed to identify the constraints opposing the spread and use of improved food processing technologies.
g) Insufficient dietary oil is consumed in most of the countries represented. Research may be needed to identify potential sources of edible oil and to develop and disseminate small oil extractors.
h) It was learned that many of the technologies developed in one country were unknown in neighboring countries. The spread of information about food technology should be encouraged. This can be done in two ways:
    —exchange of published literature such as that listed below
    —exchange visits to other countries. For example, the Sri Lanka participant learned about new stoves in Fiji and introduced these in her own country on her return.

6) Documents referred to during the discussion included:

a) the publications of KVIC, Bombay
b) the publications of the Central Food Technology Institute, India
c) the publications of TPI, England, especially the coconut grater, maize sheller and groundnut decorticator
d) the publications of ITDG, England, especially Tools for Agriculture, the Appropriate Technology Journal and manuals for making agricultural equipment

e) FAO Rural Home Techniques Series
f) FAO Guide to Food Processing and Storage Equipment
g) UNICEF's Simple Technologies for Bangladesh Women
h) VITA/ITDG's Wood Stove Manual

FOOD PREPARATION, PRESERVATION AND CULINARY TECHNOLOGY

TECHNOLOGY EXCHANGE GROUP

Participants:

The group considered the various viewpoints expressed by participants on the subject and reached the following conclusions. These conclusions may be considered to be recommendations of the group.

1) Food preparations:

The methods of traditional ways of cooking may be studied systematically to avoid wasting vitamins, minerals and other nutrients. Such waste is widespread at present in various countries of the region. In this regard examples are excessive washing of vegetables and rice and the removal of water in cooked rice. The group recommends modifications such as the use of Haybox and the use of bamboos for cooking.

2) Fuel:

a) Present village stoves should be modified to require less fuel. Stoves like the chula and lorina are widely used and could be adopted with modifications in other countries. Fuel-saving stoves should be studied further and adopted with modifications.

b) Other fuels were considered such as saw-dust, twigs, logs etc. These are recommended as possible alternatives after further investigation.

c) Use of biogas wherever possible is encouraged. Presently the cost of constructing a biogas unit is quite high and beyond the reach of many rural farm familites. The group was informed that low-cost technology is available in China and to some extent in India. Moreover, FAO of the United Nations has set up a Research and Training Center for the region in China. Adoption of biogas technology is encouraged after evaluation of available information at this Center.

d) Further research with respect to the efficient use of technology and cost reductions is recommended. Socio-forestry and agro-forestry recently launched in India and Indonesia is also encouraged.

e) The current lack of knowledge about the proper use of fuels (especially kerosene) was also considered. Education with respect to the proper and efficient use of fuels and appropriate safety precautions is urged.

3) Utensils:

The group discussed utensils which are inadequate for efficient cooking and

which waste fuels. Further study and modifications are suggested to avoid this.

4) Diversification of Dietary Habits:

The present pressure on principal foods such as wheat and rice is becoming progressively more costly. Educational and other efforts are advocated to change the dietary habits of the villagers in order to reduce demand for wheat and rice. The use of other inexpensive staples should be encouraged.

5) Fortification and Reduction in Cooking Times

Continuing inflation has caused poorer families to change their traditional diet with a resulting loss in vitamins, protein, etc. Fortification of traditional foods (for example, with soya flour) is recommended.

To avoid wasting fuel and to save cooking time, efforts should be directed to instructing farm families in cooking more than one food in a single pot if dietary customs allow for this.

6) Preservation of Food

The group wholeheartedly supports the recommendations of the Food Storage Technology Exchange Group on this subject. However, study of traditional methods of storage for cooked foods such as rice and cassava is advisable. Available information should be exchanged and adopted wherever possible. Research may be undertaken not only to preserve foods but also to reduce losses of nutrients from the foods. Fermentation of foods is also encouraged to conserve vitamins which otherwise would be lost.

WEANING FOODS AND APPROPRIATE SUPPLEMENTATION

TECHNOLOGY EXCHANGE GROUP

Participants:

The group exchanged information on the need and status of weaning food and discussed weaning food intervention programs in developing countries. Four intervention programs were presented, and these were:

a) Haiti-Dr. Berggren
b) Sri Lanka-Dr. Soysa
c) Nepal-Ms. Krantz
d) India-Ms. Lakshmi

Haiti:

Dr. Berggren described the severe nutritional problem of the transitional age group. After recognizing this need, an intervention program was undertaken.

The basic orientation of the program was a "Do and See" approach. Mothers were involved in the preparation, and parents had to see the outcome. To prepare weaning food, local foods were identified. Both cereals (corn, sorghum, rice) and legumes were available. Careful attention was given to both food availability and cost. Composition was three parts bean to one part corn given four times a day. Monitoring of the child's weight was done, and parents did see the outcome in a few weeks. Children gained weight at the Nutrition Rehabilitation Centre, but the weight fell off after leaving the centre. Reasons for lack of appropriate weight gain included giving one meal instead of four meals per day. For the very poor, who eat once a day, giving four meals was difficult.

Sri Lanka:

Two separate programs are included:

a) low-cost weaning food under Sri Lankan national management
b) home-based weaning food for lactational failure under international management

In the first category the children selected are healthy. The purpose is to measure weight gain and acceptance rate. Results showed a positive effect on growth and a low non-acceptance rate. Weaning food consisted of rice, soy flour and green grain.

The second program focused on children receiving inadequate breast milk. The procedure follows the guidelines presented in the U.N. paper on Dietary Management of Young Infants Who Are Not Adequately Breast Fed. Detailed composition is given in the U.N. paper; it is a basic gruel of cereal or root tuber with additions of milk and animal/vegetable protein. Professor Soysa mentioned that acceptability of the mixture is not yet known and that further research is

necessary.

Nepal:

Children selected for weaning food intervention were moderately to severely malnourished. Available foods (corn, wheat and soybeans) were identified. The existing culinary practice of everyday roasting and grinding of corn and soybeans for adults was routine in all homes.

Preparation and composition: Roasting and drying techniques supplemented with grinding were used. The "super flour" mixture consisted of 50% soy beans, 25% corn and 25% wheat or substitutes. Super flour was added to boiling water to prepare porridge or bread. Mothers were able to bring their supplies, and a health worker showed them how to prepare the food.

Advantages include bulk reduction, retained nutrients, stores well, available at the household, acceptable to both children and mother, and minimum cost.

India:

In the three villages studied, 75% of the children were found to be moderately to severely malnourished. The duration of breastfeeding is long, and no supplementary food is given.

Factors considered in preparing weaning foods included local availability, easy preparation, and low cost. Food was given the name WIN (Weaning Indian Food). Available foods included twelve types of grains and eight types of cereal and groundnuts.

Composition and processing: The weaning food contained green grain, ground nuts, Bengal grain and brown sugar. Processing was done at a central place because of time constraints in preparing food at the household level. Giving of the food was combined with an intensive nutritional education program. A key feature of this program was the use of a small pot for collecting foods and carrying the food to the field where the mothers worked. Food prepared on the previous day was found to pose no unusual health problem, and this practice was adopted to accommodate time constraints. Mothers were found to be more effective in disseminating the knowledge.

Conclusions Drawn from the Four Presentations:

1) The necessity of using available foods.

2) Mothers were more effective than health workers in disseminating information on weaning food.

3) The cost of food can prevent families from using the knowledge gained about weaning food (e.g., Haiti).

4) Both home and community weaning food preparations can be effective.

5) A mother's willingness to give time for weaning food preparation in connection with the limited time available and the high cost of fuel need to be taken into consideration. Hence a simple preparation is necessary.

Discussion and Recommendations:

The opinion of the group was divided regarding home versus community or centrally prepared weaning food. Dr. Jelliffe suggested that the method used depended upon local conditions. Depending on these any of the following or a combination may be employed:

a) centrally processed with government support
b) community produced
c) village mother co-op
d) home-prepared

He emphasized the fact that the particular method or blend of methods had to be worked out with respect to the needs of different countries. Dr. Jelliffe and some other members, however, considered home-prepared weaning food (to be only) for the very poor.

Principles of home-prepared food were identified by Dr. Jelliffe. The home-prepared weaning food should be nutritious, culturally acceptable to mother and child, culinarily feasible, economical and physiologically appropriate (soft, well-tolerated, non-toxic, bacteriologically harmless and appropriate for the enzymatic maturity of the child). Composition of multimixes should pay attention to caloric density, protein content and carotene and iron content. Kitchen sources include the family pot (e.g., southern India) and the family meal and snack foods. Guidance from task analyses should be taken. (See "Task Analysis and Priorities in Programmes to Improve Infant Feeding", a paper presented at this conference by Dr. and Mrs. Jelliffe.) The group recommended that:

1) All available techniques for food preparation be identified.

2) Weaning food preparation should be simple, inexpensive and less time-consuming.

3) Weaning food does not need to be based on any imported or donated food item.

4) A long-term integrated plan with a multidisciplinary approach needs to be formulated to promote growing of foods necessary for preparing weaning food.

Research Needs Identified:

1) Research on "complementary" foods for use in countries where cereals are not the staple (e.g., New Guinea and sweet potatoes).

2) Research in areas of legume scarcity and high cost for possible substitutes in meeting amino acid requirements.

3) Research on the fermentation process and its use in the preparation of weaning foods.

4) Research on household technologies available (e.g., pots and measures)

In summary, more cross-cultural research studies on household technology, resources and attitudes with respect to different foods are needed.

FOOD SANITATION - TECHNOLOGY EXCHANGE GROUP

Participants:

Scope of Discussion:

Recognising that, in the household situation, food sanitation was inextricably linked with the matter of the pollution of the environment in which the food was produced, prepared and consumed, the group addressed itself to the overall problem of achievement of a more sanitary life environment. Discussion centered upon the sources of contamination and means for their elimination and control.

The overall problem in terms of its impact upon the most vulnerable members of the community was seen to relate mainly to infection and infestation transmitted by the faecal/oral route. Gastroenteric infection leading to diarrhea and worm infestation were seen to be the major problems, although the need for attention to environmentally-borne disease, especially malaria, also received attention.

The discussion focussed upon the two primary factors of water supply and excreta disposal in so far as these were likely to influence the hygienic condition of food. Transmission of infection and infestation by insect vectors were also covered.

Water Supply:

Many commonly used water sources, i.e., surface water, water in permanent or semi-permanent ponds, shallow and deep wells and collected rainwater were considered. Seasonal variation in the nature and safety of various sources was also discussed.

It was agreed that the water supply both as a source of contamination and as a means for the washing-away of contamination represented a central factor. Availability of copious quantities of water close to the home, irrespective of its hygienic quality, was felt to be of prime importance. Ready availability would permit frequent and effective washing of the person and of food preparation utensils and foods, while scarcity of water was likely to have opposite and negative effects. Nevertheless, it was felt that every possible means should be implemented to ensure that all water used was purified to the extent possible.

Means for the procurement of clean water for use as drinking water and for food preparation were considered. The following was noted.

a) The use of filtration trenches filled with sand and gravel connecting open ponds with a collection sump, so as to remove gross contamination.
b) The use of water filters in the home in which water was filtered through a bed of sand, gravel and charcoal.

c) The boiling of water before use. This, however, although representing an ideal solution, was felt to be of limited practical application, since it predicated availability of normally scarce fuel. It was felt that pursuit of this approach could be counter productive if it diverted time and energy away from child care to the task of fuel procurement.
d) The exposure of water in shallow containers to sunlight, in the hope that this would have a sterilizing effect. The need for objective verification of this process was, however, apparent.
e) The use of solar distillation using simple solar stills to produce pure water. This approach seemed to have promise but much more information based on practical experience was obviously needed.
f) Collection of rain water from roofs or other catchment areas. This practice was felt to be particularly relevant during rainy seasons when most other water sources were either polluted by surface drainage, or became inaccessible due to impassibility of roads and streams. The coincidence of a significant increase in diarrheal disease during the wet season suggested the value of collection of pure rainwater at this time. The potential for collection of rainwater in simply constructed tanks, including the Thai cement jar and the Kenyan cement-sealed basket tank, was noted as being worthy of further exploration.
g) The possibility of use of chemical disinfectants, e.g., chlorine tablets, was discussed but was not felt to be practical in view of cost and the limited scale of purification likely to be achieved.

Disposal of Excreta and Domestic Waste:

The basic source of contamination of the life environment was, invariably, human and animal excreta. Approaches to effective disposal were discussed. These included.

a) Pit latrines. Ensuring acceptability and regular use of latrines was recognised as posing a major problem. Location of latrines in relation to the water table and flow of aquifier was important. Measures to reduce offensive odors and insect contamination such as the use of smoke-pit latrines or water seal latrines was discussed. The water-seal type was appropriate only where adequate supplies of water for flushing were constantly available. Use of the Sri Lanka young-child's squatting plate was recognized as a potentially valuable means of reducing fecal contamination of the home compound and also for inculcating good sanitary habits at an early age.
b) The use of composting latrines was seen as being culture-specific and unlikely to be universally appropriate. When used the need to achieve effective composting and to remove roundworm infestation needed special attention.
c) Biogas generators using human excreta were also felt to be culture-specific and the hazard of worm infestation of slurry effluent had to be recognized.

It was felt that the whole topic of excreta disposal was enmeshed in various aesthetic and cultural attitudes and that there was

need for much more research into the relationship of practical possibilities and cultural/aesthetic attitudes, if feasible solutions were to be found.

d) The use of soak pits for disposal of waste water from washing and food processes was recommended. It was also noted that in arid areas the use of shallow soak pits from which effluent could be diverted to irrigate home gardens could ensure more effective use of scarce water.

Food Preparation Hygiene:

On this topic the paramount importance of washing of hands and utensils and the need to provide adequate and readily accessible water supplies to make these practices feasible was given high priority.

It was also noted that processes involving crop threshing under potentially polluted conditions or the prolonged steeping of foods at temperatures likely to favor microbial multiplication needed much more attention than heretofore given.

Also noting that nutrition experts recommended more extensive use of green leafy vegetables in infant foods, the high risk of faecal contamination of such vegetables and the consequent need for thorough washing or cooking at high temperature had to be emphasized. The possibility of developing simple centrifugal washing and rinsing devices should also be explored.

It was felt that the whole area of effective sanitation of utensils and processes needed to be more thoroughly explored and researched.

Home Environment:

The need to protect the crawling and toddling infant from the hazards present in the average home environment was seen to be of vital importance. The provision of play areas from which animals and other potential contamination hazards could be excluded was felt to be feasible. Also the alleviation of the work burden on mothers so as to allow a more effective supervision of the weaning infant was seen to be most important.

Conclusions:

The average home environment is seen to present many and severe risks of infection with potentially lethal microorganisms. It is recognized that the feasibility of achieving significant amelioration of such problems is presently limited, and that there is a great need for practical research aimed at the development of effective and appropriate technological responses.

References:

1. Arnold Pacey, Rural Sanitation: Planning and Appraisal, ITDG/OXFAM.
2. Arnold Pacey (ed.), Sanitation in Developing Countries, John Wiley, London.
3. Susan Watt, Ferrocement Water Tanks and Their Construction, ITDG.

4. Mann and Williamson, Water Treatment and Sanitation, ITDG.
5. Appropriate Technology, Journal of ITDG, London.
6. UNICEF, Village Technology in East Africa, UNICEF/Nairobi.
7. UNICEF, Appropriate Village Technology for Basic Services, UNICEF/Nairobi.
8. FAO, Rural Home Techniques Series.
9. Diarrhoea Dialogue, Journal of AHRTAG, London.

CONNECTING THE TECHNOLOGIES

by Ron Israel and Paul Sommers

Household gardening, food storage, processing, preparation, and sanitation are constituent parts of a family's way of life. Nutritionists and appropriate technologists, who come to study and "improve" these ancient arts and sciences, should be careful not to lose sight of their inter-connectedness.

The development of a home-based weaning food should take into consideration existing fuel resources and sanitation practices. The preparation of green leafy vegetables begins when they are first planted in the ground. Improvements in food storage affect the amount of time and energy that must be devoted to preparation and processing. The provision of adequate water enables a garden to bloom.

Our concern about malnourishment should not blind us to the fact that household tasks also are interrelated with social and economic obligations, and a suggested nutritional change or improvement may be resisted because of its implications for other realms of existence. This is not to say that we should be paralyzed into inaction; rather we should tread very cautiously before overturning a stone.

Of all household nutrition-appropriate technologies, home gardening is perhaps the most difficult to successfuly introduce. Innovations in food storage, processing, preparation, and sanitation usually involve some labor-saving or cost-saving element. The introduction of a garden requires a relatively long term investment of labor, energy, and (sometimes) capital before a return is realized.

Yet if we want to move from ad hoc nutrition (or technological) intervention, towards a more systematic, holistic approach, gardening may be the key. It provides a basis for orienting nutrition programs towards goals of self-reliance, self-care and prevention, and away from crisis-oriented holding actions.

A garden surrounding the house, consisting of 500 square meters or less, could conceivably contribute a significant amount of household nutrition needs. Some plants, when grown in a multi-story vertical crop system, could provide building and firewood needs such as coconut, ipil-ipil and bamboo. Cooking utensils and storage containers also could come from bamboo and coconut as well as a wide assortment of gourds. Weaning foods could be processed easily in the home from a wide variety of root crops such as sweet potato, cassava, arrowroot and yams; legumes including yard-long beans, pigeon pea and winged bean; leaf crops such as kang-kong, sweet potato tops, squash tops, malungay, chili leaves; and from an assortment of fruit trees. Cooking oil and soap could come from coconuts. The problems of food storage and nutrient loss for fruits, vegetables and root crops could be minimized by keeping them in the family garden.

Even without a garden there is an inescapable interplay among household technologies. Improved storage can be achieved through household fermentation techniques, which in turn impact upon weaning food quality. New appropriate technologies have spillover effects on women's workloads and household income which in turn impact upon dietary practices and nutrition status. It is a difficult but important task to anticipate the effects of technological innovation on household life.

PROJECT PROFILES

(A description of community-based projects, represented at the Conference, and their household nutrition-appropriate technology activities)

Note: Participant lists for each of the small groups are in the process of being finalized, and will be included in the final draft.

Project Name: Consumers Association of Penang/Institute Masyarakat Berhad.

Location: Penang, Malaysia.

Size and Duration: The Consumers Association is a non-profit, action-oriented organization which was established in the early 1970's. It has 50 staff members. It works closely with the Institute Masyarakat Berhad which is oriented to long-term research.

Project Goals and Objectives: The main goal of the project is to convey nutrition information to consumers, particularly about potential detrimental effects of food preparations being pushed by the MNC's and to present more appropriate alternatives to these.

Technologies and Strategies: The Consumers Association directs its nutrition education programmes to schools since children can be good tools for implementing change. The next target group intended as a focus are women who play an important role in influencing the nutrition of the family.

CAP also does testing of many health foods and other commercially produced foodstuffs to check that they are as good as advertised. Findings are published in CAP's monthly bulletin "The Ulisar Koumimel" which has a circulation of 45,000.

As regards household level food processing technology, work has been done on the soya bean which is a cottage-based industry in Malaysia.

Fish is the main source of protein and many fish and flour products are processed. Work on belacan (shrimp paste), budu (fish paste), keropok (crackers) and other foods has been done.

Assessment of Accomplishments: Generally, the project has been successful in reaching a wide number of people with nutrition information. At a specific level, the CAP has been successful with its programmes aimed at schoolchildren: most schools now have consumer societies which organize activities and exhibitions with CAP's assistance.

Project Name: Lembaga Ekologi (Ecology of rural home garden).

Location: Citanim River Basin, West Java.

Project Goals and Objectives: The main objective of the project is to learn from the villagers about their ecological wisdom, its strengths and weaknesses, and its use as a basis for rural development.

Technologies and Strategies: Ecological wisdom is the strategy of the people to enhance their chances of survival in the environment they live in. It is part of this culture which embodies their understanding, attitude, action and reaction with respect to their environment.

An expansion of this ecological wisdom is the home garden system. It has multiple functions including a social function as a status symbol; an aesthetic function by giving ornamental plants; a production function -- to produce products for home consumption and the market; conservation of the soil and conservation of genetic resources.

Environmental changes are affecting the structure and functions of the garden. Population and economic growth require higher production levels. The challenge is to achieve this goal with the lowest possible input and to maintain the multiple functions of the garden, especially the conservation of soil and of genetic resources.

Project Name: Manufacture, Promotion and Sale of NUTRI-PAK, a low-cost food supplement for pre-school children.

Location: Nutrition Centre of the Philippines, Manila.

Size and Duration: The project was started in 1976 and is ongoing. There are 8 NUTRI-PAK plants in the country.

Project Goals and Objectives: The overall goal of the project is to improve the nutritional status of pre-school children in 2,700 villages by making NUTRI-PAK available for sale at low cost.

The specific objectives are to:

- produce an adequate supply of NUTRI-PAK by setting up and supervising plants in strategically located areas;
- promote NUTRI-PAK using video-tape shows;
- sell NUTRI-PAK to mothers using village-based, nutrition volunteer workers as supply points;
- to monitor the production, promotion and sales and to evaluate the impact of the project on the nutritional status of pre-school children.

Technology and Strategy: The project is a major component of a comprehensive delivery system of basic health and nutrition services to the villages. There are 8,000 volunteer workers covering 19% of villages in the Philippines who deliver services. Their effectiveness is strengthened by the NUTRI-BUS system, whereby supervision is given by a "mobile" registered nurse trained in communication and supervision skills as well as primary health care and nutrition. The bus makes the rounds every 2 weeks and is equipped with video equipment, NUTRI-PAK, medicines, seeds, etc. There are 30 NUTRI-BUSSES and each supervisor has 45 villages.

The NUTRI-PAK was developed from locally available foods (cracked rice, green gram , skim milk, vegetable oil) and costs us $ .07 per pack. It is cooked like porridge and a handful of green leafy vegetable is finely chopped and added to the gruel. Plants to make NUTRI-PAK use locally manufactured equipment and cost of operation is shared by the Nutrition Center and local government.

An evaluation of NUTRI-PAK on the pre-school children has been conducted. Over 6000 children were surveyed and 3,083 mothers interviewed. This was done in late 1980 and results are still being analyzed.

Assessment of Accomplishments: There is a very high acceptability of the product among mothers and pre-school children and sales projections for 1981 are estimated at 1.5 million.

Problems have been encountered in retrieving money from sales of NUTRI-PAK from the volunteer workers who in turn have trouble in collecting credit payments from mothers.

It is thought that the product is proving useful by producing an acceptable food supplement that is being bought by mothers, thus promoting self-reliance and gradually weaning the mother from the 'dole out' mentality.

Project Name: Save the Children/Acheh

Location: Acheh, Sumatra, Indonesia.

Size and Duration: Started in 1977 in the Special Territory of Acheh on the Island of Sumatra.

Project Goals and Objectives: The overall objective is to assist in improving the health and nutrition of children in the area. The specific objectives of the project are to:

- increase villagers' participation in programs aimed at changing attitudes and practices in health and nutrition;
- develop and produce appropriate and effective health/nutrition education materials;
- train community workers in motivational techniques, materials development, program planning and evaluation;
- increase the participation of Government agencies in the development and utilization of village-level health/nutrition materials.

Technologies and Strategies: A major aspect of the project has been the training of volunteer community health workers who assist their own villages to identify and solve existing health and nutrition problems. These workers are involved in primary health care, family planning and nutrition. The effectiveness of these workers and of the government extension workers is limited by lack of educational support materials. It is in response to this need that Save the Children has initiated the nutrition education project which has as a main component the development of appropriate facilities for facilitating group learning about health and nutrition and for encouraging subsequent community action.

The project has also started health/nutrition programmes through womens groups by making and selling tofu. Other projects include demonstrations on preparing baby food, family gardens, tempe production, fish farming, chicken breeding, goat raising and buffalo rearing and milk production.

Since it has been hard to change the attitudes of adults, the project aims at changing the attitudes of children.

Assessment of Accomplishments: The project has been successful in changing tastes in favour of nutritious foods such as tempe and tofu.

Project Name: Appropriate Technology Development Institute

Location: University of Technology, Lei, Papua New Guinea.

Size and Duration: Plans to start ATDI started in 1978 and it was officially inaugurated in 1980. It has a staff of 15 people and is a joint venture of the South Pacific Appropriate Technology Foundation (SPATF), the Papua New Guinea University of Technology (Wietech) and the Lik Lik Buk Information Centre of the Melanesian Council of Churches.

Project Goals and Objectives: ATDI is dedicated to assisting the people of PNG to develop technologies which utilize local skills, materials and finance, serve to improve health and well-being, create employment and maintain the PNG sense of self-sufficiency and cultural identity. With ready access to UNITEC's technical expertise, SPATF's socio-economic development programmes, and the information sources of the Lik Lik Buk, ATDI is able to conduct projects which not only deal with the research of tools, devices or techniques, but also exercise the social and economic processes which are an equally important technological development.

Technologies and Strategies:

1. Cooking fuels and stoves: ATDI has been involved in training school leavers to manufacture simple charcoal stoves made from clay, sand and cement. Work has also begun on fuel efficient wood stoves which are compatible with the needs and traditions of the various peoples of PNG.

2. Sustained Agriculture: ATDI is involved in a programme to blend indigenous gardening methods with intensive planting techniques which maintain soil fertility, inhibit soil erosion, and control pests while maintaining the use of traditional crops. Project Officers are currently working with regional planning authorities and local groups to develop several teaching/demonstration gardens.

3. Water Supply: In response to requests from local authorities, ATDI provides technical assistance in the development of basic water supplies. Research has covered basic water pumps, hydraulic ram and ferrocement storage tanks. ATDI coordinates efforts of communities, Government Departments and the University in determining feasibility, locating funding and implementing the project.

4. Food Processing: Simple techniques of slicing, drying, deep frying and packaging of otherwise wasted bananas have been developed. The banana chips are sold locally. Many other food processing activities are planned.

5. Information: As part of the ATDI Office, Lik Lik Buk serves to provide the people of PNG with information on simple ways of doing things. The Centre answers technical inquiries and maintains an up-to-date library on small scale technology.

6. Other Projects: These include bee keeping, small poultry development, housing, micro-hydro, biogas, solar energy, etc.

Assessment of Accomplishments: The ATDI has not been operating long enough to evaluate its performance.

Project Name: Feasibility Study of the Development of a Low-Cost/High Calorie/High Protein Weaning Food.

Location: Soyabean Food Research Centre, Gannoruwa, Sri Lanka.

Goals and Objectives: To develop a national capability in the area of weaning foods through developing a suitable technology to produce weaning foods at reasonably low cost, depending on locally available raw materials.

Technologies and Strategies: The method used is essentially a process of dry mixing of the individually processed ingredients. The process is a labour-intensive method avoiding high technology; yet retaining the nutrition value of the final product. Raw ingredients are prepared, partially hydrated, cooked and sun-dried. The dry ingredients are separately ground and mixed in suitable proportions to obtain the desired formula. The process is feasible in the sense that any scale of operation can be adopted according to given circumstances. The raw materiels are soyabean, rice and green gram. An imported vitamin and mineral is added.

Assessment of Accomplishments: The product is being given to a selected group of 300 babies attending the baby clinic at Colombo's General Hospital. To date, the trials suggest that the product is suitable as a supplementary food for infants.

Project Name: Small Farmers Development Programme

Location: Nepal.

Size and Duration: Started in 1975 in 2 areas but by 1985 will cover 54 districts and 50,000 small farm families. Initially funded by FAO/UNDP and extension made possible by the Agricultural Development Bank.

Project Goals and Objectives: The major objectives of the programme are to:

(a) increase the income and standard of living of poor disadvantaged small farmers and develop self-reliance among them;
(b) undertake social activities to improve the level of nutrition, health, sanitation, literacy, etc. for the small farmers and their children.

Technologies and Strategies: Some of the specific rural technologies adopted by the small farmers in SFDP areas include:

1. Improved Water Mills: The traditional water mill is inefficient and grain losses are high. Alternatively, the traditional means of household grinding takes up a lot of womens' time. To improve the situation, an improved water mill has been developed and installed in a pilot site. This can drive various types of food processing equipment including rice hullers, grinders, oil extractors, paddy and wheat threshers. The mill can also provide electric light, and power a small cottage industry.

2. Community Bio-gas Plant: One 500 cubic ft. capacity plant has been installed which gives gas for lighting and cooking to 4 households. The slurry is used by the farmers as fertilizer. The gas will also be used for operating irrigation pumps and agro-processing equipment.

3. Improved Smokeless Chula: To overcome problems of deforestation and health hazards to women using traditional cooking methods, a new improved chula has been introduced through the Research Centre for Applied Science and Technology in Kathmandu. These are smokeless, built from local materials and could save 50% of fuel used. It is expected 400 will be installed by mid-1982.

4. Storage Bins: Under the Government's "Save the Food Grain" programme, several units of improved small storage bins, which are rat proof, are distributed to the small farmer at a subsidized cost.

5. Solar Dryer: To preserve and extend the nutritional value of green leafy vegetables, simple low-cost solar driers will be installed and training will be provided to women farmers on solar drying.

Assessment of Accomplishments: An independent evaluation of the SFDP has shown that the activities undertaken are acceptable and beneficial. Income levels have increased. Rates of literacy, standards of sanitation, and cereal consumption are higher in the SFDP area than elsewhere.

Project Name: Evolving low-cost infant foods.

Location: Sri Avinashcingam Home Science College, Coimbatore, India.

Size and Duration: Covers 100 feeding centres involving 3,000 children. The project started in 1977 and is for 5 years.

Project Goals and Objectives: The main objectives of the project are to:

1. Make available nutritious low-cost infant foods utilizing indigenous foods in the villages;
2. Utilize the production of low-cost ready-to-eat infant food as an increase-generating activity in the villages;
3. Use the ready-to-eat foods in the nutritional feeding programmes to improve the nutritional status of the valuable groups;
4. Help the poor families become self-reliant through nutrition education imported in the feeding centres.

Technologies and Strategies:

1. Surveys were made to identify:
   (a) levels of nutrition in the selected villages;
   (b) low-cost local foods;
   (c) cooking procedures and eating habits;
   (d) income levels.
2. Utilizing the local food, several low-cost mixes were prepared using the simple cooking procedures such as roasting and pounding.
3. These mixes were tried on young children for three years and the efficacy of same established.
4. Village level production of the ready-to-eat mixes were promoted.
5. Leaf protein production was standardized.
6. In some mixes, leaf protein was incorporated.
7. The mixes are now used in several pre-schools, the cost being Rs .5 per kilogram.

Assessment of Accomplishments: The ready-to-eat mixes have proved to be very acceptable, digestible and almost equal to milk in growth promoting effects.

The pre-schools have emerged as a strong form for nutritional improvement, nutrition education and promotion of change.

Project Name: Home and Village Level Soya bean Utilization Training Programme

Location: Soya bean Foods Research Centre, Gannoruwa, Sri Lanka.

Size and Duration: Started in August 1978 to cover trainees in organizations dealing with Soya bean projects.

Project Goals and Objectives: The objective of the programme is to teach people the simple methods of processing soya bean at home, using the available equipment in their home kitchens such as grinding stone, Kurakkan stone, and Mortar and Pestle, rather than going in for sophistocated equipment which most of our people cannot afford. The trainees in turn are expected to disseminate the knowledge to their respective villages.

Technologies and Strategies: The duration of training programmes are limited to 2 weeks, 1 week, 3 and 2 day courses. These courses are conducted in Sinhala, English and Tamil. In addition, one-day lecture demonstrations are being held in rural areas on request. All training is free of charge.

Assessment of Accomplishments: Since inception, 1,723 people have undergone this training. In addition, 5,680 people have participated in one-day lecture demonstrations in rural areas.

In February 1981, the programme was integrated with the Farm Women Agricultural Extension Programme.

Project Name: South Pacific Commission Community Education Training Centre (SPCCETC)

Location: Suva, Fiji.

Size and Duration: Established in 1963 following need identified by a Conference of Pacific Women Leaders for a programme of community education for women. Runs one 10-month course per annum and has facilities for 40 participants who are sponsored by government, church missions and PVO's.

Project Goals and Objectives: The main goal is to provide training in home economics for women who will be community workers on their return home. The interests of village women are of major concern.

Technologies and Strategies: The subjects covered during the course include food and nutrition, housing and home improvement, home management, family relationships and family planning, maternal and child care, clothing and textiles, community development, sanitation and health, handicraft skills, teaching skills and consumer education. More recently, principles of small business management have been added to the course.

Through its student groups, the Centre has used and modified various technologies which would help make women's work easier and less time-consuming. Normally, the technologies are made from locally available materials and are developed from existing information, students experiences from their own countries and analysis of felt needs.

Specific technologies made and modified by the Centre include the Indian Chula Stove, charcoal stoves, drum ovens, food safes and vegetable racks made from used timber or wooden packing cases.

Assessment of Accomplishments: Most of the graduates of the Centre return to their own countries where they are involved in the development and implementation of rural programmes. This makes evaluation difficult but the intention is to set up mobile units which will visit other countries, primarily to conduct short in-service training programmes.

Project Name: South Pacific Appropriate Technology Foundation (SPATF)

Location: Boroko, Papua New Guinea.

Size and Duration: SPATF was established in 1977 by the Office of Village Development (which is the government agency with responsibility for co-ordinating government action on appropriate technology. SPATF has several divisions such as the Publications Division, the Technical Information Exchange Service, the Appropriate Technology Development Institute*, Village Equipment Suppliers, the Small Industrial Development Programme and the Community and Family Services Division.

Project Goals and Objectives: The major objective is to develop a programme of activities aimed at delivering technologies to the people of PNG's communities.

Technologies and Strategies: SPATF carries out its objective in a variety of ways which include:

1. Distribution of published information on technologies;

2. Response to technical inquiries from people of PNG;

3. Selection, testing and modification of technologies;

4. Supply of appropriate tools, equipment and materials to villages;

5. Development of small enterprises producing appropriate tools;

6. Promotion of appropriate technologies through provision of practical workshops and field visits.

Technologies covered by SPATF include food processing, gardening, energy, health and sanitation, water supply, charcoal-burning stoves, bush knives, sustained agriculture and housing.

* This was described earlier.

Project Name: Pilot Experimental Training Courses for Rural Women in Home Processing and Preservation of Fruits and Vegetables.

Location: Tangail and Chithagong Districts, Bangladesh.

Size and Duration: The Project is limited to small groups of highly motivated women fruit-and-vegetable-growers (from 300 villages in the Grameen Bank Project). Each course lasts for one week initially. At present, six groups are working on experimental solar drying. Started 1981.

Project Goals and Objectives: Some of the objectives of the project are to:

1. Explore possibilities of setting up small businesses in fruits and vegetables for women entrepreneurs.
2. Strengthen traditional methods and skills with scientific knowledge.
3. Create employment generation for women.
4. Identify interested experts and specialized institutions which can support such rural projects.
5. Develop curriculum and instructional materials for wider application of the project.

Technologies and Strategies: The project has taken highly motivated groups of rural women who are in search of productive activities so as to utilize Bank Credit to start a small business and has linked up their activities with the Bangladesh Council for Scientific Research which is planning an extension wing to transfer its work on solar drying to rural areas.

The project concentrates heavily on solar drying, including the training of women to use and maintain the equipment. It is also looking at the use of improved chulas to conserve fuel.

Assessment of Accomplishments: The project is too new to evaluate properly. However, the introduction of the solar dryers to improve traditional techniques and the knowledge that scientists and technologists are working for them and with them has given the women a new sense of direction and hope.

Project Name: Farm Women's Agricultural Extension Programme.

Location: Soya Food Research Centre, Gannoruwa, Sri Lanka.

Size and Duration: The programme started in 1970 within the Department of Agriculture and with funding from FAO and FFHC, Australia. Before this, there were no government programmes and all specific assistance for women was coming from NGO's. The programme is headed by an Agricultural Officer and to assist her, there are specialists and Agricultural Instructresses. For administrative purposes, the country is divided into 24 districts and the Instructresses are attached to the districts.

Project Goals and Objectives:

1. To increase production of crops, livestock, etc.
2. To make the best use of farmland and its projects to increase income and promote wealth.
3. Efficient management of home and all available resources.
4. To improve family health.
5. Profitable use from released time.
6. Improvement of farm, home and community.
7. Creation of a more positive attitude toward farming and rural living.

Technologies and Strategies: Areas of concentration include:

1. Production of food.
2. Home management and improvement.
3. Family Health.
4. Clothing.
5. Crafts and other income-earning activities.
6. Services:
   (a) Agricultural - Transplanting, harvesting, etc.
   (b) Non-agricultural - Sewing, weaving, spice growing, etc.

Specific Household Nutrition technologies include:

1. Educating village families about basic nutrition.
2. Practical demonstrations on the preparation of nutritious foods using local resources.
3. Local production of nutritious foods through gardening.
4. Encouraging use of health services and advice on hygiene.
5. Encouraging breast feeding.
6. Initiating poultry keeping and dairy farming.
7. Family planning.

Assessment of Project Accomplishments: In the areas where the project has been operating, there have been definite improvements in nutrition levels. More families have started home gardens, more use is made of weaning foods, and homes are cleaner.

Project Name: Home Gardening.

Location: Island-wide in Sri Lanka.

Size and Duration: Targets are for the 4,000 cultivation officers of the Department of Agriculture to start 100 gardens each. The programme started in 1980 when the Minister for Agricultural Development and Research decided to replicate existing local schemes in Colombo.

Project Goals and Objectives:

1. To ensure a regular supply of fresh and uncontaminated vegetables, fruits and condiments, to provide a nutritionally balanced diet for the family.
2. To make the best use of the land available and keep the environment clean.
3. To get flat-dwellers to raise vegetable crops in pots, discarded containers, packing cases, etc.
4. To cut down a family budget and augment incomes.
5. To serve as a hobby that will give pleasure and profit.
6. To educate home gardeners in simple compost-making techniques and in simple pest and disease control methods.

Technologies and Strategies:

1. Making available seeds, fertilizers, agrochemicals and other inputs in handy packs at Agricultural Service Centres.
2. Discussion groups to create awareness and motivate housewives and others by giving them elementary ideas on land preparation, plant materials, etc.
3. Practical demonstrations in preparation of seed beds, manuring, etc.
4. Demonstration plots.
5. Short courses in cultivation of vegetables, compost making, etc.
6. Food demonstrations to popularize new crops like Soya bean, Winged Bean, etc.
7. Involving NGO's, mobilizing school children and organizing home garden competitions and exhibitions.

Assessment of Accomplishments:

1. In addition to the normal seed packets, 600,000 special seed packs containing 10 different varieties of seeds and priced at only Re 1/ per packet were sold in 1980. The results were startling. The price of beans, cabbage and radish fell to rock bottom prices during peak seasons in the producing areas. In the interest of the traditional gardeners, the Home Gardeners of the project are now being encouraged to grow crops during the off season.
2. Difficulties encountered during the programme include mobility, the high cost of sinking open wells, pest and disease problems.

Project Name: Food and Nutrition Research Institute.

Location: Manila, Philippines.

Size and Duration: Established in 1947 as an Institute of Nutrition. It is now one of the implementing agencies of the National Science Development Board (previously the Ministry of Science).

Project Goals and Objectives: The main objectives of the Institute are to:

- conduct Nutrition surveys among different population groups;
- determine nutrition values of local foods;
- standardize recipes and menus to meet nutritional requirements;
- develop nutritional food products from indigenous low-cost sources and improve cottage level processing techniques;
- study nutrient requirements and develop nutrition education materials.

Technologies and Strategies: The Food Research Division of the Institute undertakes research on the development and formulation of supplementary foods for the most deprived groups, namely infants and young children. Emphasis is given to the nutritional improvement of existing traditional products such as impact food, snacks, noodles and bakery produce. These foods, being basically starchy in nature are fortified or supplemented with legume flours, oilseed flours and whole animal blood powder. A process of preparing these products has been developed using simple technology.

Other technologies include dehydration of leafy greens, yellow vegetables and fruits using solar dryers and cabinet dryers; development of home-made infant foods, and development of low-cost nutritional menus and regional recipes.

Assistance has been given to a number of cottage-scale food processors involved in the formulation of new products or improvement of existing products.

Assessment of Accomplishments: Transfer of technologies to families has been very slow. This is thought to be due to a combination of a lack of income, interest and understanding combined with food taboos.

Project Name: Save the Grain Programme

Location: Katmandu, Nepal (plus four field stations)

Size and Duration: The project started in 1980 for 2 years with the possibility of an expansion for a further 6 months.

Project Goals and Objectives: The overall objective of the project is to reduce post-harvest losses and improve the quality of on-farm operations concerned with grain. Specific goals are:

1. To reduce losses in harvesting, threshing, drying and processing of staple food grains by the introduction of appropriate technologies;
2. To reduce losses in the storage of staple food stuffs caused by insects, rodents and moulds;
3. To prepare a nationwide programme to create an awareness among farming families of the losses that occur, the causes and methods of reducing them;
4. To select and test improvement measures for reducing losses and to train farm families in adopting these measures;
5. To evaluate the effects of the techniques introduced on the reduction of losses.

Technologies and Strategies: A project involves a package of practices which could be adopted by the majority of the farmers. It also includes improvement of existing storage structures and adoption of new area by farmers who could afford it. The recommended package includes:

1. Control of insects by spraying and fumigation with recommended insecticides at a cost easily within reach of the majority of farmers;
2. Low-cost and effective storage structures have been designed, developed and evaluated;
3. Metal bins of variable capacities have been designed, tested and evaluated. These are costly (US $80) but a demand exists. To help with payment, a scheme is being evolved to allow farmers to get loans/ subsidies payable in 4 years with low interest rates.

Assessment of Accomplishments: The project has been able to establish infrastructures which could not only carry out the work, but also expand it as a nation-wide campaign to reduce post-harvest losses.

Project Name: Lalitpur Community Health Programme, (a programme of the United Mission to Nepal's Shanta Bhawan Project).

Location: Lalitpur District in Central Development Region of Nepal.

Size and Duration: Health and development assistance activities in 20 of the 31 panchayats in the district. The programme began in 1971 and has flexible plans for the next 5 years.

Project Goals and Objectives: The main objectives are:

1. To assist in developmental efforts (health, agricultural, social, economic, educational, etc.) on the district as well as village level, realizing that these efforts are all interrelated and interdependent.

2. To assist in the process of social and economic development by stimulating and helping selected communities to solve their own problems and to meet their own basic needs by utilizing local resources to the fullest extent, thereby reducing dependence on outside aid through realization of their own potential.

Technologies and Strategies: A self-help volunteer programme has been started in one area giving emphasis to the fullest use of locally available nutritious foods. A "super flour" porridge has been developed which mothers can make themselves. Also, rice bran is being used instead of B-complex tablets. Training materials have been written and incorporated in training manuals used by government and by others.

Other areas of work include introduction of pit latrines, clean water supplies, kitchen gardens, composting and better use of manure, bacterial fertilizer and multiple cropping.

Assessment of Accomplishments: The "super flour" has brought about a definite reduction of EPM in the area.

The more wide-spread use of rice bran and unpolished rice are preventing any further increase in vitamin B deficiencies.

Mothers are more confident to feed their children green leafy vegetables on a regular basis.

Drinking water supply systems have caused greater interest in kitchen gardens and have reduced the incidence of skin and diarrhoeal diseases, and also has increased interest in tree planting.

Agricultural input such as advice on wise use of manures, compost, and pest control methods has resulted in more improved gardens and general crops. Bacterial fertilizer is being experimented with. More interest is being shown in improved multiple cropping.

Animal health care volunteers along with the new availability of water have prevented further illnesses and have resulted in increased dairy product production for home consumption and sale of clarified butter, the main cash income of the hilly regions.

Community involvement/participation is on the increase.

Project Name: Sarvodaya Movement, Sri Lanka.

Location: Island-wide; central administration centre near Colombo, with 24 District Level Centres and approximately 67 village centres each of which coordinate 5 to 10 villages.

Size and Duration: The movement originated 22 years ago and now works in nearly 4,000 villages in Sri Lanka.

Project Goals and Objectives: Integrated development programmes based on moral, cultural, spiritual, political and economic elements of life, interacting with one another. The movement is 'human-being' centered.

Technologies and Strategies: The movement's emphasis is on responding to people's needs at the grass roots level. Areas of undevelopment are basic needs such as water, clothing, food, shelter, health care, communication, fuel, education and spiritual and cultural needs of the community based on the Gandhian Philosophy of 'reduce your wants/ supply your needs'.

An example of a project is the Tanamalvila Sarvodaya Development Education Institute and its 500 acre farm complex based on bio-dynamic farming systems. This covers the use of bio-gas, composting, low-cost housing techniques, smokeless cookers with integrated drier for seed materials and food storage, wind energy, etc.

Assessment of Accomplishments: The project was started in 1972, and up to 1976 it was failing because of a concentration on "Western" technologies which involved high expenditure on chemicals, etc. Since introducing the new approach, everything has gone well and for the last 3 years, yields have doubled every year.

Project: Nutrition Intervention Pilot Project

Location: Food Technology Development Center (FTDC), Bogor, Indonesia

Goals and Objectives: To develop weaning foods and dietary food supplements that are low-cost, culinarily acceptable, nutritious, and easy-to-prepare.

Technologies and Strategies: FTDC relies on a combination of cereals and legumes because of the complementary nature of their amino acids. They also use germination techniques which render grains assimilable by the child and make the resultant weaning food more nutritious. Many of the weaning food recipes are based on mixtures of soybeans and rice. Production is entirely by a dry process, eliminating spoilage and quality control risks that are inherent in a tropical environment. The dry processing, which involves roasting of soybeans as one of the steps, helps to de-activate growth retarding trypsin inhibitor, to adjust the moisture to a safe level, and to impart more acceptable beany flavor. The recipients prepare the weaning food/food supplements according to their tradition and taste (usually steaming it).

Assessment of Accomplishments: Several food supplements and weaning food recipes developed by FTDC are currently in use in Bojonegoro and West Lombok NIPP areas. FTDC also has helped develop weaning foods for the Pulau Galang Vietnamese refugee camp.

BACKGROUND PAPER

FOR

FIRST ASIAN HOUSEHOLD NUTRITION APPROPRIATE TECHNOLOGY CONFERENCE

(Colombo, Sri Lanka, July 13-17, 1981)

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BACKGROUND PAPER FOR
FIRST ASIAN HOUSEHOLD NUTRITION APPROPRIATE TECHNOLOGY CONFERENCE

INTRODUCTION

In the past decade there has been increasing interest in the relevance of appropriate technology for developing countries. Provision of energy, a potable water supply, and small scale agriculture are areas where simple technical processes and low-cost, easy-to-operate, environmentally-safe equipment are needed to improve the quality of life in rural areas. Evaluations of these technologies usually are based on the amount of resources saved (time, energy, money), production efficiency and their ability to make the user more "self-reliant."

The theme of this Conference is that there are technologies appropriate for rural households that should be promoted not only for reasons of economy and efficiency, but also for their ability to improve the nutritional status of family members. These technologies occur in the areas of food production, processing, preservation, storage, and sanitation activities.

Our Conference will focus on disseminating information about the usage (not design) of these technologies. It will include the need for specific technologies, evaluating their impact on nutritional status, and developing program strategies to make greater use of relevant technologies. The Conference will bring nutritionists, program planners, and educators together with those who have managed field projects that used "nutritionally appropriate" technologies.

This background paper briefly describes a wide range of specific technologies, highlighting those that have been evaluated for their impact on feeding habits, behaviors and nutritional status, and identifying others which need to be evaluated. Finally, it identifies for the Conference consideration of the program planning and policy issues in the use of such technologies. In accordance with the theme and location of the Conference, the paper focuses primarily on technologies for Asia. However, reference is occasionally made to work done in Africa and other areas of the world.

Food Production ("Nutriculture")

Gardening is one of the oldest interventions known. From the days when the only international technical assistance was provided by missionaries, people have been urged to plant kitchen, dooryard, or backyard gardens. More recently, FAO and UNICEF have promoted home gardens through their Applied Nutrition Program. A variety of techniques have been developed for maximizing outputs from a minimum of capital inputs. The French Intensive Method stressed unusually deep planting beds, the close spacing of plants, and the use of enormous quantities of manure (provided by the horses of Paris). Rodale's "Organic Gardening" centered around the use of organic matter, as opposed to chemical fertilizers to replenish the soil; Rudolf Steiner's "bio-dynamics" revived the ancient practice of planting in raised beds, demonstrated the value of using compost, and developed the technique of companion planting.

The work of Alan Chadwick as an advocate of Biodynamic Gardening at the University of Santa Cruz, suggests that given the twelve month growing season of the tropics, a family practicing intensive gardening can grow enough food to meet its nutritional requirements--perhaps on less than an acre of ground.[1] Unfortunately, few have tested Chadwick's hypothesis, or have ascertained the precise relationships between home gardens and improved nutritional status. Y. H. Yang, at the East-West Center in Hawaii has conducted a series of experiments to calculate the

potential nutrition contribution of a small home garden. He has found that given proper crop selection, e.g., water convolvulus, pak choy and amaranth, a 300 sq. ft. garden can provide a family of five with abundant quantities of ascorbic acid and vitamin A and increased availability of iron and protein.[2] Yang emphasizes the use of home gardens to grow vegetables that are "easy to grow, resistant to pests and diseases, high in nutritive value, palpable, and easy to prepare, high in market value and derived from a local source.

Paul Sommers and Dr. Josefa Eusebio[3] have studied the use of home gardens for family food production in the Philippines. Results indicated that the majority of gardens were used exclusively for family consumption and contained 30-40 different varieties of edible plants including legumes, fruit and leafy vegetables, root crops, spices and fruit trees. For most families the products from gardens along with the staple rice or corn grown in the fields constituted their main source of food. Analysis of the garden diagrams, with the plants identified, and their average yields calculated to arrive at potential nutrient supply, indicated that nearly all of the families had sufficient food supplies to meet vitamin A, vitamin C, calcium and iron needs. More than half of the families received a sizable portion of the B vitamin needs from the garden and one-fourth could meet needs for protein and calories from their gardens alone.

In addition, Sommers and Eusebio found the family garden to be an economical method of food production. The majority of the plant materials were locally available and no fertilizer other than that generated by the garden and household domestic animals was used. Storage was also not a problem since crops could be harvested as they were required for the family meal.

Lastly, the gardening system made good use of the land available. What first appeared as unplanned growth was actually a complex multi-tiered system of planting which resembled the local tropical primary forest. The gardens contained a top canopy layer of coconut trees, followed by shorter fruit trees, (avocado, jackfruit, guava, banana, breadfruit) to form a lower canopy. A smaller, more shade-tolerant fruit tree, such as coffee, cacao, and papaya, was grown beneath these fruit trees. Climbing legumes and gourds were trained to climb the trunks of the trees and, lastly, on the ground level, annuals were mixed with trailing plants to act as a cover for the soil. This mixture of deep and shallow rooted plants helped maintain soil structure and prevented erosion. When combined with the nitrogen-fixing legumes and plant and animal wastes, it maintained soil fertility making the family garden an efficient, self-sustaining system. In conclusion, Filipino family gardens are an outstanding example of multiple cropping and efficient resource management for providing good nutrition.

Paul Sommers also recently has written Home Gardens: Handbook for Programme Officers. This manual provides a framework for the development of policies and programs that relate to home gardens. It outlines the socio-economic factors which must be taken into account when assessing the need for home gardens. The author points out that nutritional considerations must be balanced against the need for income. In planning a home garden project it is necessary to know how much money the target group spends on food per week, which items are usually purchased and the proximity of the home garden to the market place. The economic data must be balanced with dietary information and available horticultural technology and skill to determine each garden's appropriate design.

The Mayaguez Institute of Tropical Agriculture in Puerto Rico has studied ways in which subsistence farming can meet the nutritional needs of those living in the tropics. The Institute has published a number of bulletins describing "simple

technologies for the tropical home and farm," including production and use of okra seed meal, "making vegetable curd from okra seed and green protein concentrate from leaves by home scale processing."[4]

Arnold Pacey, in conjunction with OXFAM, has written a book entitled Gardening for Better Nutrition, which argues persuasively for nutrition oriented agriculture.[5] The author goes into detail (Chapter 4) on the "Choice of Crops for Improved Nutrition." Traditional home gardens have tended to stress either green vegetables for their vitamin and mineral content, or particular beans and legumes for their protein content. Pacey stresses mixed cultivation. He points out that concentration on just one rich source of protein (e.g. soya beans) or of minerals (e.g. spinach) may produce food which the body cannot use efficiently. The manual outlines the resources needed to start a home garden in a developing country situation, e.g. an appropriate site, fencing and gardening tools; it also describes how to structure a plot, prepare a seedbed, make compost, and a variety of other gardening techniques. There are also tables listing specific vegetables and legumes and the climatic conditions under which they grow best. The manual discusses various strategies for training villagers to make home gardens. In Africa, there is a need to reach women who do much of the work involved in producing food for the family. In other areas of the world, the manual argues for incorporating gardening into community development schemes as a way of building broad-based support.

Food Storage and Preservation

There is an abundance of literature on post harvest loss. It has been estimated that in some developing countries from 20% to 50% of a crop gets lost before consumption due to molds, insects, rodents and other causes. Manuals and texts written on this subject describe technologies that can be used to minimize crop damage and assess the macro-agricultural and economic implications of small farm post harvest loss. Little, however, has been done to assess the effect of these technologies on household food consumption patterns or the nutritional status of vulnerable family members.

It would seem essential to disseminate information about appropriate technologies for drying and storing the household food supply both outside and inside the dwelling unit. Externally, many of the technologies that have been developed in conjunction with post-harvest loss apply, such as the simple concept of raising a storage crib off the ground on a platform with metal or thorn rat-baffles attached to its legs; or coating the outside of traditional basket work cribs with mud and cow dung to make them insect proof. "Save the Grain", a project in Nepal, reports that 200 rats were caught with rat-baffles in one morning in a village in Nepal.

Internally, home economists have developed a series of techniques and procedures for storing foods in a tropical climate. For example, dry foods can be stored in a variety of covered glass, pottery, wooden, tin or other metal containers. Coconuts, gourds, and calabashes may be used for storing some dry foods for a short time. A simple cupboard can be made from a wooden box with shelves. A door can be fashioned out of chicken wire so air can circulate. In Ethiopia, covered baskets are hung from the rafters and used to store dried fruits, vegetables, and bread.[6]

These types of stores give the small farmer and his family the opportunity to greatly reduce or totally eliminate storage losses, thus increasing his family food supply by up to 40% at a fraction of the cost of buying or attempting to produce this amount of additional food. Perhaps, more important, it can give him

independence from the moneylender to whom he must often go to get money to buy food for his family once his own supply is exhausted.

In a recent paper (January 1, 1981) R. C. Bates, a food technologist from the University of Florida, summarizes a variety of household appropriate technologies related to food storage and preservation.[7]

> Solar drying methods range from simply spreading the food out during sunny days to elaborate double-walled structures which serve as both solar collectors/dryers and storage facilities. There are many examples of solar drying systems suitable for durables, some even applicable to higher moisture semi-perishables and perishables and under more humid conditions. These involve indigenous construction materials supplemented by industrial materials (glass, plastic sheets, screening, aluminum foil) when economically and logistically feasible.
>
> Once the food is dry, storage facilities can be constructed from local materials such as bamboo, mud, plant fibers, ceramics, etc. Sound construction and design are necessary to protect the stored food from flooding, driving rains and predators.

Bates also cites

> ...the coating of dry legumes with about 0.5% vegetable oil and the use of small amounts of inorganic powders are promising approaches to counteract insect infestation.
>
> Semi-perishables and perishables represent a more difficult drying problem. Since deterioration is more rapid at higher moisture contents, more extensive drying is required. Thus, auxiliary preservation steps, such as salting, smoking and the use of chemicals, often accompany dehydration to retard microbial growth.

Food Preservation Techniques

Solar dryers are being suggested as substitutes for the traditional drying technique in Southeast Asia, which consists of spreading grain on the black tarmac road. Yet the cost of a piece of heavy plastic to line or cover a box is prohibitive for many poor. In areas where post-harvest conditions are unsuitable for solar drying, crops can be effectively and rapidly dried using a simple fuel-timed dryer. Such a dryer can be made from discarded oil drums. Most grains can be dried to a safe moisture content in one day with this dryer. Its major disadvantage is its high demand for fuel, which can be partially alleviated if agricultural wastes, such as maize cobs, coconut husks, or other similar materials are available. Preservation of fruits and vegetables, important foods, can both prevent food losses and provide out-of-season supplies of vitamins and minerals. For example, 15 grams of dried cow pea leaves can provide a child's daily requirement of vitamin A, useful for treating vitamin A deficiency.[8]

Many studies (Bates, Steinkraus, Gee, et al.) consider high concentrations of sugar and salt as preservatives. (Note: The nutritional consequences of consumption of such large amounts of salt and sugar would not be nutritionally appropriate for a young child.) Salting is widely practiced for preserving high protein foods such as meat or fish. Putrification is prevented in the presence of approximately 12% salt w/w. Most fresh vegetables can also be preserved by simply soaking them in salt brine. In preparation of Korean kimchi, lactic acid

fermentation of fresh shredded Chinese cabbage, radishes, and other vegetables and spices occurs in the presence of a lower concentration of salt. Since no heat is applied and the fermentation is anaerobic, vitamin retention is high; also the cost of the process is low so kimchi has been particularly important to the diets of low income groups in Korea for centuries.

Fermented fish sauces, such as Vietnamese nuoc-mam and Philippine patis, are important in the Southeast Asian diet. Fish sauce is derived through a simple technology of salting small fresh fish, over long periods of time to permit hydrolysis by both fish and bacterial enzymes. The salt content of this hydrolytic or fish sauce is at least 20%, but it is rich in the amino acids needed to complement the rice protein in the diets of Southeast Asia.[9]

Another fermented product that can be prepared in the home and requires little cooking time is tempe. This is a protein-rich meat substitute originating in Indonesia and made from soybeans. In this form, four or five hours less boiling of soybeans is needed to prepare them for consumption than if the beans are not fermented. In addition, as a result of the fermentation process, the riboflavin content of the soybeans is doubled, niacin increases nearly seven times and vitamin B-12, absent in the soybean, is produced in nutritionally significant amounts.

Indonesian tape (fermented rice and cassava) production offers a method of modifying flavor (increasing sweetness), increasing protein content, improving the amino acid balance, and increasing the thiamine content of the high starch substrates. The only fuel required is in the initial steaming applied to the substrate.[10]

Home canning has not been widely advocated in developing countries, perhaps because of the concern over botulism poisoning (and also the cost of containers and fuel). A 1977 UNICEF manual on Food Preservation in Bangladesh suggested canning as part of a project to encourage income-generating activities for women. The emphasis was on chutney and preserves of fruits and vegetables. Canning lends itself much more to community enterprise than to individual efforts. Finding markets must be part of the planning, for the glass container itself prices the product out of the reach of the poor.

Food Processing

Of all the tasks which rural women undertake daily, the one which is mentioned most frequently as being a chore they seek to get rid of is that of grinding maize, millet, sorghum, rice, or other staple crops.

Many simple labor-saving machines have been developed to help women with the processing of all types of crops. Hand-operated oil presses can help with the extraction of oil from palm fruits, coconuts, groundnuts, and castor seeds. Machines are also available to help with the shelling of maize, hulling and polishing of rice, grating of cassava, and many other tasks in which rural women are constantly engaged. Hand-operated grinding mills, which can cope with an output of about 35 to 40 lbs. of flour per hour are currently available and used on a community level in parts of Africa. Smaller hand-operated mills are available for household use. Elizabeth O'Kelley has published a manual devoted to food processing in Bangladesh (Simple Techniques for Rural Women in Bangladesh).[11]

Two types of cookers have been developed which use solar heat. One reflects the heat of the sun onto the bottom of a pot. The other uses the heat of the sun to boil the water and produce steam which is then used for cooking.

The solar steam cooker is more expensive and more difficult to construct, but it can also overcome the disadvantages involved with the reflector cooker. For instance, since the cooker is designed to use the sun's heat to produce steam for cooking slow-cooking foods such as maize and beans, it works all day in the sun (while the woman is in the fields) to produce a cooked meal in the evening. This fits in much better with the daily routine of the family and in addition, the cooking container is large enough to produce a family-size meal. Further, the cooker does not have to be moved as the sun moves and it is much less likely to be damaged or upset. Women can also cook indoors with this type of device. The solar collector can be built outside the house while the cooking pot can be built inside with the two being joined by a pipe through the outside wall of the house. Solar power would seem to be an appropriate source of energy for many Third World countries, given their proximity to the Equator. However, during long rainy seasons, solar power's effectiveness may be somewhat diminished.

Another approach which is being tried is the use of methane gas for cooking. In its simplest form, methane gas can be produced by filling an oil drum with one third of human, animal or vegetable wastes, one third water and one third air. The drum is then sealed and fermentation takes place which produces gas. This is simple and cheap enough, but the problem arises in the storing of the gas and in the transfer to the stoves in which it is to be used. Cost-wise it is more efficient to produce, store and use methane gas in large quantities. Piping gas to individual homes adds considerably to the cost of this technology. Methane gas might, however, have its uses in cooking communal meals in rural schools or day-care centers.

Cooking utensils, particularly pots, are another area of relevance to household nutrition appropriate technology. A low cost pressure cooker could do much to enhance the use and nutritional value of grains and beans.

Beans of all types constitute a major source of protein in many developing countries, but the major constraint to their utilization is the prolonged cooking time required to make them palatable and to destroy certain anti-nutrition factors. The extended cooking time problem is magnified today due to the scarcity and high cost of cooking fuel.

A process for cooking beans more quickly involves presoaking overnight in water with salt, soda and sodium carbonate. The beans are soaked overnight and then cooked in the usual way with the exception that the cooking is completed in only 1/10th to 1/2 of the time originally required for the beans with the accompanying great reduction in fuel used. The chemicals are relatively inexpensive and usually readily available.[16]

In terms of recipes and menus, a way of ordering priorities is to first consider the dietary needs of vulnerable groups, i.e. infants, pregnant and lactating mothers. Essential nutrients for these groups include calories, proteins, iron, vitamin A and iodine.[17]

In terms of the first four to six months of life, it is generally agreed that breast milk alone is the most appropriate food. The technology for breastfeeding generally falls under the category of lactation education. There are simple rules for nursing management, e.g. putting the baby to the breast as soon after birth as possible; allowing the baby to suck at alternate breasts at each feed;

making sure that the baby's tongue is under the nipple and his mouth is around the areola; knowing how to treat clinical complications such as engorgement or cracked nipples. In addition, there is socio-cultural climate that affects a woman's emotional and psychological predisposition to breastfeed which needs to be supported.[14]

There are also appropriate technologies that have been developed for the woman who cannot breastfeed. Dr. Shanti Ghosh, in her manual, The Feeding and Care of Infants and Young Children recommends the use of spoon or cup after the first five to six months of life. During early infancy, if bottle feeding is required, there ought to be adequate facilities for boiling and sterilizing both bottle and teat, a good source of water, reliable milk supply and adequate washing facilities. In addition, the mother should have sufficient funds to purchase milk or formula, time to prepare feeds and knowledge about how to do so correctly.

Beginning at from four-six months, breast milk alone usually cannot supply all the infant's needs for energy, protein and other nutrients. Then breast milk must be supplemented with other suitable foods. But the cost of Western-style commercial preparations in underdeveloped countries is prohibitive. Consequently, many countries are producing supplementary foods which are cheap and easily distribute in their own markets for use in the weaning and pre-school period.

Suitable mixtures for feeding during the weaning period can be made in the home by using foods from the household garden or the market. Often these foods already are ingredients in the "family pot", so the mother is familiar with them; she knows their flavors and how to prepare them.

The staple of the household is often cooked or pounded into a thick porridge as an important part of the family meal. Some of the same porridge can be used for the six month old infant or a young child if it is thinned slightly and given by spoon from a cup or bowl. Preferably it should be made from a local cereal, rather than a starch root or fruit, and it should be supplemented with one of the ingredients in the family's side-dish - soup, sauce or stew. The supplement might be a small amount of fish, eggs, milk or a milk product, if available, or some well-cooked beans or dhal. As the infant grows, small amounts of suitable vegetables can be added as well to help improve the protein and other nutrient values of the basic porridge.

Double mixes are the simplest weaning foods. They contain only two main foods, the staple and one other. If the mother is taught which second food to use with her staple and how much of it, she can prepare these mixes easily when she is cooking her family's meal.

Multi-mixes can consist of three ingredients: the staple food, beans and whatever animal product is available. For example, some milk or finely flaked fish might be added to a porridge of rice and beans.[19]

Recipes for household weaning foods can be found in many of the manuals that have been developed for training field workers in developing countries. The National Institute of Nutrition in India, in its 1978 manual Nutrition for Mother and Child, describes a series of "Exchange Recipes" (defined as preparations made out of different combinations of foodstuffs; modifications of what a family ordinarily consumes to meet a baby's needs), e.g., "green gram dhal khicheri with curd or boiled fish," rice payasam, sprouted Bengalgram porridge," et. al.[20] The Indonesian UPKG Program Nutrition Manual recommends what it calls "soft foods," such as porridge mixed with pulverized tempe (cake or fermented soybeans).[21]

Incorporation of green leafy vegetables into the diets of infants and young children is another priority household food preparation technology for developing countries. Xerophthalmia, vitamin A deficiency, a nutritional disease that affects children under six is a major public health problem in countries such as Afghanistan, Bangladesh, Brazil, Burma, Egypt, Ghana, Haiti, India, Indonesia, Mali, Nepal, Nigeria, Pakistan, the Philippines, Senegal, Sri Lanka and Upper Volta. It is especially prevalent in areas of the world where vitamin A deficient weaning foods (e.g., white rice, maize, cassava) predominate.

Surprisingly little has been written on the subject of incorporating green leafy vegetables and other vitamin A rich foods, e.g., yellow vegetables or yellow fruit, into the diets of infants and children. In a recent vitamin A deficiency prevalence survey of Indonesia, Dr. Alfred Sommer commented that 90% of the homes with children with xerophthalmia have members who consume green leafy vegetables regularly. He identified two problems related to including more vitamin A rich foods in the diets of young children: (a) mothers of children under the age of two don't know how to cook the leaves; and (b) mothers of children over the age of two report that their children don't like the vegetables.[22]

Preparation of locally based weaning supplements and, to a lesser extent, vitamin A rich foods have received a fair amount of attention in nutrition training manuals and texts. However, the special needs of other family members have not. For example, we know that the pregnant and lactating mother needs iron and extra calories; that the child 1-6 needs calories and protein. However, one rarely comes across locally based recipes, menus or dietary plans geared specifically for these groups.

An additional question is allocation of available food per meal. In many countries, it is customary for the male head of the household to eat as much as he wants of what is available, which is often hardly enough to go around. Should the male be entitled to more if he is a wage earner doing hard physical work? What about the nutritional needs of infants and mothers (who also work) who share the same family pot?

Nutrition Sanitation

This subject deals with household procedures to protect against contamination of food and water. Much of the literature on the subject can be found in the field of home economics. USDA's Federal Extension Service in 1963 put out a series of guides called "Aids to Extension and Village Workers in Many Countries." There are sanitation-related rules for eating foods cooked, eating foods raw, the use of fresh water and milk, the storage of perishable foods, washing hands before meals, keeping equipment and dishes clean, etc.[23]

Convincing people to boil water is difficult, as evidenced by the experience of Manoff International in Ecuador. A government nutrition education campaign, which the Manoff people helped design, found that it was easier to get people to put caps on drinking water containers than to get them to boil water. Problems of fuel availability, demands on women's time, and cultural constraints were too great to overcome.[24]

Many of the manuals on nutrition for field workers in developing countries use the term "environmental sanitation." The Baranguay Nutrition Manual from the Philippines, for example, uses a comic book format to illustrate sanitation hazards, e.g., "raw foods such as fruits and vegetables may be contaminated by insecticides, water from the well may be contaminated by surface water from the backyard."[25]

Household sources of water include rainwater and small wells. A rainwater catchment on a roof precludes having to fetch and carry water. It generally requires adequate rainfall, impervious roofing material and storage tanks. The necessary storage capacity to include dry periods can be easily calculated. Care must be taken so that the storage tank is prevented from creating a site for mosquito breeding. Appropriate roofing material can be constructed from locally-made tile, corrugated tin, or fiberglass. For rural homes, where water is being carried from a polluted surface supply and where the necessary material can be constructed or obtained, rainwater catchment can provide a substantial improvement and should be considered even though enough storage might not be possible throughout the year due to dry periods.

Roof collection also relieves the mother (for at least some months of the year) of the usual, twice daily, drudgery of collecting and carrying water from the nearest (and often polluted) source. Estimates made in East Africa indicate that the average African mother spends one-sixth of her energy on water collection alone.

The use of simple containers, such as the Thailand thin-walled cement jar, or even simpler containers, such as baskets lined with cement, can meet the problem of storing roof-collected water for use in periods when there is no rain. A 2000 litre storage jar costs less than 12 dollars to construct in East Africa and, in areas where water has to be purchased, often at exorbitant cost, a jar of this type can pay for itself very quickly.[26]

The Division of Environmental Health, School of Public Health at the University of Minnesota, has developed a manual for building and using small wells. The manual describes small wells which are up to 4 inches in diameter, a maximum of 100 feet in depth, and with a yield of up to 50 U. S. gallons per minute. Where the water table permits such wells, the manual recommends their use as an excellent source of household water supply.[27]

In areas where the only drinking water available is from shallow wells or open dams, slow sand filters can be used to improve the water quality. The slow sand filter operates in two ways. First, as the unclean water passes between the sand particles in the filter, much of the dirt that is floating in the water is removed. Second, after the sand filter has been operating for a short time, small living organisms begin to grow within the sand filter. These small organisms kill disease bacteria that exist in the water. Thus both mechanical filtering and some biological purification of water is possible with a slow sand filter.

It should be pointed out that slow sand filters may not produce completely safe drinking water. However, in areas where firewood is in short supply and other means of sterilization are unavailable, then slow sand filters are low cost, simple devices that can be used to improve the quality of contaminated water.[28]

The important point about roof collection is that it makes large quantities of water available close to home. Such water can even be piped directly into the home. Thus there will be a better facility for more frequent washing of hands,

bodies, and food; and health education, which emphasizes such washing, will at last become credible.

Program Planning and Policy Issues

To what extent do the activities described above affect nutritional status? Is it worthwhile from a policy point of view to consider them interrelated parts of a whole system? Does the system make sense in terms of interventions and investment?

From the scant evidence available, one could argue quite positively that there is a correlation between the use of home technologies and nutritional status. At least in the areas of production, preservation, and preparation, as this paper has described, the evidence has been established. In the other areas there is suspicion without adequate documentation (though perhaps our Conference will unearth new data). To our knowledge, no one has ever measured the impact of improved household food processing, storage, and sanitation activities on the nutritional status of a target population.

There are many non-nutritional benefits that accrue as a result of improved household technologies. These have been documented and, consequently, it seems worthwhile to speculate on their spill-over effects on the nutritional sector.

Increased "self-reliance" is one of the major socio-cultural factors attributable to appropriate technologies. Current doctrines of development often call for a greater degree of Third World self-reliance in terms of food. Usually, this is taken to mean greater agricultural production for domestic markets. However, technologies of processing, storage, sanitation, etc., must be developed and disseminated to make use of new production patterns. The more locally controlled these technologies are, the greater the degree of self-reliance.

Energy savings is a second nonnutritional benefit of appropriate technology that influences nutrition status. Technologies that lessen the dependence of developing countries on expensive sources of fuel, e.g., firewood and energy-intensive transportation and packaging systems, will free family income and time that can be put to use to improve household diets.

Energy and other forms of resource saving most directly affect the role of women in developing countries. Maryanne Dulansey points out that in the developing world women have a great deal to do with food.[29] Not only do women do the cooking, they plant the seeds, weed the fields, harvest the crops and take care of home storage, preservation and processing. In many countries, e.g., the Gambia, studies have pointed out that the twin burdens of wage-earner and care-giver, compounded by seasonal availability of food, affect a rural woman's nutritional status and her aiblity to adequately nourish her baby.

Technology can help women feed their families if they perceive that it will work for them. What good is a solar cooker to the woman who spends her time in the field from sunup to sundown? If her family doesn't like the taste of a food made as a result of applying a new technology, how valuable is the technology to that woman? If the woman is not aware of the technology and what it can do for her as food provider because technologies have been, and continue to be, delivered to men, then how can she be expected to respond?

The issue of ascertaining the need for specific technologies is an important one. Towards that end Dr. Derrick Jelliffe has initiated three household "task analysis" studies in Nepal, Burma and Bangladesh. These studies will focus on patterns of

The Village Technology Unit, a joint UNICEF/Government of Kenya project, has field-tested a number of appropriate technologies in the areas of household food processing, as well as storage and preservation. Their 1979 "Catalogue of Devices" includes descriptions of a maize sheller that can produce up to 120 kg. of shelled maize per hour; and a groundnut sheller enabling one person to produce 20 to 30 kgs. of shelled groundnuts per hour.[12]

The Tropical Products Institute in London has published a series of "Rural Technology Guides," many of which deal with household food processing. The Guides are really designs for making equipment and sometimes get quite technical. Guide #1 describes how to make a wooden hand-held maize sheller; Guide #5 shows how to construct from scratch a pedal-operated grain mill.[13,14] Interestingly, in many African and Asian societies, it is considered improper for a woman to sit astride, and where this is the case, women will not use a pedal-drive grinding mill, however useful it might be to them.

The nutritional implications of low level processing technologies have seldom been explored. For example, incomplete milling through hand pounding-leaves sufficient bran in rice to provide needed vitamin B. Husks are fed to chickens, later consumed. What will prevent deficiency if hand-pounding is reduced by low level or intermediate technologies?

Food Preparation

Technologies for food preparation are built around stoves, pots, fuels, feeding techniques, recipes and menu planning. Each item in the chain of tools and equipment involved in food production should be seen as a system in and of itself. Each piece of equipment or choice of technique is a variable that helps determine the health and well being of family members.

One major impediment to the introduction of improved stoves in many parts of the developing world has been their cost. Reliable stoves which use local fuels are frequently too expensive to be within the reach of most people in a developing country. However, the cost of not using stoves can not be ignored.

It has been found that open-fire cooking is associated with a high incidence of eye defects, infant burns and lung damage. Often these are caused by excessive exposure to smoke, rising gases and hot debris during the cooking process. Many traditional wood burning stoves fail to alleviate this problem. In addition they consume a great amount of wood, an increasingly scarce resource.

A number of stoves have been developed in Third World countries which cook more cleanly and are more fuel efficient. These include the Indian "smokeless chula", the Guatemalan Lorena Stove and the sawdust burning cook stove. Most are constructed out of clay, sand and scrap metal, materials freely available in most parts of the world.

Shortages of wood, charcoal and the expense of kerosene and electricity pose a fuel crisis for low income families in developing countries. In many places, fast-growing trees, that can be planted around the house, are being promoted, e.g. the leucucua.

Two other appropriate technologies that are being offered as solutions are solar cookers and the use of biogas.[15]

infant feeding in light of the variables of food availability, fuel requirements, physical labor. The results of the Jelliffe study will be presented at the Sri Lanka Conference.

Techniques of market research could also be applied to assessing the need for appropriate technologies. The audience participation surveys that Manoff International conducted in the Philippines and Indonesia, and more traditional advertising market surveys and product testing procedures should be pilot tested for their relevance to specific technologies.

Dissemination is another problem relating to the use of appropriate technologies. It is especially relevant to the range of activities described above. The use of modern advertising techniques could be applied to the promotion of specific pieces of equipment. Appropriate technology offers advertisers a concrete product to sell, a task that is easier for them than the selling of ideas or behaviors related to nutrition.

The training of trainers is another important element of the dissemination process. The person entrusted with teaching the technologies to others might be the agricultural extension agent. However, he is generally more farmer/production-oriented and less sensitive to consumer needs. Often information about nutrition appropriate technologies is found in the manual of the primary health care worker. Yet he or she already is overburdened by so many tasks and can not do justice to an additional subject. In addition, the background of the primary health care worker is primarily in medicine and he or she is probably unprepared to deal with the hardware-related aspects of appropriate technology. The home economist is another agent who could disseminate information about these technologies. However, home economists often have limited outreach capabilities. Their numbers are often few in a given country, and they frequently are tied to their institution or demonstration center.

Obviously, new materials and training courses need to be developed to disseminate information about nutrition appropriate technologies. One model might be the UNICEF/Kenya Government Village Technology Unit which acts as a demonstration and training center.[30] It is the goal of the organizers of this Conference, as a Conference follow-up, to produce a curriculum module in nutrition appropriate technology which can be distributed to extension and primary health care workers, home economists, and other change-agents in Asia.

REFERENCES

1. "Intensive Gardening: An Appropriate Technology," Newsletter, League for International Food Education, November, 1976, pp. 1-3.

2. Yang, Y. H., "Home Gardens As A Nutrition Intervention," The Food Institute, East-West Center, Honolulu, Hawaii, 1976.

3. "Traditional Home Gardens and Nutrition Self Reliance," Newsletter, League for International Food Education, April, 1979, pp. 3-4.

4. Martin, Franklin W. and Ruberte, Ruth, Survival and Subsistance in the Tropics, Mayaguez Institute of Tropical Agriculture, Mayaguez, Puerto Rico.

5. Pacey, Arnold, Gardening for Better Nutrition, OXFAM, Intermediate Technology Publications, Ltd., London, England, 1978.

6. U.S.D.A./A.I.D. Homemaking Handbook--for Village Workers in Many Countries, Extension Service, U.S.D.A. in cooperation with A.I.D., Washington, DC, PA-953, 1971, 237 pp.

7. Bates, R. P., "Limited Resource Food Processing and Utilization," paper presented at a Symposium entitled "Energy Dimensions of Small-Scale Food Processing," A.A.A.S. Annual Meeting, Toronto, January 3-8, 1981.

8. McDowell, Jim, "Appropriate Technologies for Tackling Malnourishment," Contact, #45, June, 1978, p. 4.

9. Steinkraus, Dr. Keith H., "Potential Contributions of Indigenous Fermented Foods to Conservation of Energy in Food Processing," paper presented at a Symposium entitled, "Energy Dimensions of Small-Scale Food Processing," A.A.A.S. Annual Meeting, Toronto, January 3-8, 1981, p. 3.

10. Ibid., p. 8.

11. O'Kelly, Elizabeth, Simple Techniques for Rural Women in Bangladesh, UNICEF, Women's Development Programme, 1977, 48 pp.

12. UNICEF/Kenya Government, Appropriate Village Technology for Basic Services, UNICEF, Eastern Africa Regional Office (date unknown), 55 pp.

13. Pinson, G. S., "A Wooden Hand-Held Maize Sheller," Rural Technology Guide #1, Tropical Products Institute, 1977.

14. Pinson, G. S., "A Pedal-operated Grain Mill," Rural Technology Guide #5, Tropical Products Institute, 1979.

15. Carr, Marilyn, Appropriate Technology for African Women, United Nations, Agency for International Development, 1978, 89 pp.

16. Barret, Fred F., "Energy Saving Technologies for Small-Scale Food Processing, paper presented at a Symposium entitled "Energy Dimensions of Small-Scale Food Processing," A.A.A.S. Annual Meeting, Toronto, January 3-8, 1981.

17. Cameron, Margaret and Hofvander, Yngve, Manual on Feeding Infants and Young Children, Protein Calorie Advisory Group of the United Nations, 2nd edition, December 1976, 184 pp.

18. Ministry of Health and Social Welfare, Breastfeeding, a Practical Guide to Management of Lactation, Ministry of Health and Social Welfare, Liberia (no date), 12 pp.

19. Cameron, Margaret and Hofvander, Yngve, Manual on Feeding Infants and Young Children, p. 106.

20. Venkatachalam, P.S. and Rebello, L. M., Nutrition for Mother and Child. National Institute of Nutrition, Hyderabad, India, 1978.

21. Soetarto, Dr. Asmira; Hendrata, Dr. Lukas; Rohde, Dr. Jon E.; Satoto, Dr; Sardjimin, Dr. Tony, UPGK Programme Manual, Ministry of Health, Indonesia, 42 pp.

22. Israel, Ron (editor), Workshop Report for Helen Keller International, International Nutrition Communication Service, Newton, MA, August, 1980, 38 pp.

23. U.S.D.A./A.I.D., Homemaking Handbook.

24. Personal communication with Dr. Tom Cooke, Manoff International.

25. Nutrition Center of the Philippines, The Barangay Nutrition Manual, Nutrition Center of the Philippines, Makati, Metro Manila, 1977, pp. 28-129.

26. Carr, Marily, Appropriate Technology for African Women.

27. "Small Wells Manual," A.I.D. Resource Report, March/April, 1980, #9.

28. Nutrition Unit, Ministry of Health, The Sun, Water and Bread, Report on an Appropriate Technology Workshop in Food and Nutrition, Ministry of Health, 1978, p. 31.

29. Dulansey, Maryanne, "Can Technology Help Women Feed Their Families?" paper prepared for the A.A.A.S. Workshop on Women and Development, March 26-27, 1979, Brookings Institute, Washington, DC, 8 pp.

30. UNICEF/Kenya Government, Appropriate Village Technology for Basic Services.

APPROPRIATE TECHNOLOGY IN POLICIES AND PROGRAMS FOR DEALING WITH MALNOURISHMENT

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APPROPRIATE TECHNOLOGY IN POLICIES AND PROGRAMS FOR DEALING WITH MALNOURISHMENT

SUMMARY

Defining malnourishment as a symptom of the cumulation of causative factors inherent in a deprived and disadvantaged life situation, this paper points to the need for a comprehensive community-level approach embodying, not only the nutritional, i.e., food-related factors, but also the other equally important aspects such as the family's energy balance, and the problems of preventable illness.

The paper goes on to discuss approaches based on applications of technology in a manner suitable for community-level activity, and which will be feasible within the existing constraints of the life situation, and appropriate within the local context.

Practical details as to the nature of a program support organization are outlined, together with ideas as to how the necessary innovations might be introduced and their widespread extension achieved.

Potential benefits at both community and national level are indicated, and the need for essentially practical commitment at national level, and on the part of aid agencies is emphasized.

INTRODUCTION

The problem of malnourishment is probably the most serious affecting the children of the developing world today. Due to rapid population growth and the continuing high level of incidence of malnutrition, it is likely that there are now twice as many malnourished children in the developing world as there were thirty or forty years ago when widespread intervention first began.

Malnutrition is a symptom of a deprived and disadvantaged life situation. It occurs as the end result of the action and interaction of a wide range of causative factors within the life environment. Dealing with malnutrition must, therefore, involve dealing with many aspects of the life environment itself.

Amongst the factors to be tackled is the nutrition factor, i.e., the provision of an adequate diet. This is by no means the only factor, since to this must be added those which affect the adequacy of the diet and of its utilization, - the efficiency of the food production or procurement and preparation processes, - the energy demand and possible debilitation created by the strenuous work activities necessary for survival, - and the stress and inhibition of food intake and food assimilation imposed by frequent illnesses, particularly those which cause anorexia, diarrhea, vomiting, malabsorption, and febrile conditions. Added to these are the socio-economic problems concomitant upon a disadvantaged life style in an inimical environment, and the adverse effects of such problems upon human relationships and family life.

It is impossible to deal with these problems by outside intervention only. Meaningful responses can come only from within the community through the involvement and participation of the people themselves in the process of developing and upgrading their own life situation. Approaches through community involvement are now widely recognised and accepted.

To initiate and sustain the development process at people-level there is need to utilize improved means for performing tasks and for dealing with problems, - means which can provide a significant improvement over existing methods, i.e., to use a general term, there is need for improved technology. However, the technology must be such as can be applied by the people, and must be relevant to, and feasible within, their existing life situation, bearing in mind the many constraints upon energy and material resources which that life situation imposes. In short, there is a need for technology which is appropriate to this context.

This paper is concerned with the practical considerations involved in the planning and implementation of programs which seek to help people to apply appropriate technology to deal with problems inherent in their life situation and, thereby, significantly reduce the risk of malnourishment.

ACTION ON MALNOURISHMENT AT PEOPLE-LEVEL

Many factors must be considered in attempting to improve the life situation in a manner which will significantly reduce the risk of malnourishment, but the problem areas can be seen to fall into three main categories.

Firstly, there is the problem of the family's time/energy balance sheet, i.e., the amount of time and energy expended on all the activities necessary for survival, as compared to the energy obtained from energy-gathering activities, e.g., food production and fuel gathering. This balance, and its seasonal variations, has important connotations, not only for overall nutritional status, but also for maternal nutrition, with its obvious consequences for fetal nutrition and lactation capability (1), (2), (3). The vicious cycle, induced by energy-draining drudgery imposed on girls and mothers, leading in combination with frequent illness, to nutritional stunting, and also to nutritional stress during pregnancy, and low-birth-weight babies, needs to be broken (4). Application of technology in a manner which can reduce energy demand, and thus improve the energy balance sheet will, therefore, be necessary.

Secondly, the problem of improving the overall nutrient productivity and cost-effectiveness of the food production and preparation processes represents an important area for attention. These processes, of course, form important elements in the overall energy balance, but in addition, there are the matters of efficiency of land use, efficiency of conservation of harvested crops, and minimization of the cost of agricultural inputs. For example, technologies which create dependence on synthetic fertilizers or pesticides and which, ultimately, increase the cost of food, are unlikely to be seen to be appropriate, yet many are currently being promoted. On the other hand, approaches which encourage maximum utilization of ecological relationships and biological pest control, and which are also environmentally protective, seem likely to offer more appropriate alternatives.

Thirdly, there is the problem of reducing the risk of illness. Most of the illnesses which are predominent in the primary causation of malnourishment, particularly those transmitted by the fecal/oral route, are in theory, preventable by approaches which can break the transmission chain (4), (5), (6). An excellent example of a technology which is appropriate in this field is the young child's squatting plate developed by Professor Soysa here in Sri Lanka. This simple device has the potential to greatly reduce the fecal contamination of the home environment. Other technology in this field will relate to the improvement of the availability of clean water, and to more hygienic food handling. Many methods of cereal threshing, for example, particularly those involving treading by animals or flailing on contaminated ground, are suspect. Adoption of improved technology in this area would be desirable.

The rapidly escalating resurgence of malaria due to vector resistance caused by indiscriminate use of agricultural insecticides, presents a serious challenge, since malaria is not only a serious baby killer, but placental infection can result in low-birth-weight babies and premature delivery (7).

The wide-ranging causation pattern of malnourishment encompasses virtually all of the interwoven aspects which make up the fabric of life. It, therefore, demands a comprehensive response. Any program which attempts to deal with specific aspects of the life situation in isolation from others with which they are inextricably linked, will be likely to be artificial and probably ineffective. The people, who will be involved in the planning and the practical application of the activity, will see the life pattern as a continuum, and will not divide it into artificial segments such as 'nutrition', 'health', 'environmental sanitation', or 'water supply'. The desirable comprehensive approach should, therefore, be facilitated. The term 'nutrition program' often relates to the purely nutritional, i.e., food-related aspects, and since we are concerned not only with 'nutrition' per se, but with the necessary comprehensive approach, it would seem to make good sense to move away from the term 'nutrition program', and to think, instead, in terms of 'programs to deal with malnourishment'.

INTRODUCING THE APPROPRIATE TECHNOLOGY CONCEPT

Perhaps the best of all guidelines for would-be innovators at people-level are given in the following quotation:

> "Go in search of your people,
> Love them,
> Learn from them,
> Plan with them,
> Serve them,
> Begin with what they know,
> Build on what they have."

The process of initiating and developing appropriate applications of technology should, ideally, consist in interaction with the people in order to achieve an understanding of their problems as they see them, and to go on from there to work out and implement, in partnership with them, appropriate solutions. Regrettably, the sheer numbers of people needing help, and the need for a rapid response does not allow such a leisurely approach, and it becomes necessary to employ some legitimate short cuts. Nevertheless, application of the above precepts should characterize the spirit of any approach.

Having decided to take the appropriate technology approach, the major problem which arises is in the derivation of systems which will permit interaction with the people, the sharing of ideas with them, and communication of ideas and practical information to them. Obviously this task requires an organization which can operate through existing extension or 'people-contact' channels, and which may, in addition, need to develop its own communication channels. Consideration of the detailed nature of the task which such an organization would need to perform will provide some guidelines as to its possible structure.

The Organizational and Support Task

Possible functions for a support organization might include:

1. Promotion of the concept amongst decision-makers and personnel concerned with extension work at community level.
2. Participation in, and/or advising, development planning bodies, and participation in information exchange networks.
3. Establishment and operation of a central reference and information facility.
4. Generation, development, initial functional testing, community-level evaluation, and demonstration of potentially appropriate technology.
5. Conceptual and practical training of extension personnel.
6. Practical training of community-level artisans.
7. Initiation and support of community-level training and demonstration projects.
8. Evaluation of effectiveness of training.
9. Evaluation of progress and effectiveness of community-level projects.
10. Recycling of evaluation data for modification and improvement of methods and approaches.

The nature of the organizational structure required to undertake these functions will vary according to local circumstances, and in relation to the size and ease of movement and communication within the country.

A central unit, dealing with the core functions might support a number of strategically located field units, each of which might cater for demonstration, project establishment, practical training, and the support and servicing of community-level activity. Again, in a very large country, there might be ramification into field sub-units.

Staffing of the core unit, and of the artisan cadre should be on a full-time basis, since the work involved cannot be effectively undertaken by people who already have other (and presumably full-time) duties. This cautionary note applies also to the part-time use of existing extension staff. Most extension services are already very heavily overloaded and unable to achieve adequate coverage in their presently assigned function. If extension staff are to be seconded to the appropriate technology activity, this should be on a full-time basis so that they may devote their full energies to this work.

It is necessary to bear in mind that, because of the unique nature of the activity, the ultimate success or failure of programs will depend entirely upon their credibility within the community. The community itself will be the final arbiter, and future response will depend upon how the community judges the value of the contribution which the program has made. Everything possible must, therefore, be done to establish and maintain the confidence of the community.

Communication of Ideas and Information

The most difficult of all the tasks involved is that of effectively disseminating ideas and practical 'know-how'. It is possible to develop a particular device which may have good possibilities, but it is an entirely different matter to transmit the specifications and method of construction in a manner which will

permit its replication in many communities where visual and mechanical perception may have a different basis, and where practical skills of the nature required may be hard to find. As a result, attempts at replication may fail, or the essence of appropriateness may be lost through lack of attention to important detail.

Instruction manuals embodying sketches and drawings are useful only in situations where the can be read and readily interpreted. For this reason it is necessary to envisage a two-stage communication process - firstly, communication by instruction manual to the artisan cadre, and secondly, from that point, communication to the community through a learning-by-doing approach.

It is also very important that an educational approach, transmitting ideas as to the relevance of specific innovations and their value in life-improvement, should permeate the whole activity. There will also be need for education in the effective use of particular innovations, e.g., the need to point out that a fuel-saving cooking stove will not save any fuel if the fire is allowed to consume a lot of fuel at times when no food is being cooked.

Encouraging the Initial Innovation

Most of the families who need help are already living to the limit of their existing resources. Thus, no matter how much they may be enthused or motivated, they will be unlikely to have the money or resources to expend on something which, to them, must be regarded as an experiment which might or might not work. For this reason 'seed' funds will often be needed to provide the initial subsidy to allow the new ideas to take root in the community.

At the same time, it is very necessary to avoid the paternalistic approach which resulted in the creation of dependence upon outside inputs to the extent that the program could not continue once the external input was withdrawn. Approaches of this nature tend to stultify rather than stimulate local initiative.

There is, in fact, a need to develop a working partnership with the community in which, initially, both the program and the community are co-contributors. If the innovation is worth its salt, a stage can rapidly be reached when the value of the innovation can be seen to be such as to warrant the diversion of scarce family resources to meet the full commitment needed. Approaches of this nature have worked very well in East Africa where, for example, the building of water tanks for roof-collection at individual homes was stimulated by a cooperative effort in which the program provided the cement for the first 50 tanks, and the community provided the labor and other materials. For the next 50, the project provided half of the cement - and so on in a diminishing proportion of subsidy. That community not only went on to build tanks without any subsidy, it also built tanks for many of its members who were too poor to afford their part of the contribution, and also for widows and incapacitated people who could not provide labor. It is this type of reaction which makes the task of community-level intervention so very much worthwhile. That particular community did not stop with the water tanks, but went on, through the use of their own resources to adopt many other improvements according to their own priorities. The people of Karai village in central Kenya have shown that it can be done. The major problem at this stage is not to encourage further innovation, but to prevent enthusiasm running ahead of resources.

Promoting the Spread of Innovation - The Nuclear Project

The idea of the 'pilot project' with its connotation of heavy subsidy and involvement and control by the program, and where it is intended to create a universally

replicable model, is obviously unrealistic for an approach which seeks to achieve adaptation to specific local contexts, and to different cultures and ecological or topographic conditions.

The problem of achieving a rapid initial coverage of a large area is probably best tackled through the 'nuclear project' approach. In this approach the country or area to be covered is divided into various zones on the basis of culture, ecological, or topographic characteristics, and one, or a number, of projects are initiated at strategic locations in each zone. The locations chosen should, ideally, represent natural focii for communication or staging posts on natural communication routes, for example, near to a market or similar places where there is a frequent concentration or movement of people. It is probably wise to avoid demonstrations within the precincts of, say, hospitals or health centers or similar 'remedial' facilities, since appropriate technology should be seen as a positive aspect of life, and not as a 'medicine' to be taken when one is ill.

The nuclear project allows natural diffusion of ideas from one community to its neighbors, and if those ideas are seen to be advantageous they will tend to spread rapidly. Communities anxious to adopt an innovation which they have seen in use by their neighbors should be encouraged to seek help from the program, not only because such help can accelerate their progress, but also, and most importantly, to ensure that the innovation which they wish to adopt can, if necessary, be modified to suit their particular circumstances.

The diffusion process can introduce a rate of progress which will place a very heavy demand on support services, and it cannot be too strongly emphasized that capacity to meet such a demand must be built into the support organization from the outset. Nothing will be more likely to destroy the credibility and the objectives of the program than failure to respond to genuine requests for assistance.

POLICY ASPECTS

There is now a widespread climate of commitment to the concept of community-action programs as a feasible and desirable means to promote development on a self-sufficient and self-reliant basis, and it is essential that this approach should be invoked to deal with one of the most serious problems facing many nations - the problem of malnourishment. This is particularly so because it is not possible to deal with this problem without, at the same time, dealing with the many other problems of the people. The use of indigenously appropriate technology, which offers the only feasible means for dealing with many problems at people-level, also offers potential to promote greater self-sufficiency at national level.

There can be many obvious benefits for the national economy in, for example, food production which is not dependent on massive imports of agri-chemicals, in construction techniques which use indigenous rather than imported materials, and in preventive measures which reduce illness and improve the productivity of the population, without the need for building more and more hospitals, or for continued escalation in the cost of importing curative drugs.

However, apart from the many material advantages likely to arise, perhaps the most valuable advantage, in both human and national terms will derive from the generation of self-confidence and self-reliance and the feeling of human dignity which results when the people are able to say "We did it ourselves!"

However, it also has to be realized that commitment to the idea of indigenously appropriate technology will not necessarily be universally applauded and encouraged. Those in the industrialized world who see the developing world as a potential market for their fertilizers and pesticides and high-priced technology, or who see its health problems as creating a continuing market for their drugs and pharmaceuticals, are unlikely to be over-enthusiastic about indigenous alternatives.

Commitment to the indigenously-appropriate technology approach must go beyond lip service or benign approval. It must extend to serious commitment of funds, personnel, and resources, both at national and international level. In some cases, the provision of funding scope for the appropriate technology approach may well mean the act of faith necessary to divert funds from more palliative activities to those which show promise of more progress through prevention.

CONCLUSION

It would be difficult, if not impossible, to find a more important and more uniquely appropriate focus for the application of indigenously appropriate technology, than on the problem of malnourishment. The ultimate benefit of achieving a significant reduction in the incidence of malnutrition will, of necessity, be accompanied by the many other benefits arising from attrition and removal of the serious problems, which not only generate malnutrition, but which also limit and destroy many of the essential qualities of life for millions of people.

There can be no simple how-to-do-it recipe for promoting and sustaining these programs of intra-community intervention. Each country will need to work out its own approach, based upon its own awareness of its own policies, needs, and potential for action. The guidelines given in this paper are based largely on personal experience in many African countries. As such, they may or may not be relevant, but they are offered for what they may be worth.

Perhaps the best advice to those who are anxious to develop approaches based on these principles, but who are uncertain as to exactly where to begin, is summed up by an anecdote which is essentially African, but which may also carry a certain flavor of Zen. It concerns the newly-born centipede which asked its mother "Which foot do I move first?". The mother's reply was "MOVE!".

REFERENCES

1. Paul, A. A., Muller, E. M. & Whitehead R. G. (1979) Seasonal variations in energy intake, body weight, and skin fold thickness in pregnant and lactating women in rural Gambia. Proceedings of the Nutrition Society, 38, 28A

2. Longhurst, R. & Payne, P. Seasonal Aspects of Nutrition, I.D.S. Development Paper 145, Univ. of Sussex (1979)

3. Whitehead, R. G., et al. (1978) Factors influencing lactation performance in rural Gambian mothers. The Lancet, (ii), 178-181

4. Mata, L. J., & Urrutia, J. J. Infections and infectious diseases in a malnourished population; A long-term prospective field study. Proceeding of XIII Swedish Nutrition Foundation

5. Scrimshaw, N. S., et al. (1968) Interactions of nutrition and infection. World Health Monograph Series No. 57

6. McDowell, J. (1977) Appropriate technologies for tackling malnourishment. Proceedings of joint IUNS/UNICEF/ ICMR Working Conference on Community Action Family Nutrition Programs, 66-76

7. Morley, D. (1973) Paediatric Priorities in the Developing World, Butterworths, p.79

TASK ANALYSIS AND PRIORITIES IN PROGRAMMES TO IMPROVE INFANT FEEDING

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TASK ANALYSIS AND PRIORITIES IN PROGRAMMES

There are many ways of trying to improve the nutrition of young children; one of the most important, of course, is by improving feeding practices. Even here there are many ways that may be relevant in different circumstances, including the use of factory processed foods, minimal mechanical processing at community level, home prepared foods, etc.

All of these, singly or in various combinations, can play roles in different places. However, the present discussion focuses on the question of task analysis to improve methods of educating, persuading, guiding and motivating mothers and parents to produce home-prepared foods for young children for use during the weaning or transitional period.

It is increasingly apparent that there are overwhelming advantages for home-prepared weaning foods. The ingredients are locally available and economical, and there is no chance of producing dependence, as with the use of imported processed food. Additionally, the use of home-prepared foods fits exactly into the concept of primary health care.

Of course, there can be problems. Appropriate ingredients may not be available or can be too costly. There is the undoubted glamour of processed foods for planners, for parents, and for professionals. Something which is in a can or packaged in plastic has a particular appeal and an aura of modernization. In addition, there is the pressure of commercial companies to try to increase their sales.

APPROACHES TO HOME-PREPARED FOODS.

In many cases, approaches to home-prepared weaning foods have been based on inappropriate nutrition education, in part related to a lack of detailed understanding of problems of "culinary mechanics" that the mother has in her kitchen, if she tries to follow advice that is logical from a scientific point-of-view.

If one looks at the history of nutrition education directed towards home-prepared weaning foods over the past few decades, certain features stand out. For example, after World War II, ethnocentricity was widespread, with foreign health professionals often trying to persuade mothers to use foods, utensils, fuel, etc. which were totally inappropriate and out of context culturally and economically. For instance, nutrition education concerning infant feeding emphasized the need to introduce orange juice and the yolk of egg at a few weeks of age. Likewise the methods used in nutrition education tended to be didactic. The tone, context and meaning all emphasized: "I am telling you because I know all about it and you know very little."

In recent years, nutrition education has moved forward toawards greater parental involvement, discussion and interchange of ideas. Similarly, the practical characteristics of weaning foods have been appreciated increasingly. These include certain practical characteristics and some scientific characteristics. (Table I)

(I) HOME-PREPARED WEANING FOODS

(SOME CONSIDERATIONS)

PRACTICAL:	Local Foods
	Cost
	Culture
	Kitchen
SCIENTIFIC:	Nutrients
	(Calories)
	Bacterial Content

Essentially, the need is for local foods at low-cost, which fit into the culture and culinary reality, and supply adequate nutrients, especially compact calories, with a minimal bacterial contamination. (Table II)

(II) HOME-PREPARED WEANING FOODS

(TECHNOLOGICAL CONSIDERATIONS)

Time
Hand Work
Cost (money; fuel)
Contamination
Cultural Attitudes
Responsibility

In addition, the idea of "multimixes", or mixtures of foods which are complementary one to another, especially as far as protein is concerned, came to the forefront. However, it is interesting to see how the emphasis on protein in such multimixes has given way to a more realistic position nowadays, recognized as important, but not necessarily, or even usually, the most important item, which is lacking in the diets of the young child. Instead, it is now known that calories more often are limiting, and carotene-containing foods, especially the dark green leafy vegetables, also are recognized as needing special attention.

Recent trends in young child feeding also have often tried to adapt their preparation to local cooking practices. For example, in Buganda, where foods are cooked in plantain leaf packets (ettu) mothers were encouraged to cook something appropriate for young children in a small separate packet (ettu paste).

On the whole, there has been a move towards an adapatation to local reality and towards new style education by persuasion, motivation and involvement. Classic examples include nutrition rehabilitation units in which mothers become involved in feeding their children with mixtures which they have prepared themselves, but with foods which otherwise they would not have used because of cultural beliefs concerning their harmfulness.

TASK ANALYSIS.

It seems that there is a need for an even closer look at mothers' methods of food preparation by means of task analysis.

In fact, task analysis is indeed a well-established concept in business and industry, where the method has been developed and elaborated since the 1880s. A complex methodology has evolved with detailed consideration of time and motion studies and even new units of movement (therbligs), which are unfamiliar to most health workers.

It would be neither possible nor useful to try to obtain too much detail. However, a task analysis of what the mother is doing from the time she collects the food from the field or from the store, to the time she serves the food and keeps the "left-overs" after the meal, can give very helpful insights of practical relevance.

Another discipline which has used a form of task analysis is cultural anthropology--in the form of participant observation, and child following (following children around all day). Recently, the use of various electronic devices have been developed which can be used to record human activities in the field, although their cost usually makes them quite impracticable.

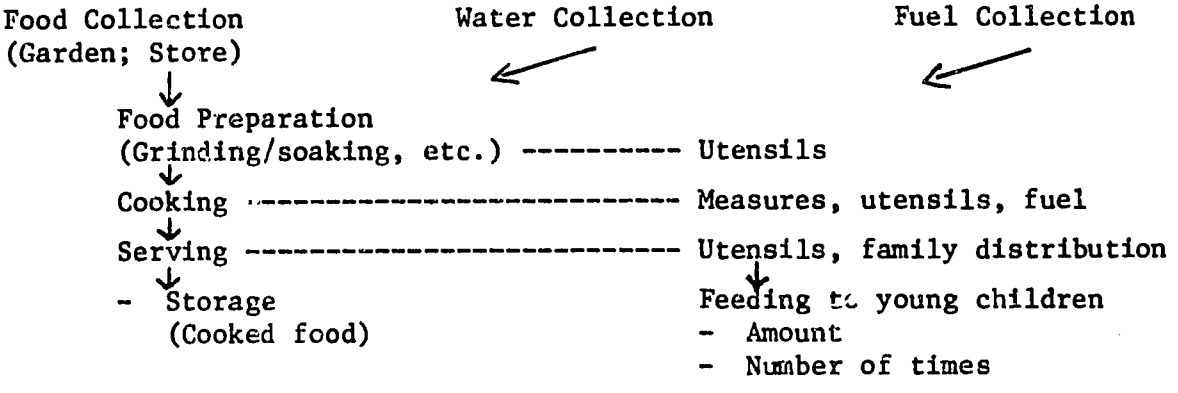
PRACTICAL CONSIDERATIONS

These investigational methods have usually been developed without health workers being sufficiently aware of their existence. In practical task analysis, it is necessary to look into the whole process of food preparation from the collection of the food from the home garden, or from the home store, through the preparation, cooking and feeding, to the storage of cooked foods at the other end of the process. Various matters need to be considered in addition to timing. These include activites needing hard physical work and the cost of different activities, in terms of money and other scarce resources such as fuel. Possible time

of potential bacterial contamination also needs to be noted. Obvious cultural attitudes which may be possible "blocks" to the mother using foods which are actually available may be noted. In addition, information needs to be collected on who is responsible for the preparation of food, how it is distributed, when prepared, and in particular, how it reaches the young child.

These more obvious aspects of task analysis can be summarized in a flow sequence. (Table III)

(III) HOME-PREPARED WEANING FOODS: SOME COMPONENTS IN TASK ANALYSIS



These ideas are quite tentative and preliminary. Several investigators in different parts of the world are currently engaged in trying to see how these suggestions can be modified to produce a practical methodology.

Information about the actual way in which the child receives food is very important, but so difficult to obtain that it can be regarded as a second part of this task analysis. In fact, the complete task analysis might be divided into that of food preparation and that of feeding young children, including the amounts, meal times, snacks, etc.

Plainly the scope of the task analysis can be widened very greatly or can be limited, and one difficulty in devising a practical methodology is how wide one should go, how wide should one's net be spread? These questions will vary with circumstances, but are currently under world investigation.

VALUE OF TASK ANALYSIS.

Considerable information can be obtained from task analysis. (Table IV)

(IV) HOME-PREPARED WEANING FOODS
GUIDANCE FROM TASK ANALYSIS

- Family meal or special food approach
- Focused nutrition education
- Suggestions for culinary appropriate technology

Basically, it should be possible to recognize whether the family meal approach or a special young child food approach is feasible for the particular society. In other words, is the food mixture for the young child going to be coming from the family pot? Or will a special food preparation b e practicable or necessary?

Secondly, task analysis enables a more specific and realistic focus as regarding nutrition education. By knowing which aspects of the mother's tasks are difficult, it may be possible to suggest realistic practical methods to help.

Thirdly, it may be feasible to suggest various "appropriate culinary technologies"--that is to say minor changes in kitchen apparatus which mothers already are using and which will conform to tradition and culture, but which will be easier to use and will minimize the more time-consuming, expensive, or physically-exhausting parts of the whole process.

FUTURE EMPHASIS.

An important need in task analysis is to emphasize and to realize its practical and scientific value. This process is much more than observing mothers cooking. There is a need to devise a scientific methodology for the whole process, and a start is being made in this direction. (Table V)

(V) FUTURE EMPHASIS IN TASK ANALYSIS

-Scientific value of task analysis

-Need for practical methodology

Many of the methods used by these mothers are ancient and time-tested. Task analysis may sometimes show that a mother is doing the very best that is possible in particular circumstances. Certainly, health workers and nutritionists have much to learn from village mothers. At the same time, no culture is completely right and perfect, and the scientific technological community may be able to suggest some relevant, economical and realistic methods to imporve traditional practices of mothers.

In other words, task analysis should not be envisaged only as leading to some type of assistance to mothers, but also leading to some type of cultural synthesis between the wisdom of the traditional practices and new suggestions of simple, low-cost approapriate technologies, which practical scientific nutritionists may be able to devise.

NUTRITION APPROPRIATE TECHNOLOGY TASK ANALYSIS

A CASE STUDY IN BANGLADESH

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NUTRITION APPROPRIATE TECHNOLOGY TASK ANALYSIS

A CASE STUDY IN BANGLADESH

Task analysis for the development of appropriate nutrition technology is a relatively new idea. A preliminary paper written by the Jelliffes on Task Analysis and Priority in Programmes to Improve Infant Feeding is the first and only paper written on the subject. There, the authors emphasize the need of task analysis to improve methods of educating, persuading, guiding and motivating mothers and parents to produce home-made weaning foods for young children for use in the transitional period. The development of home-made prepared weaning food and promoting its use as an appropriate technology for nutrition can best be studied by examining the tasks surrounding food preparation and feeding.

The present paper aims to analyse the mother's tasks in rural Bangladesh for identifying resources and strategies which can be effectively utilised for making home-made weaning foods and encouraging its use in young children. The constraints, both cultural and resource-related are also noted because failure to recognise such constraints will make nutrition education inadequate; in addition, it also runs the risk of rejection.

METHODOLOGY

The Jelliffes have pointed out that no methodology was available for doing task analysis for improving infant feeding; the authors also suggested a guideline for such a study, which could be field tested in different countries. The essential features of the guideline are (1) look into practical and scientific aspects of home-made weaning foods, i.e., find out local foods, cost, kitchen facilities as well as nutrients (calories) and bacterial content, and (2) look into the process of food preparation and feeding to find out time, cost, type of work, possible time of bacterial contamination, by studying different components of food preparation and feeding tasks.

Theoretically, by following this guideline one can collect a great deal of information on food preparation and feeding tasks. The question is how to make use of the guideline in the field situation.

The Jelliffes have referred to the participant observation method of anthropologists for collecting data on the subject. but have not elaborated on it. Being an anthropologist I believe that, to understand how mothers prepare the food and feed the family, the participant observation technique is the most useful method. I might mention here that in planning the role of a participant observer, I could not fill out a prepared questionnaire or planned schedule for recording information on foods and tasks.

It may be pertinent here to quote the remarks of an anthropologist named Hortense Powdermaker. In speaking of her field work experience, she writes, "it is not possible to work on people as if they were physical or chemical elements which could be arranged according to predetermined plan (1966:10)".

In the field, the first job is to be accepted by the female group and not to act as an expert who knows more than the mothers do. Information on food-related behavior can be gathered with much ease if the researcher, instead of denigrating certain negative aspects, emphasizes the fact that she is interested in knowing how the village mother prepares her food, and problems she faces.

The village mothers often got bewildered that I, being a woman, did not know the culinary practises. In such a situation I said, "in the city where we live, food preparation varies somewhat from yours and therefore I am interested in knowing about the process you use in preparing foods at home". The mothers were not only satisfied, but felt proud that they too could offer something to a city-bred educated woman.

TASK ANALYSIS OF MOTHERS AND MOTHER SURROGATES

For women of Bangladesh, food preparation and feeding are two most important tasks. From an early age, girls learn the art of cooking by assisting mothers in the process of food preparation. A pre-teen or a teen-age daughter does most of the cutting and washing and also assists the mother in the serving of the food. It is, therefore, necessary that we look into the tasks of not only the mother but also the mother surrogates. While preparing food, the mother has to cope with many constraints.

FOOD

The major food resource available in a household is rice. Rice accounts for 80 percent of the calories and 70 percent of the dietary protein consumption. Animal protein, mainly in the form of fish, is dependent on the purchasing power of the head of household and occasionally on seasonal fishing. Other foods used as side-dishes include a variety of vegetables, greens and lentils.

Rice is generally boiled; in most parts of Bangladesh the water used for boiling is discarded after the rice is cooked, but in northern Bangladesh water is dried up. In addition to plain boiling, rice is also used in Khichuri - a rice lentil mixture often flavored with coconut and "Kheer", rice cooked in milk, followed with gur and coconut. Rice is also prepared as "Jau" or gruel if the supply is limited. A culinary practice in rice cooking is putting a large spoonful of boiling rice and water in a separate pot for fermentation. This pot is generally kept near the stove for a few days before it is cooked for eating.

The cooking of a side-dish (curry) requires the grinding of spices and the cutting and washing of vegetables. The curry eaten with rice has a gravy which in most cases is spicy hot. In one of the study villages the sauce was made with the discarded rice water to which onion turmeric and vegetables were added. Identification of strategies of these types can provide useful information in our plan of developing home-prepared weaning foods.

CONSTRAINTS IN FOOD PREPARATION

The two major constraints faced by the Bangladeshi mothers are (1) fuel, and (2) water. While part of the fuel is obtained from collecting dried leaves and twigs, a significant portion of the fuel often has to be bought. In homes where there are no young children, collection of fuel becomes difficult because a young wife is not allowed to go too far from the house. Because of the high price of fuel, women try to conserve energy by reducing the number of items of cooking. During harvesting season, the fuel situation improves if the family harvests rice. The husk of the rice is a good source of fuel both for processing and the cooking of food (Film).

Part of bacterial contamination of food can be attributed to the limited availability of water in the kitchen for washing utensils and food. Although water from hand pumps is generally used for drinking, often circumstances such as difficulty crossing a single bamboo bridge, a long walk from home and the taste of iron in the water make alternative sources such as surface water more desireable for drinking as well as other purposes.

FEEDING TASK

Food is prepared twice a day, either in the late morning and early evening or early noon and evening. One meal, either for the late morning or noon meal is used from the previous cooking.

Before serving the meal, the eating area or the floor is swept clean - this is considered more important than careful washing of utensils or hands; before the noon meal, taking a bath is routine. Both sweeping of floors and the custom of taking a bath before the noon meal can be considered rituals because these tasks are carried out religiously. The family meal has two sittings, one for children and adult males and the other for adult females and very young children who need attention. The children belonging to the transitional high risk age group (6 months - 18 months) do not share the family meal.

CULTURAL CONSTRAINTS

In Bangladesh, the general belief among mothers is that the child is not ready to eat any solid food until some biological signals begin to appear.

These signals are:

(1) Ability to walk
(2) Shows sufficient degree of manual dexterity in feeding self.
(3) Appearance of milk teeth.
(4) Can name the food or part of the desired food.

Because such signals are considered essential before the introduction of solid food, a child less than two does not get any significant share of the family meal. This results in severe caloric deprivation and makes it all the more essential to find ways to feed the young children of this high risk group. Since high risk or transitional age group children suffer caloric deprivation due to cultural practices rather than other factors, we need to focus on nutrition eduction which will promote the use of weaning food.

So far, the approaches to this type of nutrition education have depicted "lack of understanding of the culinary practices" as the Jelliffes have already pointed out. The conclusions drawn from a study of Task Analysis can be highly useful in developing appropriate nutrition education.

The following conclusions can be drawn from our study in Bangladesh.

(1) Nutritional deficiency in the transitional age group (6 months - 2 years) is more amenable to educational efforts.

(2) Cultural constraints rather than food availability is responsible for the absence of weaning food.

(3) Rice has the potential for becoming the base of weaning food because it is the most available food item, is believed to be free of negative properties, and culinary practises used in cooking rice could be used in the preparation of weaning food.

(4) Weaning food can come out of the family cooking pot before the food is fully cooked. The custom of separating a big spoonful of rice and water for preparing "Kanji" could be used with other available ingredients, and a soft weaning food can be prepared.

(5) A knowledge of food categories is essential because in making home-prepared weaning foods, careful attention should be given to it.

NEW FOCUS IN NUTRITION EDUCATION

Nutrition education for promoting weaning foods should take note of the folowing:

(1) Education is not a one-way process, and mothers are not to be considered ignorant. Mother's knowledge needs to be synthesized with the wisdom of the scientists. Appropriate culinary technology for developing suitable weaning food should be the outcome of such synthesis.

(2) Knowledge on strategies and constraints surrounding food preparation is needed because when planning home-made weaning foods, these factors should be taken into consideration.

(3) Nutrition education needs to be integrated with the diarrhoea prevention programme because it is mainly the fear of diarrhoea which delays the introduction of solid foods in the diet of the young children.

THE RELATIONSHIP OF CHILREN'S CIRCUMSTANCES TO NUTRITIONAL PROBLEMS AS OBSERVED IN LALITPUR DISTRICT, NEPAL

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INTRODUCTION

The International Year of the Child -- 1979. How much meaning will 1979 have for the 8.1 million children in Nepal? --- for the estimated 124,000 clinically severely malnourished children?(1) What are the happenings in the small world of children in Nepal which affect their nutritional status positively or negatively? Perhaps some observations of present childhood situations can give direction to the search for answers, not just academic answers, but answers which the children could affirm and can benefit from personally and for the sake of society. These observations will be limited primarily to Lalitpur District, within the Kathmandu Valley and in the hilly areas two days walk to the South.

THE HERITAGE

A child can be thought of as a gift to his parents, wealth with growing possibilities, an investment for the present and the future. He arrives as a helpless newborn, completely dependent, severed from his carefree existence in the womb. He is exposed to the whims of a cold and very different world unless someone cares about what he can become, cares enough to nourish his body, his mind, and his spirit.

Fortunately for nearly every baby in Nepal there is continued warmth to be found as he is cuddled at his mother's breast. Hopefully his mother will give him the perfect nourishment for newborns, colostrum, to fortify him until her milk comes in. For in addition to giving a good start nutritionally to the baby, these early feedings will set the pace and length of lactation for the benefit of the mother and the child.(2) For several months postpartum, the mother and child should continue to be thought of as a unit. Anything which separates the child from his mother will be detrimental to the health of both.

THE RESOURCES

All Nepali mothers love their babies and want to be good mothers. They are supported in this role by other members of the family and by the traditional birth attendants (TBA) who are usually experienced women, professional in their own right, who have keen insights into the needs of new mothers.(3) They by their very presence give encouragement so necessary for aiding mothers during the stressful time of delivery and later also in the celebration of fulfillment.

The mother and her baby. 0-6 months.

The well-nourished, healthy, happy mother is equipped with everything she needs to fully contribute to the best welfare of her baby. She has a heart full of love, a lap, and breasts which contribute security, warmth, and nourishment, hands which comfort, and a face which is the expressive first "book" the baby will read. Because of these excellent maternal qualities, most babies thrive well and are a picture of health until about the sixth

month of life, for until this time, diet-wise, mother's breast milk is sufficient and the only food needed.(4) Why is it then that some babies thrive and others fail to thrive? Perhaps these actual situations would bring to light some answers, and more questions.

Situation A. The mother with her fretting five-day old baby was sitting in the sun by the roadside. The baby looked a bit thin and dehydrated. The mother explained that she didn't have sufficient milk and that what she had was "spoiled" so she had been feeding the baby glucose biscuits mixed with water. Upon examination, it became obvious that the mother had plenty of milk (the nurse got an eyefull!); her breasts were full. The mother was inexperienced about how to hold the baby so that he could grip the nipple and breathe regularly while sucking.

Situation B. The new mother proudly showed her most recent baby, a dimpled two-month old girl. The baby had just been massaged with oil and was now relaxing in the sunshine as she lay on her mother's lap. The mother explained that she had not had enough milk for her first child but this time she had more than enough -- perhaps because she ate more green leafy vegetables and dal regularly since the first week -- as was suggested to her during her antenatal visits and by the TBA. "I feel stronger" she remarked.

Situation C. The middle-aged mother carrying a four-month old chubby baby stopped on the mountain path to enquire, "What should I do about my baby's diarrhea?" In answer to the question, "How many loose stools does the baby have?", she replied, "Only 2-3 now but last week he had 10-12 one day." The mother was asked, "What did you give the baby for his diarrhea?". She answered, "I kept on feeding him breastmilk". When this mother understood that she had given the best first treatment for infantile diarrhea, her face lit up with pleasure and satisfaction.

Situation D. Several family members were sitting on a large mat in front of their four-storied house. The young mother was busy feeding her 4½ month old baby from a bottle which was of flat, heart-shaped design. The narrow mouth was fitted with a rubber nipple. The mother commented that the baby had had diarrhea and had started to lose weight. She willingly showed the bottle which was ringed with discolored milk and dirt inside and outside. Her husband had suggested that she use the bottle; he had brought home an attractively illustrated tin of baby formula saying, "This is what babies in the city are fed". Upon gleaning that the bottle was the likely cause of the baby's diarrhea, the old grandfather loudly commented, "I told her bottle feeding was an unnatural way to feed a baby!"

Most new mothers in Nepal, through long observation, know exactly how to handle and care for babies. Occasionally though, one finds a mother who does not know how to position the baby for breast feeding. If she is not successful, and no one comes to her aid, she may in desperation feed moistened

glucose biscuits, rice porridge, or other such foods, even while bearing the agony of engorged breasts.

A similar agony is borne by those mothers whose husbands want them to change to bottle feeding. Those who later wisely return to breast feeding are relieved and feel satisfaction in functioning again as the source of nourishment for the baby. Feeding bottles in a village situation do pose a threat to the life of the baby (some babies have died)(5,6); there is no way they can be properly cleaned. Very soiled blouses, unbathed bodies, and jewelry can also contribute to short bouts of diarrhea in even breast fed babies when these reach the baby's mouth. But one practice which every mother performs with skill is the oiling of the baby, the nutritional side benefit being that the baby gets his full requirement of vitamin D while exposed to the sun. And although most green leafy vegetables are taboo for new mothers, there are some which health workers and TBA can promote for good nutritional results.

More observations could be recorded, e.g., that the too-early feeding of glucose, or other liquids and solids to the baby serves as a depressant on lactation as well as exposing the baby to dietary infections at a very vulnerable age; that mother's milk is the perfect food which adjusts according to the child's individual needs(7); and that breastmilk is the most economical dietary and reduces chance of costly illness, etc.(8,5) But let us move on to the child who is increasing in independence and nutritional needs.

The mother and her child. 6-71 months.

By the time the child reaches six months of age, the requirement for calories, protein and other nutrients begins to exceed what the mother can supply in her breast milk. The store of fetal iron being exhausted, the child now needs iron-rich foods. If these include green leafy vegetables and pulses the requirements of vitamins A, C, and B-complex can generally be met -- if these foods reach the child's stomach and are fully utilized. But here is where some problems can arise. Where the mother understands that her child's stomach is small and can hold just so much at a time and therefore must be fed more frequently, then the daily 2-meal starvation route will be changed to a 5-6 small meals regime. In addition, if the mother is willing to prepare appropriate foods for her child, foods which have less bulk(6) and which her semi-toothless child can manage, another hurdle has been crossed. The traditional methods of dry roasting and grinding cereal grains and pulses, to be used to make porridges and breads, are excellent, one result being "Sarbottam Pitho" (Super Flour: 50% soyabeans, 25% wheat, 25% corn, or substitutions; roasted and ground into flour.) Such foods have reduced bulk, retain the nutrient content(9), store well, and smell and taste good. Most families grow all the items needed to make nutritionally excellent supplements which can complement the nutrients obtained in the two meals the children share with their parents. Those who need to buy the items will find that there is remarkably little expense involved. (For instance, 100 grams of homemade "Sarbottam Pitho" costs only 34 paisa even if all the ingredients must be bought!) (Appendix I.).

There may be regional and local problems of food scarcity, and feeding patterns, environmental, cultural, and sociological factors which influence a child's dietary intake and hence his nutritional status. But the most sensitive factors and the most illusive to fully identify and suggest answers to are these --- 1) that parents (mothers, fathers, surrogate parents, etc.) obey their children in matters dealing with or related to food intake and 2) that mothers in particular are confused by the differing counsel given by a multitude of advisors (mothers-in-law, "jhankri" (witch doctor), traditional doctor and birth attendant, health workers, etc.). Let us now look briefly into some of the situations facing young children.

Situation A. The nine-month old girl had obviously lost a lot of weight and was very fretful ("runche laageko"). In answer to a question about food, her mother said that she had refused the rice at the rice feeding ceremony and had so far not eaten any solid foods. "She hasn't asked for any food," remarked her mother, quite convinced that her little girl's present problem had been caused by contact with a pregnant woman and had no connection with food. There were plans to have the local "jhankri" transfer the harmful spirit in the sick child into an image made out of cow dung.

Situation B. The grandmother proudly showed off her fat thirteen-month old granddaughter. But the mother with great concern said, "My daughter had been able to walk short distances but for two months now she only sits." The dietary history revealed that the child was eating lots of the traditional rice porridge and biscuits in addition to breastmilk. This provided plenty of calories (from the clarified butter and sugar) but insufficient protein, iron, B-complex and other nutrients. Already the child had slight pedal edema and small Bitot's spots.

Situation C. The father of the marasmic two-year-old was very displeased. He kept insisting that an injection must be given to his very thin, weak child. When asked what the child was eating, the father proudly showed the baby food tin which depicted a fat baby eating the product. It had cost him one-fifth of his monthly wages. The food the child received amounted to a starvation ration. The mother listened attentively to instructions on how to make a food which would be more nutritious at a fraction of the cost of the tinned food --- using the foods available in the home --- soyabeans, wheat, and corn. She said happily, "We have everything needed to make the "Sarbottam Pitho"." But the father kept turning the tin around in his hands while still insisting on the injection.

Situation D. The mother in the south hills proudly showed her sturdy little girl, while saying, "You should have seen her three months ago. She was very thin and irritable." In reply to "What have you done for her?" she said, "The Village Health Worker told me to roast and grind whatever cereal grains and pulses I had in the house and to make a porridge for her. I used white beans, black gram, corn, and

millet." To the question, "Do you have a grinding stone?" she replied, "The water mill is only two hours walk from here. When I take corn to be ground I also get the "Sarbottam Pitho" made."

There are several expressions used repeatedly by parents of undernourished or ill children. When a child refuses to eat, it is said, "His spirit is not hungry."; "He doesn't want to eat."; "He doesn't obey me when I tell him to eat." And that seems to settle the matter! When the child is ill or has lost his appetite, instead of encouraging the child to eat, it is said, "The child hasn't asked for food."; "He hasn't asked for water." and no food is therefore offered. But if the child asks for a certain food, even an inappropriate food, likely he will be given it, e.g. a child with bad diarrhea will be given a green chilli pepper because "He asked for it." or a sour plum because "He wanted it." Do parents obey their children because of a "twisted love" as one lady health worker expressed it? How can it be that a child can suffer starvation in a home that has food enough to sell? Is it because "He hasn't asked for food" or are there hidden reasons --- beliefs that a curse has been put on the child or some such explanation? These reasons need to be sought out --- for the sake of small children who need to eat regularly whether they want to or not.

Too often non-thought-through dietary changes can leave behind small, malnourished sufferers. The children, who have been given the bakery bread, biscuits, and other foods made from highly refined flours and sugar, to the exclusion of wholesome traditional foods, accept these foods and even become habituated to them. Advertising and the example of urban society have brought additional nutritional problems where there are too many already. Usually the truly traditional foods have more positive than negative features and these need to be searched for and retained or brought back into use. For example, "gundruk," (fermented leaves, dried), "masyaura" (mixture of ground black gram and colocasi stems, dried in small lumps), "Sarbottam Pitho", unpolished rice, and certain green leaves have been analyzed and proven to be excellent nutritionally (Appendix II.). Persons both from the city and from villages are regaining their respect for these foods and subsequently their own self-respect for what they can do for themselves --- without dependency on commercially produced imported foods. Mothers especially need encouragement in their responsibility of providing appropriate food for their families. Health Workers on all levels can play an invaluable supportive role in this. Children thrive or suffer according to the food choices and beliefs of their parents.

Child/mother/family studies.

There is value in spending time with families, with listening, observing and learning from them. It is difficult for health workers in institutions to do this --- there is always the pressure of the immediate situation. But for those who work out in the community the collage of impressions must of necessity lead one to see people as individuals in community, free, yet bound by many customs and the hard realities of life. There may be an initial amazement that more attention is sometimes paid to the diet or illness of a buffalo than to that of the small undernourished child in the

same family. Certainly there needs to be a growing respect for the fortitude of mothers and children and for the expectation of the fathers.

Through village health work, home visiting, and surveys (one being a year-long nutrition survey), it was found that many mothers simply lacked the necessary knowledge about the relationship of food to the health of their children. Small children were not being fed often enough, many of the foods given were inappropriate to the age and condition of the children, and children's mealtimes were usually unsupervised. Therefore, as an additional educational thrust, in 1974 (in Chapagaon) a small Nutrition Rehabilitation Center (NRC) which could accommodate four mothers was begun on a trial basis.(10) Its aim was to teach mothers of malnourished children how to use local foods and other resources in the rehabilitation of their children so that they in turn could teach other mothers in their home areas. The case studies which will be presented are of children who have recently lived with their mothers at the NRC. The children all had to be re-initiated into the art of eating, not an easy task. They progressed to the point of eating two meals with their mothers and 3-4 small supplementary meals, including "Sarbottam Pitho" porridge sometimes with, sometimes without green, leafy vegetables incorporated into it. (Mothers are required to bring foods from home for themselves.) The success of the NRC depends in large measure on the rapport established between the mother and the staff person. Patient, and understanding caring coupled with loving perserverance plays just as important a part as regular, appropriate, nutritious food.

CASE STUDY A. (NRC Admissions Chart No. 182.)

Tulku Yonjan - male	Mother	Father
Age - 25 months	Age - 27 years	Farmer
Weight - 7.0 kg	Pregnancies - 4	Day labourer
Height - 73 cm	Living children- 2	
UAC. ** - red	Deceased " - 2	
	(at 15 and 24 mo.)	

Degree of undernutrition* - 1°

Why the mother came to the NRC: (a two hour walk from home)

The mother came on the advice of another mother. She was concerned that he had become extremely thin, and that he cried constantly. She remarked that he refused to eat and had recurring bouts of diarrhea (similar to what had happened to her deceased children).

Condition on arrival at the NRC: Marasmic, with chronic diarrhea.

There were signs of apathy; hair was thin and with dyspigmentation; dermatitis; muscle wasting (arms weak; legs unable to support the child); constant crying, and diarrhea.

* According to Harvard Standard, Height for Weight.

** UAC (Upper Arm Circumference) Tape
Green section = well nourished
Yellow section = borderline
Red section = severely undernourished

Reason for illness according to the mother:

"While I was on my way to do "puja" (worship), my older sister's child, who was "sukuwaa rog laageko" (marasmic) ate rice from my child's plate. This caused my child to get the same illness."

What advice the mother received from others concerning local treatment:

The "jhankri" (witchdoctor) said that the child had the "drying-up disease" and that Rs. 5 should be given. Also an image of a child should be formed out of cow dung so that the child's illness could be transferred into the image. Even though this was done the child continued to get worse.

Home feeding pattern and foods available:

Morning - rice, buffalo milk, beans
Snack - wheat bread, milk, rice
Evening - rice, roasted wheat, potatoes

Family circumstances:

Four persons are in the household and enough food is grown to last for 10 months. There is no latrine. The house is freshly mudded only three times a month but other cleaning is done every 2-3 days. If the child is well he is bathed once a week.

Condition of the child at the time of discharge:

He has steadily gained weight for five days, from 7.0 to 7.5 kg. and had recovered from the diarrhea by the second day and now is accustomed to smiling instead of crying. Since there had arisen a problem in the home and because the child "wanted to go home", the mother and child left the NRC rather prematurely.

CASE STUDY B AND b., TWO BROTHERS. (NRC Admission Chart Nos. 185,186).

Ram Bdr. (B)	Hom Bdr. (b)	Mother	Father
Age - 20 Mo.	Age - 60 mo.	Age - 36 yrs.	Farmer
Weight - 6.5 kg	Weight - 12 kg	Pregnancies - 5	
Height - 74 cm	Height - 95 cm	Living children - 4	
UAC - red	UAC - yellow	Deceased " - 1	
Degree of under-nutrition - 2^{o}	Degree of under-nutrition - 1^{o}	(at age 5 w/fever)	

Why the mother came to the NRC:

She brought her two sons after she finally got permission from her husband who said, "If they die, they die." She really wanted to get help for the children.

Condition on arrival: Both were marasmic pre-kwashiorkor.

Ram Bdr. - Pale, hair changes (dry staring, dyspigmentation, thin, easily pluckable), small Bitot's spots, inelastic skin, calf tenderness, muscle wasting, very slight pedal edema. He had no strength in his arms or legs and didn't want to eat or play. Chronic diarrhea.

Hom Bdr. - Pale, hair changes, Bitot's spots with corneal involvement in one eye, dermatitis with desquamation, pot-bellied, calf and bone tenderness, muscle wasting, and edema of the face. He was very upset about his loss of sight (night blindness). He will not eat green, leafy vegetables.

Reason for illness according to the mother:

Ram Bdr. - became sick because he had been touched by a mother whose child had just died.

Hom Bdr. - had been taken to the hospital for acute diarrhea and vomiting but had not recovered from weakness.

What advice the mother received from others concerning treatment:

Ram Bdr. - "The "jhankri" said that the touching of a pregnant woman had affected the child. He said that 2 chicken eggs, and a "mantra" costing about Rs. 100 was required. But nothing happened so I took him to the clinic."

Hom Bdr. - "A traditional doctor said he had "runche". Therefore 6 duck eggs and a red rooster needed to be offered to the god at Swayambhu. About Rs. 400 were spent but without benefit."

Home feeding pattern and food available:

Morning - rice, corn mush, pumpkin vines
Snack - wheat bread, roasted soyabeans and corn
Evening - rice, black dal, pumpkin vines

Family circumstances:

There is enough food grown to last 5 months for six people. Money is earned through day labour and weaving baskets. The house is mudded over once each month in addition to each month at the full moon, but it is swept clean every day. They have no latrine.

Condition at the time of discharge:

Ram Bdr. - He is eating and playing happily and has a much improved appetite.

Hom Bdr. - He has no edema and is happy because he can see so much better. Both children will continue on A and D capsules and a diet containing generous amounts of green, leafy vegatables at least twice a day. Both have learned to eat and to like spinach.

CASE STUDY C. (NRC Admissions Chart No. 184)

Sanu Babu - male	Mother	Father
Age - 30 months	Age - 26 years	Farmer
Weight - 6.0 kg	Pregnancies - 4	Firewood cutter
Height - 76 cm	Living children-2 (youngest 1 mo. old)	
UAC - red	Deceased - 2 (abortion and 2 years)	
Degree of under-nutrition - 3°		

Why the mother came to the NRC: (a two hour walk from home)

A villager told her to go but it was the Village Health Worker who convinced her to go for the sake of her very thin, weak, post-measles child. (Among the 89 neighborhood households there had been 12 recent post-measles deaths.)

Condition on arrival at the NRC: Marasmic, with chronic diarrhea.

He had these symptoms: apathy, pallor, irritability, hair changes (dry staring, dyspigmentation, thinness, easily pluckable), inelastic skin, calf and bone tenderness, and muscle wasting. He could not walk and showed no interest in food or surroundings except to "fight" anyone who got near.

Reason for illness according to the mother:

"The child was touched by a pregnant woman. Also something harmful had gotten into his food."

What advice the mother received from others concerning local treatment:

The "jhankri" (witchdoctor) said that a spirit had affected the child and that banana blossoms must be cut and observed. Also 3 duck eggs and 3 chicken eggs were needed to bring peace of mind. "Even so, there being no benefit, I brought him here".

Home feeding pattern and food available:

Morning - rice, wheat bread, potatoes
Snack - roasted wheat and soyabeans
Evening - corn mush, salt - chilli peppers, dried beans

Family circumstances:

> The four persons in the family have enough food to last 8 months. Money is earned by cutting and selling firewood. The house is mudded over one time in addition to at full moon. There is no latrine.

Condition at the time of discharge:

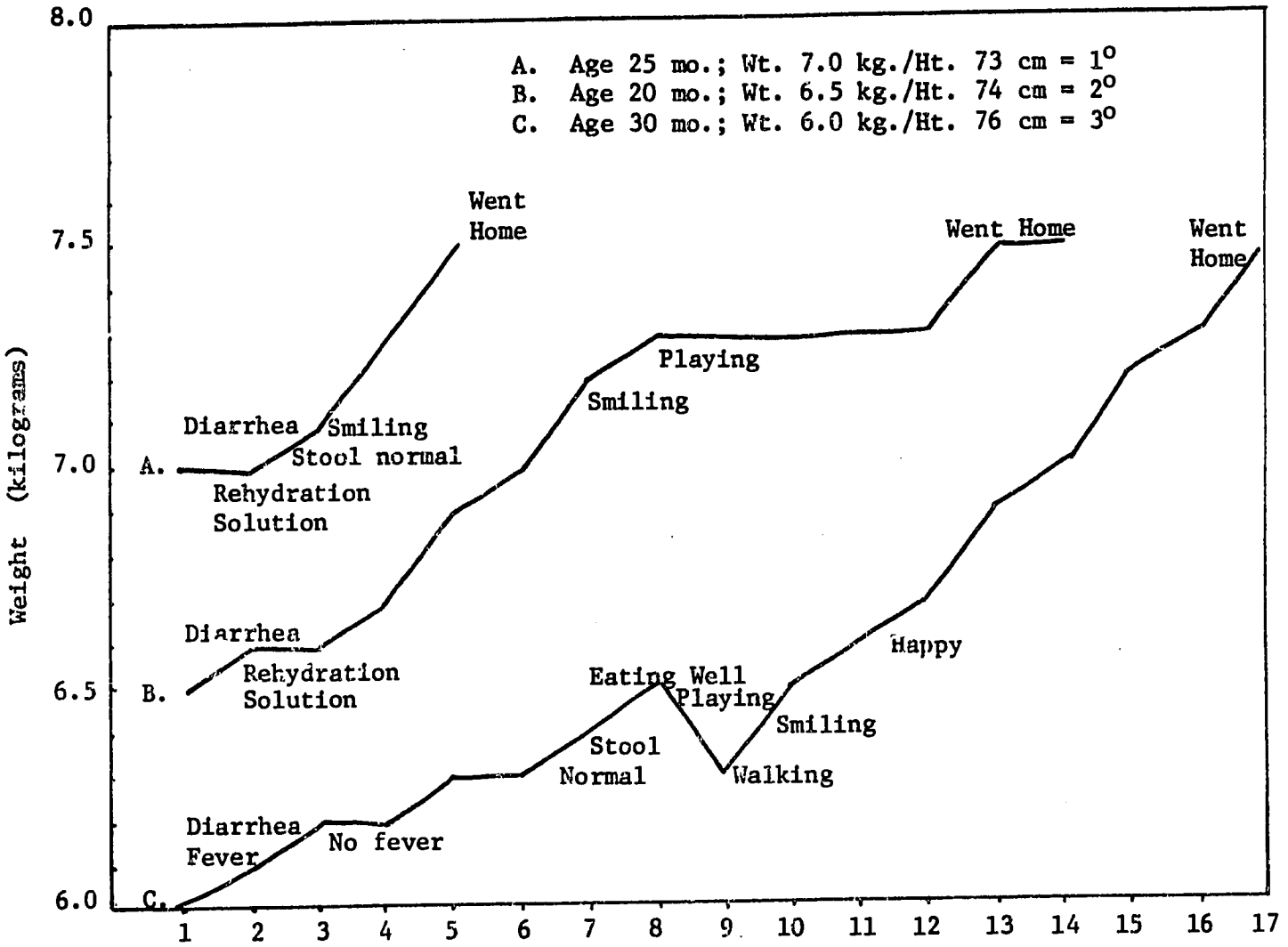
> He has gained weight steadily from 6.0 kg. to 7.5 kg within 16 days and had grown 1 cm. His appetite is astonishing; he licks his plate meticulously! He enjoys eating, playing and walking around and will even now smile at strangers.

These four fairly representative studies point out that there is usually a combination of circumstances which leads a child to a state of undernutrition. Customs and beliefs of parents dictate their first responses to the ill child. In a supportive atmosphere, a mother is willing to attempt what to her is an impossible task, that is, to feed an uncooperative child, a child who weakly repeats, "Ne, ne"., a child who gags and deliberately spits out food or rehydration solution, etc. Mothers learn that they need to take the initiative. By the end of the first week, when there is no more diarrhea, when the child easily accepts the food and may even be asking for more, when the child again has started smiling, talking, walking and playing, the mother begins to understand the relationship of food to health. (See Figure 1.) Comments then can be heard, such as, "Now I won't need to call the "jhankri" anymore; food is making him well!" "I have everything at home to make "Sarbottam Pitho". "May I go home next week?" or "Now I can tell my neighbor that her child needs to eat more often.", "I didn't know that green, leafy vegetables could help my child get his eyesight back.", etc.

Children adjust quickly to new tastes and feeding schedules --- if they have encouraging support. Take for instance Ram Bdr., (B) who had not eaten green leafy vegetables before and whose older brother refused to eat them. He was started out on five small meals a day including "Sarbottam Pitho" (15 gm) made into an unsweetened porridge, beaten rice porridge, rice, and pumpkin vines, giving a total of 413 calories and 6.7 gm protein, in addition to breast milk. At the end of two weeks he was eating six meals including Sarbottam Pitho (40 gm), beaten rice porridge, whole wheat bread, pumpkin, spinach and banana, giving a total of 848 calories and 23.6 gm protein, in addition to breast milk. He made a fairly regular weight gain of 1.0 kg. during those two weeks at the NRC. Children, once they start eating again, seem to gain weight rapidly on a diet containing only minimal calories and generous amounts of mixed vegetable protein. There seems to be nearly complete utilization of food.

Home-based rehabilitation is certainly far superior to a NRC in meeting the problem of malnutrition in any part of a district. The trauma of being moved a long distance to a strange place may be too much for some severely undernourished children. In the home is where the mother and child are most comfortable. So it is there that the greatest opportunities lie for Village Health Workers (VHW), other formally trained health workers, TBAs,

Figure 1.



Weight records of 3 children (A,B,C) including notes of other improvements while at the NRC.

and volunteers to encourage mothers to make fullest use of their resources of maternal love and patience and of home-grown local foods in order to prevent malnutrition.

Recently two nutrition-related surveys were done in the general vicinity of the NRC (in Chapagaon Panchayat). The first, among other things, discovered that according to the U.A.C. among the 256 children coming to the MCH (Maternal Child Health) Clinic within a specified time, 42.6% were in the green, 48.0% in the yellow, and 9.4% in the red.(11) The second was a total household survey covering 1210 households containing 794 children between age 1 and 5, of which 786 were measured. According to the U.A.C. 91% were in the green, 8% in the yellow, and 1% in the red. Only 83% of children living in the town area were "in the green" as compared to 97.4% of those in

the very rural areas. The suggestion was aptly made that although those from the distant areas do not regularly attend the MCH clinic, they are still eating traditional foods rather than commercial ones and "are giving food to the children at regular times each day". Also the hygienic conditions are better there than in the more populated town.(12) It is natural that mothers are more likely to bring sick children to a clinic rather than well ones and this probably accounts for the difference in percentages.

In contrast to the surveys done in Chapagaon area where there has been MCH work for about 25 years, a total household survey was done in Asrang Panchayat, where a lone VHW had begun work only nine months previously. Of the 150 children between age 1 and 5, according to the UAC, 55% were in the green, 35% in the yellow and 10% in the red. However, the percentage of children dying before 5 years of age was found to be 21.5%, a figure much lower than the national one.(13) Since Asrang is a food deficit area, people eat wild roots and tubers, forage leaves and wild plants and are not as particular about observing the taboos on food for new mothers, for example. There in that semi-remote area, the credibility of the VHW was remarkable in its impact on mothers of small children.

CONCLUSION

The International Year of the Child is now full term. Many organizations and individuals are in one sense acting in the role of a midwife. New ideas, new inspiration, new expectations have been brought to birth --- and all hopefully for the sake of the baby or of the child in Nepal.

May special tribute be paid to mothers who in situations of plenty or of scarcity have given themselves sacrificially for the sake of providing wholesome nourishment for their babies and children; to those traditional birth attendants who give invaluable emotional support, assistance, and helpful nutrition advice to new mothers; to shop keepers who have resisted stocking their shelves with items which are potentially harmful to babies; to institutions and places of business which have provided places where working mothers can breast feed their babies; to medical facilities which actively consider practical nutrition a primary concern for pregnant and lactating women and their children; to all community health or social workers and especially to all volunteers and Village Health Workers who regularly generate hope in the parents of health or of malnourished children; to those in all levels of government, in planning, coordinating, and training, who conscientiously seek for the nutritional welfare of children; and finally to Her Majesty the Queen of Nepal.

The writer wishes to thank the Committee of the NMA International Year of the Child Seminar for the opportunity to contribute this paper, all Community Health Program staff who contributed in any way to its writing, and Dr. Rick Allen for his helpful suggestions.

REFERENCES

1. National Nutrition Strategies. The National Nutrition Co-ordination Committee HMG/N, Jore Ganesh Press Pvt. Ltd., Balaju, Mangsir 2035, p. 4.

2. Salariya, E. M., Easton, P. M., Cater, J. I. 1979. "Duration of Breast-feeding After Early Initiation and Frequent Feeding." J. Hum. Nutr. Vol.33, No. 2, p. 1141.

3. Mogedal, S., and Budhathoki, B., 1979. "The Traditional Birth Attendant in the Health Care System, Experiences with Simple Training, Lalitpur District, Nepal," Shanta Bhawan Hospital Community Health Programme, p. 1, 2.

4. Davidson, S., Passmore, R., Brock, J. F., and Truswell, A. S., 1975. "Pregnancy, Lactation, Infancy, Childhood and Adolescence." Human Nutrition and Dietetics. Churchill Livingstone, 6th ed., p. 648.

5. Myres, A. W., 1978. "Breast or Bottle Feeding: Is There Really a Choice for the Third World?" Cajanus, Vol. 11, No. 2, pp. 112-115.

6. "Consultative Group on Maternal and Young Child Nutrition", 1979. Food and Nutrition Bulletin, Vol. 1, No. 3, pp. 21, 22.

7. Rolles, C. J., 1977. "Can We Really Mimic Human Milk?" Midwives Chronicle and Nursing Notes.

8. Jelliffe, D. B. and Jelliffe, E. F. P., 1975. "Human Milk, Nutrition, and the World Resource Crisis". Science, Vol. 188, p. 558.

9. Bressani, R. and Elias, L. C., 1979. "Improvement of the Nutritional Quality of Food Legumes". Food and Nutrition Bulletin, Vol. 1, No. 4, p. 28.

10. Krantz, M., 1978. "Nutrition Rehabilitation Center, Chapagaon, Evaluation Report," Shanta Bhawan Community Health Program, pp. 1-4.

11. Mogedal, S., 1978. "MCH Clinic Evaluation", Shanta Bhawan Community Health Programme, (raw data).

12. Shakya, M., 1979. "Total Household Survey of Children's Health in Chapagaon Panchayat (Lalitpur District, Nepal)," pp. 2, 3.

13. Krantz, M., and Shakya N., 1979. "Asrang Panchayat Total Household Survey, Preliminary Report," shanta Bhawan Community Health Programme, pp. 9-13.

BABY FOOD COMPARISON CHART

FOOD ITEM	COST	WEIGHT DRY	PRO-TEIN GM	FAT GM	TOTAL CHO GM	LAC-TOSE GM	SUC-ROSE GM	CALO-RIES	CAL-CIUM mg	PHOS-mg	IRON mg	VIT.A CARO-TENE IU	THIAM. B1 mg	RIBO. B2 mg	NIA-CIN B3 mg	VIT. B6 mg	FOLIC ACID	VIT.C mg	VIT.D IU	SALT inc ASH
SUPER FLOUR "SARBOTTAM PITHO"	3.35 0.34	1000gm 100gm	20.7*	8.3	53.0	-	-	370	400	490	14.0	430	0.92	0.45	7.0	-	0.32	-	-	3.3
"NAYA LITHO"	4.00 1.60	250gm 100gm	20.7	8.3	53.0	-	-	(370)	(400)	(490)	(14.0)	(430)	(0.92)	(0.45)	(7.0)	-	(0.32)	-	-	(3.3)
BAL-AMUL	13.60 2.72	500gm 100gm	22.0	7.0	60.0	-	-	390	1000	800	6.0	1500	0.50	0.60	5.0	-	-	50.0	300	-
NESTUM	12.50 4.16	300gm 100gm	7.5	0.5	84	-	-	366	Minerals 3%		15.6	1875	0.60	0.70	-	0.4	0.25	45.0	500	-
CERELAC	19.40 4.85	400gm 100gm	11.0	7.8	77	-	-	422	275	225	6.25	750	0.20	0.30	-	0.2	0.10	20.0	200	-
FAREX	19.50 4.87	400gm 100gm	12.6	3.0	75.0	-	-	375	750	400	20.0	-	-	-	-	-	-	-	300	3.5
ANKORTA	33.00 3.30	1000gm 100gm	19.5	24.0	-	50.0	-	500	Minerals = 4%			420	-	-	-	-	-	-	-	-
AMULSPRAY	35.90 3.59	1000gm 100gm	22.0	18.0	50.0	-	-	450	1000	800	4.0	1500	0.60	1.00	6.0	0.3	-	30.0	400	-
ANGEL	41.00 4.10	1000gm 100gm	21.6	19.0	-	30.8	20.0	460	Minerals = 6%			1500	0.60	1.00	6.0	0.3	-	30.0	400	-
LACTOGEN	23.75 4.75	500gm 100gm	21.6	19.0	-	30.8	20.0	461	-	-	6.0	1500	-	-	-	-	-	-	400	5.6

( ) Other source of information.

* Complete protein.

To make "Sarbottam Pitho" Supplementary Food:
25% corn (or other whole grain)
25% wheat (or other whole grain)
50% soyabeans (or other pulse)

1. Roast each food item separately.
2. Grind into a fine flour. Mix.
3. Cook in boiling water to make a porrdge, thin or thick.

MK & NS/gs
Aug. 27, 1979

Appendix I.

NUTRIENT CONTENT OF TRADITIONAL NEPALI FOODS AND/OR FOOD PREPARATIONS
(Per 100 gm. of edible portion)

FOOD ITEM	MOIS-TURE GM %	CALO-RIES (Kcal)	PROTEIN GM %	CARBO-HYDRATE GM %	FAT GM %	CALCIUM mg %	IRON mg %	CARO-TENE mg %	THIA-MINE mg %	RIBO-FLAVIN mg %	NIACIN mg %	VITAMIN C mg %
"MASYAURA"*[1]	9.1	-	21.2	-	4.1	478.8	44.9	-	0.34	0.36	2.40	-
"GUNDRUK"**[1] - radish leaves	11.6	-	-	-	-	2506.0	96.6	640	0.16	0.53	3.21	-
- grape leaves[1]	11.8	-	-	-	-	2458.0	94.3	1520	0.48	0.79	6.97	-
- cauli leaves[1]	9.2	-	22.9		3.8	1411.0	49.0	-	-	0.47	3.50	-
- soya leaves[2]	13.5	-	24.4	-	3.9	636.0	47.6	1283	0.095	0.80	1.38	-
- carrot leaves[2]	14.7	-	14.4	-	4.1	810.0	66.6	1388	0.176	0.624	1.96	-
STINGING NETTLES[3] ("sisnu")	81.14	55.0	6.91	6.2	-	928.4	-	-	-	-	-	53.15
"ALLO" (Bhogta sisnu)[3]	82.33	54.0	2.67	8.2	1.00	518.37	-	-	-	-	-	7.95
BUCKWHEAT LEAVES[3] (fresh)	83.28	63.0	4.08	8.09	1.61	113.81	-	-	-	-	-	131.65
"TAATE SIMI"[3] (Lablab niger)	80.13	65.0	4.44	10.8	.54	31.36	-	-	-	-	-	21.26
"BEJORLO"[4] (a seed)	9.14	493.85	17.85	36.15	30.88	263.16	4.17	-	-	-	-	-
"GITTHA"[4] (a tuber)	64.65	130.00	2.22	29.44	.43	31.17	-	-	-	-	-	6.45
"RANI BHYAAKUR"[4] (a tuber)	72.72	101.4	2.29	22.71	.16	24.71	8.38	-	-	-	-	-
"GHAR TARUL"[4] (a tuber)	58.61	147.31	4.07	32.69	.07	69.80	24.03	-	-	-	-	-

* "MASYAURA" - Pounded black gram dal and colocasia stems, dried.

** "GUNDRUK" - Dried, fermented leaves.

1. Analysis by National Institute of Nutrition(NIN), Hyderabad, India, courtesy of UNICEF.
2. Analysis by NIN, Nov., 1978.
3. Analysis by in Food Research Lab., Dpt. of Food, HMG/N, June, 1979.
4. Analysis by in Food Research Lab., Dpt. of Food, HMG/N, June, 1978.

Appendix II.

HOME GARDENING

Asian Household Nutrition
Appropriate Technology Seminar
13-17 July 1981

V. Sathianathan

Agricultural Office (Home Gardens)
Extension Division
Department of Agriculture
Sri Lanka

HOME GARDENING

INTRODUCTION

Sri Lanka is a tropical island of approximately 16.2 million acres. The mean temperature ranges from 70 to 80 degrees Fahrenheit. The annual precipitation follows a distinct bimodal pattern. The rainfall is from two monsoons, the northeast monsoon from October to January (Maja) and the southwest monsoon from May to September (Yala).

The country is divided into three major climatic regions. The wet zone, comprising 3.8 million acres and located in the southwestern sector, receives a rainfall of more than 125 inches annually. The intermediate zone that occupies a position between the wet and dry zones comprises 2.1 million acres which receive a rainfall between 75 and 125 inches. The dry zone that occupies the balance, 10.3 million acres, receives a rainfall of less than 75 inches. Sri Lanka is blessed in the sense that almost all types of crops, both temperate and tropical crops, can be grown.

AGRICULTURAL EXTENSION SERVICE

The Department of Agriculture falls within the purview of the Ministry of Agricultural Development and Research and is responsible for research, extension, training and supply of quality planting materials for all crops except tea, rubber, coconut and minor export crops. The director is supported by five deputies who are in charge of the four functions and of administration.

Extension is through the T. and V. system, as advocated by the World Bank, and has full coverage of the island. The Deputy Director of Extension is assisted by 24 assistant directors who are posted at each one of the 24 administrative districts. Each district is broken up into segments with an agricultural officer for approximately ten agricultural service centres. An agricultural instructor (middle-level officer) is posted to every range covered by an agricultural service centre. There are approximately 500 agricultural service centers that cover the whole island. The Deputy Director is assisted at headquarters by a set of subject-matter specialists for the different disciplines of which home gardening is one. Each agricultural segment has two to three specially trained subject-matter officers, each for two to three disciplines. The area covered by one agricultural service centre is further divided into four or five managers, with a "krushikarma vyapatha sevaka" (village-level worker) engaged in extension.

Until 1980 special attention to home gardening was paid only in Colombo, where a special division was organized in 1970, with an agricultural officer in charge and two large plant supply nurseries at Ratmalana and Torington Square. A concerted effort was made by the administrative officer and his staff in the Colombo municipal limits, the Dehiwela-Mountlavania urban council limits, the suburbs of Kotte, Mahavagama, Kollanowa and Aggoda, and the coastal belt from Moratuwa to Negombo. A great impact was made here. Approximately 350,000 rupees worth of planting material was sold annually, and 2500 individuals were trained in home gardening annually.

In 1980 the Honourable Minister for Agricultural Development and Research made a decision to extend this drive throughout the entire island with a subject-matter specialist at Perdeniya to monitor the programme. His Excellency the President is also deeply interested in the programme.

Definite targets of 100 model home-gardens were sent to each of 4,000 cultivation officers of the Agrarian Services Department. The responsibility for training, demonstrations and supply of inputs, however, belongs to agricultural department officers. They are also responsible for extension work in home gardens in the urban areas. Besides the normal seed packets, 600,000 special home garden packs containing ten different varieties of seeds and priced at only 1 rupee per packet were sold in 1980. The results were dramatice. The price of vegetables (especially beans, tomatoes, cabbage and radishes) fell to rock bottom prices during the peak seasons in the producing areas. In the interests of the traditional vegetable growers, the home gardeners are now being encouraged to grow crops during the off season.

OBJECTIVES OF THE HOME GARDENING DRIVE

1) To ensure a regular supply of fresh and uncontaminated vegetables, fruits and condiments, and to provide a nutritionally balanced diet for the family.

2) To make the best use of the land available and to keep the environment clean.

3) To encourage flat-dwellers to raise vegetable crops in pots, discarded containers, packing cases, etc.

4) To cut down on family budgets and augment incomes.

5) To serve as a hobby that will give pleasure and profit.

6) To provide the much-needed exercise, especially for the urban folks.

7) To educate home gardeners in simple compost-making techniques (the improved Dalpadado process and Holey barrel or garbage in orbit).

8) To educate home gardeners in simple pest and disease control methods.
   a) Use of pest and disease-resistant varieties
   b) Hand picking
   c) Tobacco wash, soap with kerosene, lime sulphur, etc.
   d) mixed cropping
   e) use of carbofuran

SERVICES AVAILABLE

1) Making readily available the following inputs in handy packs at agricultural service centres and other sales points.
   a) Quality seed at nominal prices (10 gram to 200 gram packets)
   b) Seedlings in the case of small seeded varieties like Capsicum brinjal, tomato, cabbage and knol-khol

c) Fertilizer mixtures (2 kilo packs)
d) Compost (3 kilo packs and by the bucket)
e) Agrochemicals
f) Fruit plants

2) Discussion groups with a view toward creating a sense of awareness and toward motivating the housewives and others by giving them a few elementary ideas on land preparation, plant nutrients, etc.

3) Practical demonstrations in the preparation of seed beds, manuring, pest control, etc.

4) Demonstration plots.

5) Short courses ranging from one day to three months in the cultivation of vegetables, compost-making, etc.

6) Food demonstrations to popularise the new crops like soya bean, winged bean, etc. and food preservation (Farm Women's Agricultural Extension).

7) Home-to-home advice.

STRATEGY

1) Involving public service organizations and religious organizations like the Lions Clubs, the Rotary Clubs, Sarvodaya, Y.M.C.A., Y.M.B.A., etc. with a view toward an organized effort and wide coverage.

2) Involving rural-level institutions like the rural development societies, community development centres, Mahila Samithies, etc. especially in community projects like nurseries.

3) Mobilizing school children, members of the Young Farmers Clubs, Boy Scouts, Girl Guides, etc.

4) Mobile sales at village fairs, etc.

5) Organizing home garden competitions at various levels. For example, the Bank of Ceylon has sponsored a home gardens competition among members of the Young Farmers Clubs in all twenty-four districts this year.

6) Exhibitions. A cultivated model home garden is a special feature at all exhibitions now.

SPECIAL PROGRAMMES THIS YEAR

1) "Million-Plant Drive." Trees like jak, tamarind and ipil ipil, etc. are to be planted on the wayside beside the homestead.

2) Development of model villages.

3) Target of 100 model home gardens per cultivation officer.

CONSTRAINTS

In developing the home gardens programme the following problems have surfaced:

1) Mobility -- fuel charges.

2) Water supply - water taxes, and the high cost of sinking open wells.

3) Pest and disease problems - papaw virus, mango leaf hopper, etc.

NEW SHORT-CUT METHOD OF MAKING COMPOST (KASALA MENIK) BY THE "DALPADADO PROCESS".

What is Compost?

Compost is nothing other than decomposed organic matter.

The Advantages of using Compost:

* Compost is a complete plant food, as it has all 16 plant nutrients.
* Commercial fertilizer has only the three macro plant nutrients N.P.K.
* Compost improves the physical condition of the soil.
* Compost increases the water holding capacity of the soil.
* Compost is cheap and readily available.
* Compost can be made by anybody.

THE 12 DAY PROCESS

Materials Required:

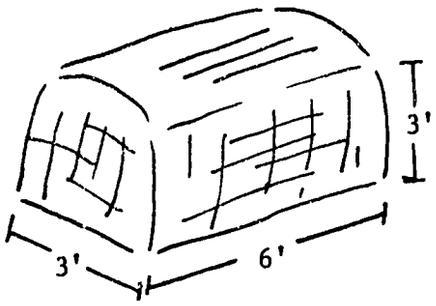
* City garbage, road sweepings of flowers and leaves.	)
* Crop residues, lawn clippings, tender stems and leaves.	)
* Wasteland shrubs and weeds.	) 70% - 75%
* Aquatic weeds and cannery wastes.	)
* Poultry litter (if available).	)
* Farm and abatoir wastes.	)
* Urine impregnated soil (animal or human).	- 1% - 2%
* Fresh cattle dung.	- .5% - 1%
* Kitchen or bakery ash.	- 5% - 7%
* Old compost.	- 15% - 20%

Making of Heaps:

As aeration is important, a heap should not exceed 6' in breadth and 3'in height. Length will depend on the site and availability of material. It must be moist at all times. Oxygen, Water, Nitrogen -- food for the agents of decomposition, should be made available at all times. These are supplied by the addition of fresh cow dung, urine impregnated soil and fresh leaves.

With regard to size of material -- the smaller the material the better it is for quick decomposition. It should not generally exceed 4" X 2". Hence, chopping is essential. Plastics, etc., which do not decompose readily should be sorted out. The above-mentioned material is thoroughly mixed and a layer 6" in thickness is made out of the mixture and watered well. About 15 - 16 such layers will give the required height. The heap has to be completed in one day.

Heap on First Day



Turning Over of Heap:

1st Turn: 2 days after completion of the heap. The material is mixed so that the material at Centre and Bottom are piled on the outer sides and those outside are within. Slurry (cow dung & urine mixed in water) and urine-impregnated soil and water are applied after every layer.

2nd Turn: 4 days after the 1st turn i.e. 6 days after the completion of the heap. Water is applied after every layer.

3rd Turn: 3 days after the 2nd turn i.e. 9 days after the completion of the heap. Water is applied after every layer.

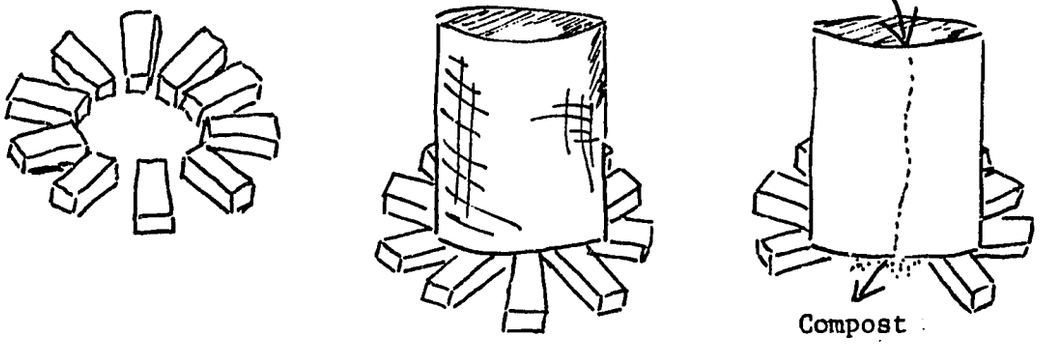
4th and Final Turn: Three days after the 3rd turn i.e. 12 days after the completion of the heap. Water mixed with wood ash is sprinkled after every layer. The heap will be in the shape of a cone. Then it is covered with cadjans and kept moist. The compost can be used after another 12 days i.e. 24 days after the completion of the heap.

Heap at the 12th Day.

The Holey Barrel Method (Garbage in Orbit):

A discarded perished 45 gal. Tar or Oil Barrel with both ends open is used. It is placed on a circular layer of bricks. Garbage, kitchen refuse, etc. are fed from the top and the compost is removed regularly from below 1½ months after the first charge.

Holey Barrel



A NEGLECTED FOOD RESOURCE: HOME GARDEN

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A NEGLECTED FOOD RESOURCE: HOME GARDEN

"The recommended intake of retinol for 1-3 year olds....presents in 12 to 20 g of amaranth. This is the weight of 6 large or 12 medium amaranth leaves....Every small herb plot near the doorstep can produce the leaves needed."

John F. Wilson, Director, Royal Commonwealth
Society for the Blind
Xerophthalmia Club Bulletin No. 22, January 1981

1. INTRODUCTION

1.1 Population and food supply

In a broad term, nutritional status of people is the result of a race between population and food supply. World population, in the past decade, 1969-79, increased 22.2 percent[1] while food production increased 28.9 percent, a net gain of 7.1 percent in per capita food supply. In the case of Asia, population increased in the corresponding period 26.4 percent, while food production increased 33.0 percent, hence with 8.0 percent increase in per capita food supply. However, this meager increase, at an average rate of less than 0.8 percent per year, from a very low baseline was not evenly achieved. Per capita food supply in a number of countries was, in fact, dropping. Hence, calorie and protein availabilities in many Asian countries fall below the nutritional requirement of people.

The problem in Asia is further aggravated by the fact that the 57.9 percent of world population (1979) depends on only 28.9 percent of the world's arable land. In other words, the realistic approach to improve the food and nutritional status of people in Asia is to increase efficiency of production, with special attention to crops rich in nutrients now deficient in the common diet.

1.2 Food and nutritional problems in Asia

There are two instruments generally used to assess food and nutritional status of people, namely the compilation of food balance sheets and the conducting of nutrition surveys which usually includes food consumption, clinical and biochemical examinations, and the collection of information on the determinants affecting nutritional status of people. The former gives indication on per capita food availability, while the latter provides more precise information.

Many nutrition surveys were conducted in Asia. Generally speaking, energy, and to a lesser extent, protein malnutrition, is the major problem among low income and nutritionally vulnerable groups. Among the minerals, calcium intake is generally low yet clinical evidence of calcium deficiency is not common. Of course, its increase in consumption is desirable. Iron-deficiency anemia is most rampant, affecting not only children and women, but adult males as well.[2] Vitamin A deficiency is another major public health problem particularly in Southeast Asia. In Indonesia alone, for instance, there were 120,000 blind children, mostly due to vitamin A deficiency.[3] Riboflavin intake is also generally low. The deficiency of iodine is regional, while ascorbic acid deficiency is seasonal, depending on the supply of fresh vegetables and fruits.

1.3 Importance of dark green leafy vegetables (DGLV)

A food consumption survey conducted in Luzon, Philippines in 1974 by the Food and Nutrition Research Institute[4] revealed that the consumption of green leafy and yellow vegetables is only 30.9 percent of the recommended level of

consumption, with only 23.2 percent in the Manila area, although the total vegetable consumption exceeded the recommended level. A nutrition survey conducted in rural Bangladesh in 1975-76 by the Institute of Nutrition and Food Science, University of Dacca[5], reported a similar situation. Out of a total of 126 g/person/day vegetable consumption, only 20 grams, or 16 percent of the total, had significant nutritional value. The survey concluded that, among others, the deficiencies in calcium, vitamin A, riboflavin, and ascorbic acid were major public health problems, with 81 to 93 percent of the households under survey deficient in those essential nutrients. Seventy percent of the population were anemic, mainly due to iron deficiency.

As can be expected, all survey reports recommended the popularization of dark green leafy and yellow vegetables through all conceivable channels.

It is true, vegetable crops can produce in a unit area more calorie and protein than some cereal crops.[6] Dark green leafy vegetables are exceptionally rich in vitamin A value and ascorbic acid and moderately rich in calcium, iron, and riboflavin. This is one stone that could kill many birds simultaneously. Yellow vegetables, such as carrots, though often listed in the same food group, are rich only in vitamin A value.

2. HOME GARDENS AS A NUTRITION INTERVENTION

2.1 Experiences learned in Hawaii

With the view of quantifying nutritional contribution of a small home garden to a family of 5 members: father, mother, son, 18 years old, daughter, 14 years old, and another daughter, 6 years old, a series of observation and experiment was conducted, beginning in 1975, in East-West Center Community Garden, Honolulu, Hawaii.

Differences by crop selection

The most popular vegetables growing in home gardens in Hawaii are Manoa lettuce, snap bean, cucumber, and egg plant. By using the average production record of respective crops published by the University of Hawaii[7] as the basis of calculation, nutritional contribution of a typical garden of 300 square feet in size is almost negligible. However, if the DGLVs, namely, ongchoy (Ipomoea aquatica), amaranth (Amaranthus tricolor), and pakchoy (Brassica chinenses) are planted, the picture will be totally different, as shown in Table 1:

Table 1: Calculated nutritional contribution of home gardens in Hawaii

(300 square feet)

Vegetables planted	Estimated output (lb/day)	Protein g	Iron mg	Vitamin A value, IU	Ascorbic acid, mg
Garden 1, typical	0.71	3.21	2.67	3,330	38
Cucumber, egg plant, lettuce, snap bean					
Nutritional contribution in % of RDA of a family of five members		1.4	3.6	8.1	11.3

Table 1: Calculated nutritional contribution of home gardens in Hawaii

(300 square feet)

Vegetables planted	Estimated output (lb/day)	Protein g	Iron mg	Vitamin A value, IU	Ascorbic acid, mg
Garden 2, improved	2.09	18.19	15.09	35,170	294
Ongchoy, amaranth, pakchoy, snap bean					
Nutritional contribution in % of RDA of a family of five members		8.5	18.8	86.4	144

Experimental gardens in 1977 and 1981

During the Research Methods and Program Management Workshop held at the East-West Center, spring 1977, a vegetable garden experiment was conducted by the workshop participants, with the following objectives:

(1) To familiarize participants with the nutritional value of different vegetables;

(2) To design and operate a small garden with a variety of vegetables aimed at maximal nutrition output; and

(3) To stimulate the interest of further research to strengthen nutritional dimensions in agriculture.

Because of the limited space available in the East-West Community Garden, an area of 18.5 square meters, roughly equivalent to 200 square feet, was allocated for the experiment. Participants were divided into three groups and each group kept two plots with some 2.5 square meters planting area. From the total garden area of 18.5 square meters, 53.3 kgs of vegetables were produced in 40 days, equivalent to a production of 72 g per day per square meter, or about 700 kgs per day per hectare. All the measuring and weighing was made in the presence of a third party.

Another precise experiment on the output of small home gardens was recorded in May-June 1981 during a Workshop on Human Ecology Research for Social Scientists, with similar objectives and design as the previous one. From a total planting area of 25.7 square meters, 59.5 kgs of fresh DGLVs was produced in 34 days, equivalent to a production of 68.1 g per day per square meter. Their nutritional contribution to people is outstanding, shown in Table 2:

Table 2: Nutritional contribution of a small garden expressed in % of recommended dietary allowances for a family of 5 members

(18.5 square meters or about 200 square feet)

	Energy	Protein	Calcium	Iron	Vitamin A value	Ascorbic acid
1977 garden	1.7	7.9	27.5	21.7	173.8	157.3
1981 garden	1.7	8.0	47.9	20.7	176.6	160.0
Average:	1.7	8.0	37.7	21.2	175.2	158.7

Incidentally, the first experiment was conducted by agricultural scientists, while the second one by social scientists. The results were surprisingly similar.

It is evident that a small home garden could make a valuable contribution toward fulfilling the nutritional gap of people, particularly in vitamin A, ascorbic acid, calcium, iron, and even protein. The 8 percent increase of protein supply from an area of 200 square feet to a family of 5 members is truly phenomenal. All those significant contributions can never be achieved without DARK GREEN LEAFY VEGETABLES.

In addition to their nutritional importance, small home gardens also have economic significance. The market value (Honolulu price) of vegetables harvested from the garden equalled $1.50 per day in the 1977 experiment and $1.40 per day in the 1981 experiment. A food budget savings of $40-50 a month is meaningful to medium- and low-income families.

2.2 Crops recommended for home gardens

Criteria for crop selection

Vegetables selected for home gardens are based on the following criteria:

(1) Easy-to-grow, long yield season, adaptable to different soil and climatic conditions;

(2) Not easily susceptible to insects and diseases;

(3) High in nutritional value and low in substances harmful to health;

(4) Palatable and easy to prepare; and

(5) Relatively high in market value.

Vegetable crops

Among the plants tested in the East-West Community Garden, the following vegetables are especially recommended:

(1) Amaranth (Amaranthus tricolor)

We introduced in 1975 from Dahomey, Amaranth Fotete, a spineless amaranth with pointed leaves. It grows vigorously like weeds and propagates itself like weeds, yet its leaves and young stems are soft and tasty when cooked. This is "calaloo" in the Caribbean countries.

Chinese spinach, another kind of amaranth with broad leaves, is popular in Hawaii. There are two varieties, green stem with green leaves and purple stem with purple lined green leaves. Both are very productive and delicious. However, they require a little care and are relatively vulnerable to insects and diseases.

Amaranth can grow year-round in the tropics and a plant can be harvested 2-3 times by cutting the young branches and leaves. They will grow back in 4-5 weeks.

Regretably, amaranth is relatively high in oxalate content. However, because of its easy care and high nutritional value, it is one of the vegetables most recommended for home gardens particularly in areas where water supply is limited. In fact its oxalate content will be greatly reduced when cooked. Hence, mashed amaranth is recommended for infant feeding.

(2) Kangkong, ongchoy (Ipomoea aquatica)

Kangkong is perhaps the most popular vegetable in Southeast Asia. It usually grows in swampy areas. Upland kangkong was first introduced from Taiwan to the East-West Center Community Garden in 1975 and immediately gained popularity among the home gardeners in Hawaii.

Previously, I introduced upland kangkong in 1965 to the Philippines and in 1967 to the Republic of Korea for their school and village garden programs, with equal acceptance. It can be easily propagated by cuttings and has a long yield season. Cut the entire plant just above the ground and another crop is ready for harvest in 5-6 weeks. This is the best plant for home gardens if water supply is not a problem.

(3) Edible hibiscus (Hibiscus manihot)

Edible hibiscus is a tree, introduced to Hawaii from the South Pacific by the Department of Horticulture, University of Hawaii. There are two kinds, red stem with narrow leaves and green stem with broad leaves. The former is "Sunset Hibiscus" and seems more tasty.

Edible hibiscus can be propagated easily by cuttings and requires very little care. It is best planted at the edge of a garden to form a protective fence against chickens and animals. Eat the tender leaves and stems like spinach.

(4) Pakchoy, Chinese green stem spoon cabbage (Brassica chinenses)

Among many varieties of Chinese cabbage, the "spoon" cabbage with green stems is perhaps the easiest and quickest to grow in the tropical area. It could reach maturity in a month after transplanting and grows year-round. Its taste is well-liked by most Asian people, as experienced in the East-West Center.

(5) Mustard cabbage (Brassica juncea)

Among all the vegetables tested, mustard cabbage is most efficient in producing essential minerals and vitamins. Harvest it a little earlier before full maturity to avoid its slight bitter taste which may be objectionable to some people.

(6) Leaf lettuce (Lactuca sativa)

Two kinds of loose-leaf lettuce, namely Manoa Lettuce and Anuenue Lettuce, were released by the University of Hawaii for planting in the tropics. Although nutrition wise, lettuce is not comparable to other DGLVs; it grows quickly, relatively free from insects and diseases and has high market value. It becomes a much welcomed addition to the home garden.

(7) Other DGLVs

Other popular vegetables in the East-West Community Garden include kamote (Ipomoea Batatas), dandelion (Taraxacum officinale), Swiss chard (Beta vulgaris), coriander (Coriandrum sativum), chives (Allium schoenprasum), green onion (Allium cepa), and garlic leaves (Allium sativum). The latter four kinds are often interplanted with other vegetables or planted in line at the edge of a plot, in the hope that they could provide biological control of insects and possibly diseases.

Leguminous crops

(1) Soybean (Glycine max)

It is essential that the soil should be properly innoculated with rhizobia if it is the first soybean crop planted in the plot. Mulching and pinching, as practiced in Korea, could increase substantially the soybean yield.

Dry soybean seeds can be prepared in many ways[8] for human consumption. For saving cooking fuel, soybean may be harvested 2-3 weeks before maturity. Green soybean is very easy to cook and soft and tasty as well. If properly mashed, cooked green soybean could feed infants beginning at age 5-6 months.

(2) Pigeon pea (Cajanus cajan)

Although the yield and protein content of the pigeon pea is only half that of soybean, it has the merit of continued production for 2-3 years without the replanting trouble. Dry pigeon can be cooked soft in 30 minutes if soaked overnight. Again, green pigeon peas as a vegetable may be preferred by some people.

In Hawaii, we have almost year-round production, with two major harvest seasons, one in early summer and another in winter. Similar to edible hibiscus, pigeon pea can be planted as a fence of the garden.

(3) Winged bean (Psophocarpus tetragonolobus)

Much enthusiasm on winged bean has been developing since the publication of "The Winged Bean, a High-Protein Crop for the Tropics" by the U. S. National Academy of Sciences in 1975. It can be adapted to different soil and climatic conditions and has been demonstrated[9] to produce per hectare more than 4 tons dry seed, 15 tons of tuber, 10-15 tons of green pods and plenty of green foliage. Protein content of its dry seed is similar to that of soybean. It is particularly significant that the winged bean tuber has about 15 percent of protein, 10 times more than any other starchy root crop.

Our experience found that winged beans could be a very promising backyard crop if the grower can afford to construct the necessary stakes or has a fence for the plant to climb. As the dry seed is very difficult to cook soft, requiring at least two hours even soaked overnight, green winged bean, picked about 2-3 weeks before its maturity, with about 13 percent protein, may be the best form to eat, including infant feeding.

2.3 Keeping a home garden in sustained production

To have a successful home garden, research at the local level is most essential, as crops and cropping systems are time-specific and location-specific and its operation is influenced by many cultural and socio-economic factors. Here are some experiences we wish to share with our fellow gardeners.

(1) Land preparation - deep digging and raised bed

Unless threatened by the possibility of serious soil erosion, land should be dug thoroughly, at least 6-8 inches deep and mixed in with as much as possible compost and other organic materials such as animal manure, grass cuttings, leaves, and fish waste. Turn grass down deep in soil. If soil is heavy, mixing in sand, wood ashes, saw dust, and compost is especially important.

The plot bed should be raised 6-8 inches to ensure better aeration and drainage of soil and development of a healthy root system.

The size of the plot, to accommodate the physical condition of women and children who are usually the real garden workers, is best made 2.5-3.0 feet wide and 10-15 feet long, separated with a path of 1.0-1.5 feet in width. The patch will be eventually covered by garden plants.

In areas with heavy downpours, the sides of the plot should be protected with bamboo, banana trunk, or coconut leaves. Otherwise, the whole garden could be washed away overnight. All good agricultural practices including terracing are applicable to home gardens.

Thorough land preparation, picking out all the roots of grass, mixing in organic materials, and forming a raised bed is the first step and foundation of a successful home garden.

(2) Designing a cropping system

Crops for home gardens should be selected mainly among those already established in the area. Crops introduced from the outside should be first tested in their adaptability to local environment and acceptability to local taste.

To ensure a sustained vegetable supply, some plants with a long yield season may serve as basic vegetables of the garden. This category may include kangkong, edible hibiscus (garden fence), kamote, chives and dandelion greens. Those plants are cut-and-grow, lasting a long time.

Other vegetables such as pakchoy, mustard cabbage, Swiss chard, and lettuce may be planted in succession to ensure their continuous supply. Keep a small seedling bed all the time so that the transplanting of seedlings can be made whenever suitable space is available. There is no law that crops must be separately planted or grown in straight rows. Intensive-, inter-, mixed-, and catch-cropping are the key words for a productive garden system.

In a highly mixed cropping system, crop damage from insects and diseases could be much less than mono-cropping systems. If we find some plants suffering from diseases, pull them out and stop planting them for several months. We have more than 400 edible leaves[10] in the tropics to choose from.

(3) Maximal recycling of organic materials and no chemical pesticides

Keep a compost pile near the garden and gather all available organic materials for recycling. We must return the nutrients extracted by the vegetables back to the soil. Otherwise, vegetables can hardly grow well again.

We do not use chemical herbicides to control weeds as they may destroy the natural ecosystem of the soil. Weeds in small gardens can be controlled manually if the gardener decides to do so. We also object to the application of chemical pesticides as vegetables in home gardens may be picked by young children three times a day. They cannot wait for two weeks.

However, we do apply some chemical fertilizers. Nitrogen extracted from soil by vegetables can hardly be replaced through recycling of organic materials and crop rotation with legumes, unless there is a zoo, chicken farm, or fish market nearby.

(4) Water conservation

Water is scarce everywhere except in the monsoon season and watering the garden is labor-consuming. The application of mulching practice particularly to the newly planted and young vegetables also not only ensures their survival but could substantially reduce water requirements.

A reliable water source is prerequisite to a successful garden.

(5) Considering economic incentive

While the nutritional importance of home gardens is attractive to nutrition and public health people, the gardeners may be interested more on its possible economic benefit. Hence, in crop selection for home gardens, market value and transportability of the vegetables should be seriously considered, so that, eventually, the gardeners may get some income from the garden, aside from its health benefit which is usually invisible. Economic incentive is a reliable motivation to gardeners for a sustained vegetable production.

2.4 Toxicity in legumes and greens

Some legumes and greens may have toxicity or other substances that could adversely affect the health of people. The common poisonous substances are alkaloids, cyanogenic and goitrogenic chemicals, oxylates and trypsin inhibitors.

Some of the poisonous substances, notably trypsin inhibitors existing in soybean, can be inactivated through proper cooking and many other toxic chemicals can be eliminated in the same way. We should, however, be cautious to introduce unknown species or varieties in our home garden program. Let the research institutes experiment.

The wide presence of soluble oxylate in plant leaves causes much concern to nutritionists as it could adversely affect calcium metabolism. In fact, if the greens are cooked and only moderate amounts are consumed each time, this adverse effect is negligible in the tropical area. Their health benefit far outweighs this negative effect. Nevertheless, this factor should be among our considerations in crop selection for home gardens.

2.5 "Care free" garden system

A home garden aimed at sustained food production naturally requires constant care and necessary production input. However, this approach may not be workable under certain circumstances.

For those with a very limited labor force, perennial crops such as malunggay (Moringa oleifera), edible hibiscus, pigeon pea, banana (Musa sapientum), papaya (Carica papaya) and guava (Psidium guajava) may be planted, and if possible, vegetables with long yield seasons including kamote, amaranth, kangkong, and chives may be included later.

While we do not have the opportunity to record the output of this "care free" garden system, its nutritional contribution could be also substantial.

2.6 Raising small animals as a part of the garden system

With a garden of 200-300 square feet in successful operation, vegetable trimmings and other garden wastes may be sufficient to support 1-2 rabbits, while

rabbit droppings will be used as garden fertilizer. Rabbit-raising is a part of the garden system.

Raising 10-15 chickens in a deep litter system could provide a substantial amount of manure to improve soil quality of gardens. In the meanwhile, garden wastes could also reduce the cost of chicken feed. This system, however, may be considered as mutually beneficial to separate operations.

Raising of a milk goat along with a vegetable garden was practiced in Korea, with some success. However, there are many problems in the milk goat side not yet solved. Otherwise, it could be an ideal combination.

3. INNOVATIVE VEGETABLE PRODUCTION SYSTEMS

I wish to mention four innovative production systems that may be adapted by individual households with limited land space, particularly those in urban areas.

3.1 Pot garden

Growing vegetables in pots has been practiced in many countries. We can buy pot soil from garden stores or make our own culture soil, a mixture of 2 parts of top soil, 2 parts of matured compost and 1 part of sand, to ensure healthy root development and better drainage. Yield from pot gardens could be higher than that of ground gardens as moisture and pests can be controlled and plants can be arranged to fit their sunshine requirements. An automatic drip irrigation system could be installed if the area of the pot garden justifies it.

Vegetables for best pot cultivation are those with short root systems such as green onion, chives, garlic, kangkong, pakchoy, and lettuce.

The drawback of pot gardens is the need for constant care and that pot soil must also be changed periodically.

3.2 Vertical garden

A study of vertical culture techniques in Taiwan[11] proved that vertical gardens could have a very promising future, with 2-4 times the production than horizontal cultivation. The system required (1) vertical pollulator - tubes of 16 cm in diameter and 90 cm in height, with openings of 2.5 cm in diameter every 12 cm, 4 rows each tube, (2) growth media - a mixture at weight ratio of 10:1:2 of soil, rice husk, and vermiculate, and (3) nutrients and water - slow N.P.K. plus micronutrients mixed in the medium and water. The best harvest results obtained, according to this study, were from pakchoy (Chinese green spoon cabbage), lettuce, rape green, and strawberry.

Based on the record that each pollulator can harvest 1.3 kgs of pakchoy in 5 weeks and each square meter can hang 4-5 pollulators, about 5 kgs of fresh vegetable can be produced in each square meter every month. This is twice as much as the East-West Center record.

Frequent change of medium, in every 2-3 crops, heavy dependence on chemical fertilizers, and requiring very intensive care perhaps would limit the wide application of this gardening technique.

3.3 Box garden

Big bottomless boxes of 5' x 30' x 8", filled with "custom-made soil," a mixture of sawdust and sand, or other inert and organic combinations, together with a balance of fertilizer can grow most crops with an abundant yield.[12] The custom-made soft soil offers many advantages, including perfect drainage, aeration, and balanced feeding.

The major problems in box gardening are the heavy initial investment and over-dependence on chemical fertilizers. Unless built with very solid framing, tropical heavy rain may destroy the whole system.

3.4 Hydroponic or soil-less gardening

Hydroponics is the growing of plants in a solution of nutrients necessary for plant growth, rather than directly in the soil. All the frustrations of outdoor gardening, namely the weeds, insects, diseases, lack of proper nutrients and moisture can be totally free in hydroponic gardening[13].

The three components of hydroponics are a container, gravel or sand, and nutrient solution. Many systems of hydroponic gardening have been developed with varying degrees of sophistication, from manual feeding of solution at a household level to totally automatic operation at a commercial scale.

The recent introduction to Hawaii of the "Vegetron" system, a battery of horizontal nutrient tubes arranged in a terrace on a frame[14], aroused considerable interest of urban gardeners. Nutrient solution is circulated to different tubes by an electric pump which is controlled by a timer to ensure plants are timely supplied with the proper dose of nutrients. This system, similar to the vertical garden mentioned above, fits nicely for roof and veranda gardening.

The high initial cost and total dependence on electricity and chemical fertilizer would impose many problems if this system is introduced to rural areas in the developing countries. Nevertheless, hydroponics could be one practical technique for urban gardening.

4. PROMOTING HOME GARDEN PROGRAM

4.1 Advantages of home gardens

The advantages of home gardens may be summarized as follows:

(1) Efficient production of nutrients deficient in common diet;

(2) Productive utilization of spare land and labor;

(3) "Garden-to-kitchen" freshness, no transportation and storage expenses;

(4) Reduction of dependence on fossil oil and its products;

(5) Development of children's interest in agriculture and providing exercise and recreation to adults;

(6) Saving on food budgets and increase of sid income; and

(7) Fostering of self-help spirit of the community.

4.2 Current programs in different countries

The cultivation of home gardens is a common practice in rural areas in most countries. School and village gardens received strong attention in the Applied Nutrition Projects implemented usually with FAO/WHO/UNICEF assistance. The results were not uniformly encouraging due to lack of research and education support, leadership, community motivation and participation, coordination with concerned ministries, and continued followup. Vegetable gardens flourished during the periods when contests were going on, then, gradually disappeared. However, such experiences, even if expensive, are valuable lessons for future home garden programs.

Recently, the government of the Philippines launched its "Green Revolution Campaign" and "Project Compassion". Malaysia introduced a "Green Book" to encourage local food production. The "Saemaul Undong" (New Community Movement) in Republic of Korea featured home food production as an important component. Indonesia, after her prolonged effort to fight against the widely prevalent vitamin A deficiency with different technologies, emphasized again this micro-horticulture approach as a measure of long-term solution. Similar programs were also implemented in Thailand, Sri Lanka, Bangladesh, Nepal, and some other countries.

4.3 Steps to organize an effective program

(1) Collection of Baseline Information

Perhaps one of the major factors adversely affecting the success of a home garden program is the lack of sufficient baseline data for realistic planning and subsequent evaluation. The agency responsible for the program should, at least, have the following information:

a. Soil and climatic condition and availability in the target area of land space for garden parcels and/or in local cropping system, water (current and potential), labor, tools, and planting materials;

b. Current status of home garden, kinds of vegetables and fruits planted and those with high nutrition value adaptable to local conditions;

c. Prevalence in the target area of protein-energy malnutrition, iron-deficiency anemia, and vitamin A deficiency;

d. Current food consumption of people and their food beliefs and dietary practices in relation to vegetables and fruits and in feeding of infants and young children;

e. Availabilities of infrastructure, technology, and local leadership; and

f. Attitude and resources of target community and potential cooperating departments and agencies in implementing the program.

This long list of information does not mean that an expensive and time-consuming survey should precede any action program. In fact, much of the above data are already available in related departments and institutes or easily obtainable by

some spot visits. If a survey at a village and household level is still necessary, it should be a simple one, preferably jointly designed and conducted by community people.

(2) Research and Extension Support

The introduction of all year gardens in subtropical and tropical areas through careful crop selection and rotation aimed at optimal calorie and nutrients output requires much research at the local level, considering soil quality, climatic condition, environmental problem, and availability of production inputs and infrastructure, as well as the consumption and marketing of outputs. It could be an easy-to-care, mostly with perennial plants, garden requiring moderate to intensive care, depending on local factors. Research is particularly important when vegetables are included as a crop in local cropping systems.

Rural people are "traditional conservatives", trusting their eyes rather than their ears. While mass media, if fortunately accessible to them, pamphlets, slide sessions, group discussions, and even individual interviews are all valuable in spreading information, they may not take any action until they actually see a nutritious garden operation and taste the produce. Result-demonstration is most essential to a successful garden program. Of equal importance is the education in the proper utilization of garden produce, particularly in the feeding of infants and young children.

It may be urged here that horticultural research institutes should pay appropriate attention to the tropical greens such as amaranth and kangkong if nutritional improvement of people is among their research objectives. In fact, some tropical vegetables may be introduced to the temperate zone because of their high nutritional value and requiring less care. Ongchoy from Taiwan grows vigorously in Korea during summer and is highly acceptable to local people.

(3) Community Motivation and Action

Past experience indicated that one major factor inhibiting the spread of home gardens is the failure to motivate community interest. Community resources are not fully developed and utilized to implement the program.

Program personnel should, at the very beginning of program initiation, plan with the community leaders and motivate them to take a major role in program planning, implementing, and evaluation. A home garden program is a community-based program. Its success depends entirely upon community participation, motivation, and action.

(4) Provision of Necessary Inputs

The most needed input in vegetable production, aside from land area which, in most cases, could be solved at the local level, is water which often requires assistance from external sources in terms of credit and materials such as tubes, cement, and pumps. Garden tools could also present a problem in some countries. The community concerned should be encouraged to solve their problems as much as possible. External resources to provide necessary inputs may be resorted to only when local ability is exhausted.

(5) Planning, Implementation, Coordination, and Evaluation

A community program is different from a military operation. Home garden program plans must be flexible and the time schedule must accommodate the climatic condition and labor availability of the community. However, once a plan of operation is agreed upon by all parties concerned, it should be carried out

faithfully. Otherwise a home garden program could be dragged on a few years without any accomplishment.

Start with a few small demonstration gardens and gradually cover the whole village. Good small gardens are far better than poor big gardens. When gardeners have experience, they would expand the area themselves. Grow the "basic vegetables" and add the others later. Always encourage, never complain. People take pride to show their accomplishment. Let villagers make their own self-evaluation on their garden performance. An example of evaluation form is attached. Education and self-evaluation should be an integrated activity of a home garden program.

Ideally, a home garden program should be a part of the country's socio-economic development program, with support from the government and full participation of community in its planning and operation. Or, from bottom up, the program be initiated and organized by the community themselves if sufficient motivation has been created. If neither is the case, for practical purposes, home garden programs must have a leading agency, using as much as possible the existing framework. In a country, the school system has great influence over community life; education channels may be the right carrier. Otherwise, agricultural and community development people should take up the major responsibility. In all the cases, voluntary agencies, such as church groups, often play an important role to promote community welfare including home gardens. Creation of a new institution to operate home garden programs is expensive and often ineffective.

A home garden program has close relevance to many ministries including agriculture, rural development, health, social welfare, and education, as well as voluntary agencies. The leading agency should be in close coordination with all concerned beginning at the planning stage of the program, with the terms of responsibilities of different cooperating agencies clearly spelled out. The capacity of the leading agency to encourage participation, accommodate aspiration and differences, and acknowledge credit, of the cooperating agencies, determines, to a great extent, the degree of success or failure of the program.

As a development program, a home garden program should be assessed against its objectives, on its operation and cost/benefit. Vegetables, different from capsules and tablets, are food and their consumption is a part of the people's everyday life. Although a home garden program is primarily aimed at nutritional improvement of people, it is unfair to compare the cost of vitamin and mineral tablets with that of vegetables in the treatment of malnutrition. The purchase and distribution of drugs requires constant government budget support, elaborate infrastructure, and efficient logistics, while a home garden program, once organized, could become a part of everyday life of people. The former is for emergency intervention, while the latter is a long-term improvement. They should be made complementary.

Progress and end result evaluations should, therefore, include both economic and nutritional impacts, in terms of additional food produced, income generated, and dietary and nutritional improvement of people in the target community. It should be conducted as much as possible by people involved in the program and community themselves.

As indicated before, home gardens could have significant contributions to the nutritional improvement of people. However, it does not solve all nutritional problems. Many people, because of land space and otherwise, in fact, could not keep home gardens. It is essential that the governments concerned should formulate a sound food and agricultural policy and develop supporting programs at both macro- and micro-levels, to ensure a sustained supply and consumption of foods that constitute nutritionally balanced diets of people. Home gardens, often neglected by the planners as a reliable food resource, should be widely promoted as a practical measure toward this direction.

ATTACHMENT

EVALUATION OF INDIVIDUAL GARDEN PLOTS

Pulok_____
Village_____
Municipality_____
Province_____

Plot	Land Prepara.					Nutrition consid.					Space utiliz.					Plant growth					Weed Control					Total Score
	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4	
1																										
2																										
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25																										
																									Average :	

Guidelines for rating

Land preparation

0 No land preparation
1 Dig slightly, bed not raised
2 Dig once, turned in some organic material, bed slightly raised
3 Deep dig once, turned in organic material, bed raised 4-6 inches
4 Deep dig twice, turned in plenty organic material, bed raised 6-8 inches

Nutrition consideration

0 No dark green leafy vegetables(DGLV)
1 Some DGLV growing
2 Half of area growing DGLV
3 3/4 area growing DGLV
4 All area planted DGLV

Space utilization

0 More than half space not utilized
1 Only half space utilized
2 About 3/4 space utilized
3 Still some small space not utilized
4 Garden space fully utilized

Plant growth condition

0 Plants all wilted, dying
1 Most plants in bad shape
2 About half of plants in good shape
3 Plants growing in good condition
4 Plants growing all vigorously

Weed control

0 Weed outgrows vegetables
1 Big and small weeds scattering whole garden area
2 Some weeds found between vegetables
3 Only a few small weeds
4 No weed

Total score rating

		Numbers	% of total
Under 8	"Poor"		
8-10	"Fair"		
11-13	"Good"		
14-16	"Very Good"		
17 and above	"Excellent"		

Evaluators_____ Date of Evaluation_____

Date Started Garden_____

References

1. "1979 FAO Production Yearbook," Vol. 33, Food and Agriculture Organization of the United Nations, Rome

2. Florentino, R.F. 1975. "The Malnutrition Problems in the Philippines" (mimeo.), Food and Nutrition Research Institute, National Science Development Board, Manila

3. Soekirman. 1974. "Priorities in Dealing with Nutritional Problems in Indonesia," Cornell International Monograph Series No. 1, Cornell University, Ithaca, New York

4. Villavieja, G.M. et al. 1977. "1974 Food Consumption Survey in Luzon and 1975 Food Consumption Survey in Visayas" (mimeo.), Food and Nutrition Research Institute, National Science Development Board, Manila

5. "Nutrition Survey of Rural Bangladesh, 1975-76," Institute of Nutrition and Food Science, University of Dacca, Dacca

6. Yang, Y.H. 1979. "Tropical Home Garden as a Nutrition Intervention," Tropical Foods, Vol. II, Academic Press, New York

7. "Planting Guide for Vegetables and Melons in Hawaii." 1974. Department of Horticulture, College of Tropical Agriculture and Human Resources, University of Hawaii, Hawaii

8. Yang, Y.H. 1979. "Easy-to-Prepare Soybean Foods for Villagers," Tropical Foods, Vol. II, Academic Press, New York

9. Singh, R.B. 1981. Editorial Remark in IBPGR Regional Committee for Southeast Asia Newsletter, Vol. 5, No. 2 (April 1981), FAO Regional Office, Bangkok

10. Martin, F.W. and Ruberte, R.M. 1975. "Edible Leaves of the Tropics," Mayaquez Institute of Tropical Agriculture, Agricultural Research Service, South Region, United States Department of Agriculture, Mayaquez, Puerto Rico

11. Juang, T.C. 1980. "Report on Improvement of Vertical Culture Techniques," Project 78-C18-A-2662, Soil Department, National Chunghsin University, Taichung, Taiwan

12. Mittleider, J.R. 1975. "More Food from Your Garden," Woodbridge Press Publishing Company, Santa Barbara, California

13. Bridwell, R. 1974. "Hydroponic Gardening," Woodbridge Press Publishing Company, Santa Barbara, California

14. "Vegetro, Soil-Less Gardens," New-Techni Corporation, Anaheim, California

TRADITIONAL HOME GARDENS AND NUTRITIONAL IMPROVEMENT

THE ROLE OF THE NON-GOVERNMENT ORGANIZATION

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TRADITIONAL HOME GARDENS AND NUTRITIONAL IMPROVEMENT
THE ROLE OF THE NON-GOVERNMENT ORGANIZATION

Home gardens - the areas designated for family food production are common throughout South East Asia. The traditional home garden is a subsistence garden and often appears mixed. It should not be confused with a market garden where crops are grown in straight row, monocropped, or raised beds. They are grown in a companion planting mixture of annuals and perennials utilizing the limited space available around the home. Mixed gardens differ from backyard gardening in that they often surround the home. In many instances climbing vines are trained on the side and on the roof of the home. Mixed gardens also differ from vegetable gardens because they contain fruit trees, medicinal plants, herbs and spices, masticants and stimulants, ornamentals, fiber, fuel and building materials as well as small domestic livestock.

A study was recently completed which researched the structure and function of the traditional mixed home garden and also the potential contribution of the garden to the family's nutritional intake.

Forty households were surveyed near 4 towns located in distinct climatic and cultural regions in the Philippines. The households were selected on the basis of the most representative examples of mixed gardening.

Highlights of the research findings included:

- Seventy-five percent of the households constructed their home garden primarily for home consumption.
- Over 50 percent of the gardens were between 400-600 square meters surrounding the house.
- Most gardens contained between 30-40 edible plant species which included legumes, fruit and leaf vegetables, root crops, spices and fruit trees. In addition, plants for firewood, building materials, fiber, ornamentals, cooking utensils, and medicinal plants were included in the garden structure.
- Over 75 percent of the respondents indicated their home garden, in combination with their staple field of rice or corn, was the main source of daily food.
- Nearly all of the 40 households surveyed had the potential crop resources from the home garden to meet or exceed their R.D.A. for Vitamin A, Vitamin C, Iron, and Calcium.
- More than 50 percent could make sizeable contributions to their R.D.A. for Vitamin B complex.
- Twenty-five percent could meet their R.D.A. for protein and energy, exclusive of their rice and/or corn field and livestock.

The study revealed that the traditional home garden, as a system for food production can be economically viable, because food for the family can be produced and income generated by marketing small amounts of surplus garden produce throughout the year. In addition, the cost of production is extremely low because the majority of the plant materials come from the local area and by fertilizer derived from plant and animal residues generated from the home garden population.

The gardens are ecologically sound because they resemble the original structure of a tropical primary forest. At one time, forests covered most of South East Asia. The mixed gardens are multi-storied, vertical plant canopies. A typical mixed garden is generally comprised of coconut trees dominating the top canopy layer. Various fruit trees are grown beneath the coconuts such as avocado, jackfruit, guava, banana, breadfruit, etc. A smaller, more shade-tolerant group of fruit trees can be found growing below the taller trees. Coffee, cacao, and papaya are in this category. Climbing legumes and gourds are trained to climb the trunks of the fruit trees. On the ground level, annuals are mixed with trailing plants to act as a cover for the soil. The re-creation of the primary forest into a forest of edible plants aids in the maintenance of soil fertility and soil structure, prevents erosion; and develops a self-sustaining agronutri ecosystem.

The gardens are of high nutritional quality due to the diversity of the plant species. Storage is not a serious problem because most of the crops are harvested as required for the family meal. Root crops are especially important as they provide the main staple food during the period between the end of the rice supply and the next harvest.

In short, the traditional mixed garden is a vital part of rural Filipino life. These gardens were created centuries ago and were designed to meet basic human needs to ensure survival. Mixed gardens are outstanding examples of efficient resource management and appropriate technology for the Philippine socio-economic and climatic environment.

Non-Government Organizations (NGOs) have a potentially important role in the development of gardening programmes.

Gardening has been a popular intervention scheme and has appeared in such familiar forms as school gardens, community gardens, kitchen gardens, victory gardens and home gardens.

In the late fifties/early sixties, the U.N. established "Applied Nutrition Programmes" in Guatemala, Mexico, Chile, Philippines and Tunisia. The 3 basic components included (1) Supplemental Feeding Programmes, (2) Gardening, (3) Nutrition Education. Such organizations as the C.R.S., CARE, World Bank, and U.S.AID, etc. became interested and also developed gardening projects.

Despite the general enthusiasm shown by various donor groups toward garden projects, problems in technology and programming still remain. This may be due in part to the recipient government's assigned low priority to gardening and the lack of trained personnel both in the government and donor group in garden programming.

However, now that nutrition is receiving greater attention, there has been an increased interest in gardening projects. Since NGOs often work at the community level, they have a greater opportunity to be effective in influencing improvement in gardening projects.

A few of the possible areas that NGOs can provide assistance in are:

RESEARCH

Funds are needed to do studies into existing traditional home gardening practices throughout Indonesia. Without solid data on the socio-economic and climatic factors influencing home gardens, the chance for successful programming is limited.

PROGRAMME DEVELOPMENT

An essential ingredient is garden programming that is based on materials, knowledge, and participation of the local community. In addition, education aids such as posters, technical publications, media campaigns, etc will all help with the dissemination of the home garden idea. There still remains a great deal of room for development of home gardening extension materials.

PROGRAMME IMPLEMENTATION

This area has tended to be the major stumbling block in gardening programmes. A few reasons for this may be that the implementors lack training in the technical and extension techniques and have difficulty working with the target groups. Plant material and garden equipment are also problems, but are secondary to the problem of motivation.

EVALUATION

Although garden programmes have been in operation for many years, basic questions still remain: Do garden projects improve the nutritional status of the target group? Does awareness of the nutritional benefits from gardening necessarily mean adoption? An effective means for evaluating garden projects is needed.

RURAL SAVE THE GRAIN PROGRAMME

IN

NEPAL

By

S. K. BHALLA

RURAL SAVE THE GRAIN PROGRAMME IN NEPAL

In the agricultural situation in the Kingdom of Nepal, where 63% of the farmers own 0.5 hectares or even lesser land to till and where post-harvest losses in foodgrains are estimated to be 10 - 15% and where farmers are aware of these losses, the program for reduction of the losses is very well taken by the farmers. With a view to helping the farmers to minimize these losses, His Majesty's Government of Nepal in cooperation with FAO has launched in two years "Rural Save The Grain Project" aimed at reduction of the losses and also making available additional quantities of foodgrains to the farmers. Under this program, loss-assessment studies, research, developmental extension and training activities are being carried out. "Post-Harvest Technology" and package of practices are adoptable in villages, but arrangements are required to ensure regular supply of inputs, material, etc. The savings from food losses would provide not only additional nutrition to rural poor, but would also add extra income to families and to the nation.

INTRODUCTION

As the world population increases it is becoming a matter of urgency to increase the food supplies. The application of science and technology to the traditional agriculture is resulting in a steady increase in production of foodgrains. The upward trend in production of foodgrains will continue with increased land brought under cultivation, and foodcrops, better farm management, increased use of fertilizers, pesticides, provision of high yielding varieties, modern technology, credit, etc. However, increased production of foodgrains is not sufficient to feed the growing population if adequate steps are not taken to avoid losses at all levels.

It is, therefore, imperative that all foodgrains produced in Nepal be conserved as efficiently as possible to help offset deficits and, where surpluses exist, that the quantity and quality of foodgrains moving into trade channels be maximized to promote farm income levels and increased availability of grain.

The FAO's program for prevention of food losses responds to this long-standing need, which received some prominence at the 7th session of the U.N. General Assembly in 1975 when a call was issued to reduce post-harvest losses in developing countries by at least half by 1985. The main aim is to provide help and assistance to small farmers in reducing losses by use of improved techniques and adoption of improved/new storage structures.

Under this program of FAO, the Rural Save the Grain Programme has been launched in Nepal from February, 1980 in collaboration with His Majesty's Government in Ministry of Food & Agriculture, the duration of which is 2 years. Such programs have also been launched by FAO in a number of countries and these programs are expected to be catalytic in nature. Such a pilot project would, subsequently, become a national program and would carry out the work on a continuous basis.

BACKGROUNDS, NEEDS AND JUSTIFICATIONS

Rice, maize and wheat and to a lesser extent millet, barley and pulses are the staple foodstuff of Nepal. About 70% of the grain produced does not enter trade channels and is consumed locally. The Food & Marketing Services Department has estimated Nepal's per capita cereal consumption in 1971-72 at 143 kgs. A calculation made by the Ministry of Finance had indicated that families in the hill and mountain regions can sustain themselves from their own production at a minimum

subsistence level for only 225 days in hill areas and for 191 days in the mountains. The capacity to purchase supplementary grains, if available, is limited or non-existent. Moreover, there are difficulties in moving supplementary grains into many of the areas involved. It, therefore, requires all-out efforts to reduce losses in the country.

No studies have been made of losses in farm threshing, drying and processing, but from consideration of their nature, it is evident that both quantitative and qualitative losses are occurring. From experience elsewhere, the recovery of rice from hand-pounding is less than 60% compared with 60-65% from a well-adjusted huller or hand-operated mill.

With limited subjective examinations, definite loss assessments have not been made, but general patterns are evident. On a commodity basis, losses from insect infestation appear greatest with wheat, less severe although locally variable, with maize and of marginal significance with paddy, even in long-term storage. Millet is practically unaffected and barely is produced and consumed in the cooler areas where insect activity is minimal. From a regional point of view, production and consumption patterns in mountain areas and interaction with cool climatic conditions result in little loss from insect infestation. A similar result is achieved in the Terai from attention to drying of grain for on-farm consumption, use of traditional insect-excluding storage containers and storage hygiene. In middle hill areas, however, where maize and wheat are particularly important, significant problems do exist. The main crop, maize, harvested towards the end of the monsoon may suffer considerable damage from grain moth before the onset of cool weather. The wheat harvest coincides with the time of increasing activity of the grain moth and weevils at the start of summer just before the monsoon. Infestation during drying seems undoubtedly a major consideration.

Grading of foodgrains according to quality is important. Mixing of different varieties of the grains results in processing losses. The provision of pure seed and its wider popularization should receive due emphasis and will lead to increased production and decrease in processing losses.

Losses in storage from rodents are more consistent and widespread. The traditional storage structures are not rodent proof and although surveillance by farmers limits the problem, it is significant in Terai and more so in the lower hill areas where, with the greater dependence on maize and its storage on-cob with little protection, losses reach recognizably significant levels. There is undoubtedly a case for urgent and effective action aimed at limiting these losses.

INSTITUTIONAL FRAMEWORK AND RELATED ACTIVITIES

The programs emphasize loss reduction activities in the rural sector in particular, as well as the establishment of an infrastructure for prevention of losses in the other sectors. The cumulative effect would be far-reaching in the context of total grain availability. At present, there is no baseline data to identify areas where the specific post-harvest operations need priority attention. The Rural Save the Grain Program is attached to the Ministry of Food & Agriculture which will ensure coordination and planning of post-harvest activities. A central unit will coordinate all concerned activities involved in various aspects of post-harvest program (quality upgrading as well as losses in various post-production operations) in order to achieve the objective of reducing post-harvest losses in the rural sector. A team approach for the post-harvest food loss reduction program will involve various organizations and agencies as shown following:

Quality Improvement:	Food Research Section, Department of Agriculture, Rice Exporting Companies, Nepal Food Corporation and Rice Mills
Threshing, Drying and Milling:	Food Research Section, Agricultural Engineering and Rice Mills
Storage:	Entomology Division, Agricultural Engineering, Nepal Food Corporation and Food Research Section

OBJECTIVES

General: To reduce post-harvest losses and improve quality on-farm operations concerned with grain.

Specific:

1. To reduce losses in harvesting, threshing, drying and processing of staple foodgrains, by development and introduction of improved techniques and simple equipment capable of local production and at prices within reach of farmers.

2. To reduce losses in storage of staple food stuffs, particularly maize, wheat and pulses caused by high moisture and attack by insects, rodents and moulds.

3. To prepare a nation-wide program to create awareness among FARMING FAMILIES of the losses that occur in grain quality, the causes of these losses and practical methods of reducing them.

4. To select and test improvement measures for reducing losses and to train FARM FAMILIES in adopting these measures.

5. To evaluate the effects of the techniques introduced on the reduction of losses.

WORKPLAN

1. The Ministry of Food & Agriculture will appoint a senior officer as Chief of the Project (it has already been done) and the project will be placed in the structure of the Ministry. The project will be integrated with the Ministry and other Organizations.

2. The present project has been designed to improve the efficiency of the post-harvest activities and will be carried out in context of on-going agricultural development projects in the country. It is intended that a nationwide program will be launched to make the farmers aware of the problems of post-harvest losses. The program, in addition, would emphasize loss reduction activities in the rural sector as well as the establishment of infrastructure for prevention of losses in the commercial sector.

3. The broad field program and framework for activity will cover:

a) Application of loss reduction measures
b) Measurement of losses both under traditional/improved practices
c) Identification of areas where economical viable changes can be made
d) Preparation of training manual
e) Current on-farm operations and storage practices
f) Modification of existing storage structures
g) Use of simple equipment/techniques to demonstrate the potential of loss reduction techniques
h) Extension program to other priority areas for adoption/action
i) Construction/fabrication of storage structure, equipment and pest control material necessary for on-going operations
j) Training on post-harvest technology and orientation courses for various functionaries which will include:

- o District agricultural officers
- o Other District level officers/officials
- o Village level workers
- o Farm youth
- o Lady program officers/officials
- o Farm women
- o Village rice millers
- o Training to junior staff in loss assessment/loss reduction techniques
- o Workshop artisans/blacksmiths, etc.
- o Other miscellaneous village workers

SOCIAL & ECONOMIC CONTEXT

Throughout Nepal socio-economic diversities are more pronounced. A small number of farmers control large areas of land whereas a vast majority owns or cultivates smaller fields. A sample survey of 18 districts of Nepal found 88% of all house-holds had holdings of 2 - 7 hectares and below. Other studies put the vast majority of farmers cultivating about 0.5 hectares.

An extensive socio-economic survey conducted by KHARDEP illustrates spending capacities of small farmers as under:

	Farm Size (Hectares)		
	0.5	0.5-1	Over 1
Average Farm Cash Income Per house-hold in rupees	414 ($.35)	1052 ($.88)	1402 ($.117)

US $1.00 = NC Rs. 11.90

The same survey indicated that farmers with 0.5 hectare spend 57% on food whereas farmers holding over 1 hectare spend 33% of expenditure on food. It therefore indicates that small farmers not only have limited income but are forced to spend much on food. Therefore, financial capabilities of the average Nepali for agricultural and other investments are severely constrained. Moreover, due to financial reasons there is migration of men, particularly from deficit food areas in the hills and mountains (World Bank 1976), but this is seasonal migration and does not contribute to any shortage of labor during peak agricultural operations.

Under the circumstances, FOOD STORAGE TECHNOLOGY involves a package of practices which could be adopted by the majority of the farmers, and also improvement of existing storage structures and adoption of new ones by farmers who could afford it. The Rural Save the Grain Project has been able to consolidate and recommend a package of practices for:

1. Control of insects by spraying and fumigation of rural storage structures with recommended insecticides at a cost easily within reach of the majority.

2. Low cost and effective storage structures have been designed, developed and evaluated. These storage structures are improvements and modifications of existing storage structures and could be made and fabricated in villages with available facilities. These modified, improved storage structures reduce losses and make additional quantities of foodgrains available.

3. Along with low cost improvements of existing practices, the metal bins of variable capacities have been designed, tested and evaluated. These are no doubt costly, but in view of the demand and need, it has a viability. In order to enable a majority of farmers to purchase such metal bins, a scheme is being evolved to enable farmers to get loan/subsidy payable in 4 years with low interest rate.

The Rural Save the Grain Project in Nepal has been able to establish infrastructures which could not only carry out the work, but also expand it as a Nationwide Campaign to reduce the post-harvest losses. The quantum of food losses at various stages, especially by farmers, are being assessed to enable Government to give needed emphasis for reduction of these losses and also plan suitable investments. Additionally, the package of practices along with improved and new storage structures have been recommended which would reduce losses considerably when adopted and extended from project areas to all parts of the country.

HOUSEHOLD FOOD PRESERVATION AND PROCESSING IN MALAYSIA

by

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HOUSEHOLD FOOD PRESERVATION AND PROCESSING IN MALAYSIA

The educated civilized urban man has always been thought to be the more learned and knowledgeable person. It is from him that masses of the less privileged can learn. But what has the 'civilized' man taught the rural man today:-

- that commercially prepared food products are better than his traditional foods.

- that bottled drinks like Coca-Cola are more satisfying and thirst-quenching than traditional drinks like soya bean milk or barley water.

- that to have a hamburger as a snack is the more fashionable thing to do than to have rojak (a mixture of fruits and vegetables like pineapple, cucumber, turnip, mango and others flavored with prawn paste).

- that powdered milk formula is more nutritious and the more civilized way to feed your baby and breast-feeding is backward and outdated.

These are some of the fallacies that have penetrated far and wide to the most rural parts of the country, by personnel who have the strength, power, resources and intelligence to do it.

Nutrition Education has for a long time, in Malaysia, been influenced by the advertisements in the media, which in other words means the food industry. Every adult and child in the village knows that Ribena is an excellent health drink which is rich in vitamin C (so says the advertisement). But how many of them know that the guava (jambu batu) which is such a cheap local fruit available all the year round is a very rich source of vitamin C (almost 100 mg Vitamin C per 100 gms.)?

Advances in food technology and modernization have brought about much change in the food habits of communities, which have had serious ill-effects on the nutritional status of the people. The ill-effects are particularly felt by the poor, who are also ignorant. One example is that of sweetened condensed milk (SCM). Sweetened condensed milk was first manufactured and introduced into the market chiefly for adults; it is coffee-shop milk. The high sugar content has been deliberately achieved as a preservative. It is, therefore, a totally unsuitable food for babies. Yet, in Malaysia, mothers have been lured by advertisements and driven by poverty and ignorance to give their babies Sweetened Condensed Milk.

In rural areas, mothers who cannot afford to buy the more expensive powdered milk often switch to sweetened condensed milk as the alternative source of food for their babies. Some milk companies in Malaysia and other South-East Asian countries have proclaimed that their SCM is 'an excellent food for infants'.

Ironically, the rural man on the other hand has a lot to offer the urban, commercial world in the way of nutritious, preserved food. The processing and preparation is done both on a very small scale in the homes, just sufficient for the household consumption or sometimes it is done on a larger scale to be sold to neighbouring towns and villages. The difference here from the commercial world is there is no extensive marketing system or publicity. The product is not distributed nationwide, so very often people go all the way to the manufacturers of these delicacies to buy the product.

For example, people travelling to the East Coast state of Kelantan bring back for themselves and their friends a very popular fish paste made there called, 'bub'. Or if you've gone to the Island of Pangkor for a holiday, you'd be sure to bring back 'satay fish' which is small fish that has been seasoned with salt and chillies and dried in the sun. It is very crispy and is eaten as a snack.

However, traditional technologies today are under tremendous pressure from modern technology, and there is a great need to preserve these appropriate traditional technologies, as they may provide the nutritional fulfillment for the millions of the rural poor.

Malaysia, with its multi-racial population, has a variety of traditionally processed and preserved foods which provide the people with cheap in cost and rich in value sources of protein and other nutrients.

This paper gives an account of the various foods in Malaysia processed at the household level or on a cottage industry level.

Soya Bean Milk (Tau Chui)

Ingredients: Soya beans
Grinder
Sugar
Water

Method:

1. Soya beans are soaked in water for 5-6 hours.
2. The soaked beans together with water are ground in a stone grinder.
3. Water is boiled separately in another pot.
4. The grounded mixture is then poured into the boiling water and allowed to boil for 5-10 minutes. It has to be stirred continuously to prevent burning.
5. Pandanus leaves can be added to give an aroma.
6. The mixture is then sieved over a muslin cloth and the liquid is carefully squeezed out.
7. Sugar is then added to sweeten the milk. White brown sugar can be added as desired.

The dry residue left behind can be used as animal and poultry feed. Soya bean milk tested on a dry basis was found to contain 30% protein.

Soya Bean Curd (Tau Fu Fah)

Ingredients: Calcium Sulphate
Soya Bean Milk

Method:

1. A tablespoonful of calcium sulphate (plaster of paris) is dissolved in about half a cupful of water.
2. The soya bean milk which has been filtered is slowly poured into the container with calcium sulphate solution. No stirring is done as this will prevent proper coagulation.
3. The milk coagulates into a jelly-like mass.
4. The top layer of foam and bubbles is then scooped off.
5. The curd is served in a bowl with a few spoonfuls of either brown sugar or cane sugar solution.

Tested on a dry basis, protein content here was found to be 45-50%, fat: 20-25% and carbohydrate: 25-30%.

A point to note is that the beans must not be soaked for more than 8 hours, or the texture of the tau fu fah formed will not be of the exact firmness. Addition of greenpea flour or corn flour will smoothen and soften the preparation.

Soya Bean Jelly (Tau Fu)

Ingredients: Calcium Sulphate
Soya Bean Milk

Method:

1. The preparation is similar to that in soya bean curd.
2. However, when the coagulating process is taking place in the container, a bamboo sieve is placed in it. The sieve should sink in the coagulating layer or else a weight is placed on top of it to enable it to do so.
3. Water from the coagulating bean curd seeps into the sieve and this excess water is scooped up, leaving the bean curd behind.
4. A piece of muslin is then placed over a mould, and the bean curd is scooped up carefully and placed onto the muslin cloth over the mould.
5. It is then carefully wrapped up and a heavy weight placed on top of it to press out the whey.
6. The solid mass is then cut into smaller pieces and used for cooking.

The protein content here is 50-55%, fat 20-30% and carbohydrate 10-15%. Tau Fu is cut into small cubes and fried with prawns, shallots or bombay onions or it is added into soup preparations. The drained whey is a good detergent for kitchen utensils.

Fried Bean Cake Cubes

Ingredients: Soya Bean Jelly

Method:

1. The whey has to be completely removed from the soya bean jelly to give a fairly dry perparation.
2. It is then cut into cubes and deep fried in oil, until they turn a golden brown.

The protein content here is 40-50%, fat: 35-40%, and carbohydrate 10-15%. These can be cooked with onions, vegetables and/or noodles. A popular dish is stuffing the cubes with mince meat or fish and then frying or boiling in soup.

Bean Cakes (Tau Kuah)

Ingredients: Soya Bean Milk
Calcium sulphate solution (30 gms of calcium sulphate + 30 cc. water)
Salt Solution (2 tablespoons salt to half a cup of water)

Method:

1. The hot soya bean milk is allowed to cool for about 15-20 minutes.
2. Calcium sulphate solution and the salt solution are gently added to the milk, with continous slow stirring.
3. When precipitation appears on the surface of the solution, the addition of the coagulant is stopped.

Good bean cake of tau kuah requires the addition of 3% of calcium sulphate and 6% of salt as compared to the weight of the beans used. For example: if 1 kilo of soya beans is used, 30 gms of calcium sulphate and 60 gms of salt must be added. The protein content found here ranges from 50-55%; fat: 30% and carbohydrate: 15%.

These are some of the more popular soya bean products. Apart from this there are still many other by-products of the soya bean which are used in a variety of food preparation. Detailed accounts of their preparation methods are given in the booklet 'Soya Bean - nutritious food for the people', a publication by the Institute Masyarakat Berhad.

FISH AND PRAWN PRODUCTS

In Malaysia, fish food forms about 70-80% of the protein intake of the population, especially the poor. Fish forms a cheap and important source of protein for the lower income groups, and it is an extremely vital part of the diet of these peoples.

Belacan (shrimp paste) making:

Ingredients: Shrimps
Salt
Sunlight

Method: In Household Production

1. The fresh shrimps are salted and left in bright sunlight for about two hours.
2. The salted shrimps are then either spread out on gunny sacks or raised bamboo platforms for effective drying and to prevent animals getting at it.
3. The dried shrimps are then collected and poured into a wooden mortar and pounded into a finer form.
4. After this, it is removed and left in a container overnight for fermentation to take place.
5. The drying process is resumed the following day after which the pounding is repeated. A little water is added to facilitate easier pounding.
6. The paste formed is then pressed flat into pound or rectangular blocks.

In Commercial Production

1. In the commercial manufacture of balacan the shrimps are salted and left overnight for about 14 hours.
2. They are then removed and dried in bright sunlight for 4-5 hours, after which they are collected and put through the first mincing process by means of a mincing machine.
3. The minced shrimps are stored and left to ferment for 2 weeks.
4. They are then dried in the sun again for 4-5 hours.
5. Mincing is then done again for a second time and the paste is stored for 3-4 months in giant wooden tubs. The minced shrimps must be kneaded compactly into the tub to ensure that no air is trapped before storing it or else a yellow colouring appears and a 'foul' smell is emitted.
6. After storage, it is removed from the tubs, minced again (third time) and exposed to 2 hours of good sunshine after which it is again stored.
7. The next day it is minced the fourth time so that a finer texture is obtained.
8. The balacan or shrimp paste which it has now become is cut into blocks or flattened pieces and packed for sale.

Belacan is widely used in Malaysian and Indonesian cuisine and salad dishes, and is a very popular food item for the people of these regions. In Malaysia, almost all fishing villages are engaged in belacan manufacture either on a commercial scale or on the basis of family consumption as it is a cheap and important item in the food of these people.

Belacan-making on a subsistence basis is very labour-intensive and is mainly carried out by the womenfolk. In the village it is an activity in which the womenfolk perform together. It gives them an opportunity to meet and chat. Hence, it is a social activity as well.

In commercial production the implements are few and easy to operate, but the implements used in small-scale or subsistence production are elementary and a lot of hard work is required. The technique is passed on to the younger generation in the process of the latter working and helping their parents in the village.

This technology is applicable to regions where there is a ready source of shrimps and a demand for belacan as a food.

Keropok-making (Crackers)

In Malayasia, the keropok-making industry has been confined mainly to the Malay ethnic group. It is one of the ways of preserving fish, especially in the East Coast where marketing of catches is limited. Since the crackers contain 40-50% of either fish, prawns or cuttlefish, it is a rich source of protein.

Ingredients: Fish, prawns, cuttlefish. The types of fish normally used are sardines, swordfish, pilchard.
Sago flour
Rice flour
Flavours - pepper, chillies and other spices
Water

Method:

1. The fish are cleaned and the flesh extracted leaving the bones, heads and tails behind. A big basket of fish with around 1,000 fishes can be cleaned in 2-3 hours by 4-5 workers.
2. The fish is then pounded fine using a mortar and pestle with some spices - according to taste.
3. Then, sago, rice flour and a bit of water are added and pounded thoroughly. The ratio of fish to sago and rice flour is 3:4:1.
4. The pounded misture is then kneaded well and rolled into long rolls. This takes about 10-15 minutes.
5. Meanwhile water is boiled separately in a frying pan which is lined with banana leaves.
6. When the water is boiling, put in the rolls. The banana leaves will prevent the rolls from sticking to the frying pan. Boil the rolls for 1/4-3/4 hour.
7. When the rolls are found floating at the water surface, they are scooped up and placed in the basket trays to drain away the water. The rolls are placed apart to prevent them from sticking.
8. When the rolls are cooled and hardened they are cut into thin slices and arranged apart in the bamboo trays to prevent sticking to one another. The slices of Keropok are dried under the sun.
9. When the keropok are completely dry, they are deep-fried. The oil must be well-heated before putting in the keropok, otherwise the crackers will not be as brittle and delicious as expected.

Keropok can be bought either in the form of the dried slices or deep fried. If is is bought in the former form it can be deep fried in the home whenever desired. After frying, it has to be stored in an air-tight container or it will go soft.

The Malay communities make use of the available local resources - seafood, sago palms (found along river banks) for the main ingredients in keropok-making.

The apparatus is made primarily from bamboo and timber easily accessible in the surrounding woods. Firewood is collected in the woods. Coconut husks are also used. The clean environment and spacious compound provides a good ground for sun-drying the products. Abundant labour is also available in the rural areas where the housewives are keen to carry out some form of economic activities.

The technology is simple, with very little capital outlay and within the control of the people. However, the markets are very localized and the people have to compete with the highly commercialised factories producing other types of crackers that are of lower nutritious values than the keropok of the cottage industries.

Pekasam (fermented fish)

In Malaysia, this process has been carried out on a very small scale at the household level. However, very recently this technology has been given more attention as a valuable source of protein food. It is carried out more in the East coast state of Kelantan. The types of fish used here are fresh water fish.

Ingredients: Fish
Salt
Pounded Rice

Method:

1. The fish is first scaled and cleaned and put into large containers.
2. A large amount of salt is added and it is covered tightly with a piece of cloth and allowed to lie for about a month until the bones are soft and easily disintegrate.
3. After being allowed to lie for a month the fish is taken out and washed with fresh water.
4. Coarsely pounded rice is then added to the fish. This is done to improve the flavour and give it a sourish taste.

Pekasam is eaten as a side-dish with rice. The technology here is also fairly simple. When done on a household level, no special utensils are required - any container suitable for storing the fish can be used, preferably a porcelain container. However, when prepared on a large scale, large porcelain barrels are used for storing the fish.

Budu (Fish Paste) Making

This is again a delicacy of the East Coast of Malaysia, especially the state of Kelantan. It is made out of tiny fresh fish about 2½ inches long which look like sardines.

Ingredients: Fresh Fish
Coarse Salt

Method:

1. The coarse salt is poured onto the fresh fish and mixed thoroughly.
2. The fish is scooped and put into cemented cylinders, which are then covered up for about 4 months with gunnysacks.
3. After that the unwanted top layer is removed. The budu is then boiled and put into bottles to be sold.

Budu is used in Malaysian cooking in the preparation of gravies and salads and enhances the flavour of the food. One point to note here is the hygienic conditions during the processing. Often during the long 4 months period of storage, maggots can be found in the fish in the cylinder. They are removed along with the top layer but the chances of some remaining behind and getting boiled with the fish are very great. However, this does not bother the local people.

Salted Fish

This is very popular with all the ethnic groups in Malaysia. It is a useful source of protein when fresh fish is not available. In rural homes, where there are no refrigerators, shopping for fresh fish has to be done daily as fish cannot be stored for long. This is where salted fish comes in very useful on days when shopping is not possible.

Ingredients: Fish
Salt
Lots of sunlight

Method:

1. The fish is first scaled and cleaned thoroughly and cut into small pieces.
2. It is then salted thoroughly and spread out on mats and dried in the sun for a few days until it is completely dried.

Salted fish can be bought and stored in an airtight bottle for quite a long period. When desired, it is fried and eaten with rice and other vegetables or it can be made into a gravy.

Dried Prawns

These are prepared on a similar basis to salted fish. The shrimps are washed, salted and dried in the sun for several days until completely dry. They are then stored in a jar and used for cooking gravies or added to vegetables when frying them. They can also be pounded and added to vegetables when cooking and gives a delicious flavour. Dried prawns are also used in preparation of noodles and soups.

OTHER PRESERVED FOOD PRODUCTS

Salted Eggs

This is prepared by the Chinese and Malay communities.

Ingredients: Eggs
Salt

Method:

1. Eggs are immersed in highly salted hot water. The water should be just enough to cover the eggs completely. Normally about 1 kati of salt (approx. 1¼lbs.) is used for 10 eggs.
2. The eggs are soaked for about 4-6 days.
3. They are then taken out and dried and ready to be eaten. In the commercial preparation of salted eggs, the salt is mixed with black earth and wrapped around each egg; - about ¼ inch thick layer. The eggs are left in a large pot for several days. When taken out, they are ready to be eaten. They are eaten just plain or with broth.

Tapai (Fermented glutinous rice)

This is a delicacy of the Malay community and is usually prepared as a tea-time delight.

Ingredients: Glutinous rice
Yeast

Method:

1. About 1 kati of rice is first washed and cleaned.
2. It is then put in a steamer until soft. This usually takes about 45 minutes to one hour.
3. A handful of yeast is crushed up and pounded into a paste and mixed thoroughly with the rice. The mixing must be thorough and even throughout; otherwise it will not taste right.
4. The rice is then put into a large clean container and covered with a tight-fitting lid.
5. Next morning, it is ready to be eaten.

This delicacy keeps for about a week and is made by rural women. Some even make it in large amounts and sell it.

A superstition associated with this food is that while preparing it, the maker should keep silent or it will not turn out right.

Durian Cake

Durian is a seasonal fruit in Malaysia. It is available in large quantities only between the months of June - August. It is an extremely popular fruit and to be able to enjoy it all the year round, it is preserved with sugar into the form of a cake.

Ingredients: Durian
Sugar

Method:

1. The flesh is removed from the seeds in a container.
2. Sugar is added to taste and it is cooked and stirred continuously.
3. Cooking takes a very long time and the stirring has to be carried on continously and so this is quite a tedious process.
4. When the durian is brown in colour and does not stick to the pan and rolls up into a round mass, it is ready.
5. It is flattened or rolled and wrapped.

This can be kept for long periods and is very high in energy.

Preserved vegetables (Long Beans, Brinjals, Chillies, etc.,)

This is more commonly practised by the Indian community in Malaysia. Any vegetable can be used and this is a good way of preserving seasonal vegetables. However in Malaysia, most vegetables are available all the year round.

Ingredients: Vegetable
Salt

Method:

1. Boil the vegetables in salt water till they are one-quarter cooked.
2. Then take them out and dry them in the sun for 2-3 days till they are completely dry.
3. They are then stored and used for cooking whenever desired.

They have to be cooked before eating and are usually deep fried or cooked in gravies (e.g. sambar).

Preserved Fruit (Mango/Lime)

Again this is practised by the Indian community in Malaysia and is a popular way of preserving seasonal fruits.

Ingredients: Fruit
Salt

Method:

1. The fruit is sliced and washed.
2. Salt is then rubbed into the fruit thoroughly and left for about 3 days. This is to allow the natural water from the fruit to seep out.
3. The fruit is then dried in the sun.
4. When thoroughly dry, more salt is rubbed into it and it is dried out.
5. This is done several times till all the fluid from the fruit seeps out and the fruit is completely dry.
6. The fruit is thoroughly dried in the sun and then kept.

This can be eaten just dried or it is more usually used in the preparation of pickles where all kinds of spices and oil are added to the fruit. It is then eaten as a side-dish to the meal and adds flavour to the whole meal.

Preserved Meat

The most common meat that is preserved is mutton or pork. As it is again a practice of the Indian community, beef is never used as it is not usually eaten by the Indians. However, beef could also be preserved in this way if desired.

Ingredients: Meat
Chilli powder
Salt
Oil

Method:

1. The meat is boiled in a little water with some chilli powder, salt and oil.
2. When the meat is cooked, it is taken out and dried in the sun for several days till the meat is completely dry.
3. It is then stored.

It is used for making curries and gravies and also pickles.

These are just some of the household food preservations that one would find in Malaysia.

A longer and deeper study into this issue could reveal a wide range of traditionally preserved foodstuffs which would be valuable food resources for the country.

Perhaps what is needed here, is for the Government to aid these small-scale technologies by way of training the personnel in hygiene and cleanliness and helping in the distributing and marketing of the produce. Some training in fortification of the foodstuffs would help in uplifting the nutritional value of the food, for although most of the foods serve as good and cheap sources of protein, much of the vitamins are destroyed in the excessive drying, pounding and grinding.

FOOD PREPARATION AND NUTRITION

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& Family Welfare Trust

FOOD PREPARATION AND NUTRITION

1. INTRODUCTION

No living being can survive without food; it is the basic need for survival. Nature has provided the resources. It is the duty of the human being to choose the correct food and prepare it properly for eating without losing the nutrients.

Existing habits of people are such that sometimes food nutrients are drastically destroyed. Although the food availability is normal, because of ignorance, people are not able to choose and eat properly nutritious food. The socio-cultural and economic barriers also have a bearing on this.

The following few paragraphs disclose certain facts that show suitable modifications are required to improve the food habits in the Indian context. This paper aims at highlighting the points to be considered:

2. POINTS TO BE CONSIDERED

2.1 How to make the people use the locally available food stuffs?

2.2 How to identify the methods and preparations of food which are socially and culturally acceptable and functionally efficient?

2.3 How to get people to plan the food needs and keep within their economical resources?

3. AVAILABLE FOOD STUFFS IN INDIA

The major components of Indian food are cereals from which major energy needs are derived. The common cereals are rice and wheat. To meet the protein requirement, people use Redgram, Blackgram, Greengram, Bengalgram, Cowgram, and Horsegram as resources. Though people realize the importance of milk and milk products, they are not in a position to acquire these for use because of their financial inaccessability. Similarly, meat, fish and eggs are rarely consumed by the poor people.

In regard to vegetables, there are about 40 different leafy vegetables and 12 roots and tubers and 40 other vegetables commonly consumed by people in India. In view of Indian geographical variability, the availability of food stuffs

varies from place to place and season to season. Therefore, food practices are mainly influenced by the availability of food stuffs locally. Suitable habits of utilizing the locally available food stuff should be encouraged in the population.

4. FOOD HABITS OF THE PEOPLE

4.1 Food Preparation

The food preparation process is a vital factor (in good nutrition). Though many traditional habits of preparation are good ones, some cooking processes act adversely by destroying the nutrients. When reviewing food preparation practices, the following facts should be kept in mind.

The people prefer to eat polished cereals without knowing the importance of Brawn which is rich in Vitamin 'B' and minerals. Unknowingly, while people are washing rice, the vitamins and other nutrients are removed. Excess water is being added for cooking but discarded at the end along with nutrients like Thiamine, Nicotinic Acid and Phosphorous, etc.

Using rice, particularly polished rice, is a matter of social prestige. This social preference acts as a barrier to use of other mixed cereals and par-boiled or hand-pounded rice. Therefore, intensive education is the means to change the traditional way of cooking cereals.

The process of cooking vegetables is another means by which we often destroy the vitamins and minerals, and also lose the food values. Therefore, the following principles should be encouraged and followed:

a) Using a large amount of water for cooking should be avoided to save cooking time and preserve vitamins and minerals in the foods.

b) Peeling of vegetables should be avoided, to save the nutrients.

c) Usage of baking soda for cooking green vegetables should be avoided because it destroys the vitamins.

d) Tamarind juice, to give flavour and taste, should be added only at the end of the cooking process.

e) Vegetables should be cut in large peices. By smaller cuttings, we may lose minerals and vitamins.

f) Greens should be uncovered while cooking to retain color by allowing volatile acids to escape.

g) Steaming should be encouraged.

h) The length of time that vegetables cook should be as short as possible.

i) Eating raw vegetables in the form of chutny, pachadi and salads should be advocated.

4.2 Wastage of Fuel

Indian villagers use cow-dung cakes, coal and firewood for cooking which are becoming costly now-a-days. Further, they affect the health as they produce smoke in the house. The condition can be minimised by using a haybox. The haybox can be made from local materials like dry hay-stack and a small wooden box. The half-cooked rice and vegetables can be kept in the hay-box and left for one hour to complete cooking. Another important cooking element is the smokeless Chula. This can be introduced in the household to modify the existing pattern of the traditional smokey oven in order to save money and time, and to promote health. The Poonamallee Research cum action experiments show that this smokeless chula is most useful for the rural home.

4.3.1 Preserving of prepared food in rural India: people keep the residual rice in water for about 2 days before eating. This cold rice process produces vitamin 'B'. This kind of practice should be encouraged and is particularly suitable for the poor. This same practice is followed with Chapatties (wheat preparation) in the north of India.

4.3.2 The most popular methods of preparing foods are salting and smoking. The salting method is used in preparing pickles in rural India to keep the food stuffs for six months to one year.

4.3.3 Drying in the household may be appropriate technology to preserve food in rural communities. Cold storage is another cheap method which could be made from local country wood and wire mesh.

5. ONE OF THE SUCCESSFUL EXPERIMENTS

The Gandhigram Institute of Rural Health and Family Welfare has developed supplementary foods and ways to educate mothers to prepare supplementary food from local resources to feed their children. We found it is very difficult to change the habits of women in rural communities so they will adopt the new idea. However, by proper community organisation we hope to modify the local food pattern.

The Institute is producing three types of supplementary food for children under five years of age by utilizing locally available food. The cost is less than commercially prepared foods and the Institute's foods can be prepared by the mothers themselves. See enclosed annex for details.

6. CONCLUSION

A scientific nutritional education approach will prove successful in changing food habits. A slow and steady effort is needed to reach this objective. Since changing food patterns is very difficult, the socio-cultural, and economic influences on peoples' lives should be kept in mind in order to effect permanent change.

GANDHIGRAM INSTITUTE OF RURAL HEALTH AND FAMILY WELFARE TRUST
PO AMBATHURAI RS : MADURAI DISTRICT : TAMILNADU : INDIA ; 624309

LOW-COST RECIPES

1) Wheat Porridge

Coarsely broken wheat	-	1 cup
Grated coconut	-	1 cup
Cardamoms crushed	-	2
Sugar or jaggery	-	to taste
Salt	-	to taste

Method:

1) With boiling water extract the coconut milk three times.
2) Boil the second and third extractions.
3) When it is cooked soft, add sugar and jaggery.
4) When the wheat particles are quite soft add the first extraction of coconut milk and allow to simmer for 5 minutes. Add the cardamom and remove from fire.

2) Wheat Adai

Wheat flour	-	1 cup
Butter or ghee	-	2 tsp.
Salt	-	to taste
Grated coconut	-	2 tbsp.
Ginger	-	1 small piece
Green chillies	-	2
Lime juice	-	few drops
Curry leaves	-	a few
Drumstick leaves	-	a handful

2) Wheat Adai - continued

Method:

1) Knead wheat flour with ghee and salt
2) To this add the other ingredients and knead well into a thick dough.
3) Smear a plantain leaf with oil.
4) Place a lime-size dough on the leaf and spread with the hand.
5) Place on a hot thawa with a few drops of oil and bake the adai on slow fire till it is crisp and golden brown.

3) Wheat Balls

Wheat flour or Maida	-	1 cup
Green gram	-	½ cup
Jaggery or brown sugar	-	2 tbsp. or more
Salt	-	a pinch
Cardamom	-	1

Method:

1) Knead the wheat flour and keep aside.
2) Cook the green gram in just enough water till it is quite dry.
3) Remove from fire and mix with brown sugar, crushed cardamom, and some salt. Grated coconut can be added if desired.
4) Mix this well into a smooth consistency.
5) Take a lime-size dough, make a hole in the center, place 1 tbsp. of the filling in it, and close it.
6) Steam it in an iddli deskhi.

4) Summer Salad

Cucumber	-	1
Tomato	-	1
Capsicum	-	1
Pineapple	-	1 slice
Salt	-	a pinch
Sweet lime	-	½

Method:

Peel the cucumber and cut into very fine pieces and add along with capsicum and salt. The rest of the ingredients are also cut into small pieces.

5) Brinjal Curry

Brinjal	-	50 gms.
Onions	-	30 gms.
Tomato	-	32 gms.
Pepper	-	5 gms.
Oil	-	15 gms.
Salt	-	5 gms.

5) Brinjal Curry - continued

Method:

1) Wash and cut into cubes and keep under water to retain its color.
2) Heat the oil in the cooking pan and add powdered pepper and cumin.
3) Cook the tomato till it turns tender; peel and mash the tomato to remove the seeds.
4) Add tomato preparation to onion mixture with salt.
5) Cook the above for 10 minutes and add brinjal pieces. Allow to simmer until the brinjal becomes tender.

6) Wheat Uppuma

Broken wheat	-	6 tsp.
Onion	-	2 tsp.
Oil	-	2 tsp.
Black gram dal (udath)	-	2 tsp.
Drumstick leaves	-	1 bunch
Dried Chillies	-	a few
Mustard seeds	-	a few
Curry leaves	-	a few
Salt	-	to taste
Water	-	as required

Method:

1) Fry mustard seeds, chillies, curry leaves, and dal in oil until brown.
2) Add broken wheat and fry until brown.
3) Add chopped onions and chopped drumstick leaves.
4) Add water and salt and cook over low fire until done.

Nutritive value: 237
5.9 gms. protein
Suitable for infants, preschool and school children, and pregnant and nursing women.

7) Ragi Adai Sweet

Ragi flour	-	6 tsp.
Roasted Bengal gram flour	-	2½ tsp.
Jaggery	-	3½ tsp.
Grated coconut	-	1 tsp.
Oil (groundnut)	-	1½ tsp.
Water	-	as required

Method:

1) Dissolve jaggery in water.
2) Mix ragi flour and roasted Bengal gram flour. Add to dissolved jaggery.

7) Ragi Adai Sweet - continued

Method - continued:

3) Add coconut and prepare a thick dough.
4) Prepare adai and fry on a greased thawa.

Nutritive value: 299 calories
6.1 gms. protein
Suitable for school children and pregnant and nursing women.

8) Cholam Pittu

Cholam flour (millet)	-	6 tsp.
Roasted Bengal gram flour	-	5 tsp.
Grated coconut	-	1 tsp.
Jaggery	-	4 tsp.
Salt	-	a pinch
Water	-	as required

Method:

1) Sieve raw cholam flour.
2) Mix cholam flour, Bengal gram flour, and salt.
3) Add grated coconut.
4) Add 2 tsp. of water and mix well.
5) Add jaggery powder and steam for 15 minutes.

Nutritive value: 305 calories
9.1 gms. protein
Suitable for infants, preschool and school children.

9) Bengal Gram Burfi

Roasted Bengal gram flour	-	10 tsp.
Jaggery	-	10 tsp.
Cardamom	-	a pinch
Water	-	sufficient to make a syrup

Method:

1) Make a syrup with jaggery and water.
2) Add Bengal gram flour and mix thoroughly.
3) Add a pinch of cardamom.
4) Transfer mixture into a greased plate and spread.
5) Cut when cool.

Nutritive value: 375 calories
10.0 gms. protein
Suitable for preschool and school children, pregnant and nursing women.

10) Sprouted Gram Salad (Usal)

Sprouted green gram	-	10 tsp.
Green chillies, cumin, mustard seeds, and salt	-	to taste
Lime	-	1
Coriander leaves	-	one small bunch
Oil (groundnut)	-	½ tsp.

Method:

1) Wash the sprouted gram and retain the husks
2) Add salt, chopped chillies and coriander to the gram
3) Heat oil, and fry cumin and mustard seeds until spluttering stops.
4) Mix all the ingredients, garnish with lime, and serve cold.

Nutritive value: 180 calories
11.0 gms. protein

11) Ragi Malt

Ragi	-	sufficient to make flour for one month's use

Method:

1) Clean the grain.
2) Wash the grain well and soak it in double the quantity of water.
3) Soak the grain for 16 hours or a little over half a day.
4) After soaking, scrub the grain in water and remove the seed coat by washing the grain in water.
5) Let the grain soak for 2 more hours.
6) Drain off the water and spread the ragi on a plate or cloth to the depth of a finger joint.
7) Cover with a damp cloth and keep it for one day (24 hours). During this period, the grain will germinate or sprout. This is known as malting.
8) The next day the ragi should have a small sprout resembling a small white dot. Do not allow the sprout to grow long as this imparts a taste which is not acceptable to children.
9) Dry the grain in the sun by spreading it on a tray or dry cloth.
10) Roast the grain lightly in an iron pan to develop the characteristic malt flavor. (Do not over-roast.)
11) Powder the grain into fine flour.
12) Sieve the powder. This is not necessary for older children.
13) Store the powder in an airtight container. This will keep for one month.

Malting (sprouting) changes some of the carbohydrate into a more easily digestible form for babies. There is also a slight increase in the vitamin B content.

12) Amaranth Curry

Amaranth	- 1 bundle
Black gram dhal	- 1 tsp.
Red chillies	- 3
Red gram dhal	- 1 tsp.
Mustard	- ½ tsp.
Oil	- 1 tsp.
Coconut scrapings	- 1 tsp.
Salt	- to taste

Method:

1) Wash and shred amaranths.
2) Heat the oil in an aluminum vessel and put in the mustard, black gram dhal, and split red chillies.
3) When dhal turns brown add shredded greens and salt, long till the greens get soft.
4) Add coconut scrapings before serving.

MAHARASHTRA RECIPES

1) Fish Curry

Fish	- 500 gms.
Green chillies	- 5 gms.
Coriander	- 15 gms.
Red Chillies	- 5 gms.
Coriander leaves	- 1/8 bunch
Ginger	- a small piece
Turmeric	- a pinch
Onion	- 55 gms.
Garlic	- a few flakes
Coconut	- 55 gms.
Tamarind	- 20 gms.
Slat	- to taste
Mustard	- a pinch
Oil	- 30 gms.

Method:

1) Clean and wash fish and cut into pieces.
2) Grind together coriander, dry chillies, ginger, garlic, and coconut.
3) Soak tamarind and extract pulp.
4) Chop green chillies and onion.
5) Heat oil, add chopped green chillies and onion; sauté.
6) Add ground Masala and fry well.
7) Add tamarind pulp, water, and salt. Bring to boil.
8) Add fish; cover and simmer till fish is cooked.
9) Remove from the fire and add chopped coriander leaves.

1) Fish Curry - continued

	Calories	Protein (gms.)
Total	788	99.32
Per portion	197	24.83

2) Pooris (with 50% peanut flour)

Maida (flour)	- 50 gms.
Peanut flour	- 50 gms.
Salt	- 2 gms.
Ghee (fat) for rubbing in	- 20 gms.
Water to mix	- about 50 ml
Fat for frying	- 30 gms. (absorption)

Method:

1) Sieve both flours together. Rub in fat. Prepare a stiff dough with sieved flour, water, and salt. Set aside for at least half an hour.
2) Knead dough again till soft.
3) Divide into even balls.
4) Roll out to ¼ cm thickness and 7 cm to 10 cm in diameter.
5) Heat fat till blue smoke appears on surface of fat. Deep-fry pooris gently pressing down with a flat spoon in circular motion; when puffed up, turn over and fry till light golden brown on both sides. Remove. Drain well on paper.
6) Serve hot with potato Bhajee.

	Calories	Protein (gms.)
Total	811	31.0
Per portion	405.5	15.5

3) Palak Raita

Curd	- 225 gms.
Palak (spinach)	- 115 gms.
Green chillies	- 5 gms.
Salt	- to taste
To temper:	
Jeera (cumin)	- 1 tsp.
Mustard	- 2 tsp.
Methi (fenugreek)	- 1 tsp.
Whole red chillies	- 2 to 3
Oil	- 15 gms.

Method:

1) Pick and wash palak. Steam.
2) Beat curd and mix with steamed palak and chopped green chillies. Add salt.
3) Temper with red chillies, mustard, Jeera, and Methi.

3) Palak Raita - continued

	Calories	Protein (gms.)
Total	299.9	9.27
Per portion	75	2.32

NORTH INDIAN RECIPES

1) Dal - Sukha Dal

Urud Dal	- 225 gms.
Garlic	- 5 gms.
Green chillies	- 5 gms.
Turmeric	- a pinch
Cumin seeds	- a pinch
Salt	- to taste
Fat	- 15 gms.

Method:

1) Soak Dal for 2 hours. Drain the water.
2) Heat fat. Add sliced garlic, chopped green chillies, turmeric, and cumin seeds; sauté.
3) Add Dal. Fry for 5 to 10 minutes.
4) Sprinkle water; cover and cook on a very slow fire till Dal is cooked. Stir occasionally and sprinkle more water if necessary.
5) When Dal is cooked, add salt, stir, and serve hot.

	Calories	Protein (gms.)
Total	677	54.1
Per portion	169	13.5

2) Tomato Sauce

Tomatoes	- 225 gms.
Bacon	- 5 gms.
Butter	- 15 gms.
Carrots	- 20 gms.
Turnip	- 20 gms.
Onions	- 20 gms.
Flour	- 15 gms.
White Pepper	- to taste
Salt	- to taste
Stock or Tomato liquid	- 300 ml

2) Tomato Sauce - continued

Method:

1) Slice onion and tomatoes finely.
2) Shred carrots and turnip.
3) Put all into a pan with stock, bacon, butter, and seasoning.
4) Cook until tender.
5) Rub through a sieve and blend in flour.
6) Return to pan; stir until boiling.
7) Boil for 4-5 minutes and remove.

	Calories	Protein (gms.)
Total	230	4.01
Per portion	57	1.00

LOW-COST NUTRITIOUS RECIPES

by

NATIONAL INSTITUTE OF NUTRITION
INDIAN COUNCIL OF MEDICAL RESEARCH
HYDERABAD - 500 007.
INDIA.

1) Wheat-Gram Porridge

Roasted wheat flour	- 25 g (1 3/4 tbsp.)
Powdered, roasted Bengal-gram dhal	- 15 g (1 tbsp.)
Powdered, roasted groundnuts	- 10 g (1 tbsp.)
Sugar or jaggery	- 30 g (2 tbsp.)
Spinach (or any leafy vegetable)	- 30 g

Method:

1) Roast groundnuts, wheat, and Bengalgram; powder them.
2) Mix all the three powders. Dissolve jaggery in water and make into a thin syrup. Prepare a batter of the powders with the help of this syrup.
3) Boil spinach in water till soft; mash and strain through a clean cloth.
4) Add the juice to the batter and cook for a few minutes, stirring continuously till semi-solid.

2) Rice Porridge

Rice	-	30 g (2 tbsp.)
Powdered, roasted groundnut	-	15 g (1½ tbsp.)
Powdered, roasted green-gram or redgram dhal	-	10 g (3/4 tbsp.)
Sugar or jaggery	-	30 g (2 tbsp.)
Spinach (or any leafy vegetable)	-	30 g

Method:

1) Cook the rice.
2) Add to the cooked rice pulse and groundnut powders.
3) Boil leafy vegetables in water and add the juice to the above mixture.
4) Add sugar or jaggery and cook for a few minutes.

3) Rice Kitcheri

Boiled rice	-	1 cup (equivalent to 40 g uncooked rice)
Boiled pulse (Redgram or Greengram)	-	½ cup (equivalent to 20 g uncooked pulse)
Cooked leafy vegetable	-	2 tbsp.
Sugar or jaggery	-	30 g (2 tbsp.)

Method:

1) Mix boiled rice and pulse.
2) Mash the cooked leafy vegetable with additional water; strain through clean cloth, and add the juice to the above mixture. Add the sugar (or jaggery) and mix well. Instead of sugar, salt and seasoning can be added.

4) Bajra Infant Food

Bajra (dehusked, roasted)	-	45 g (3 tbsp.)
Roasted greengram dhal (or any other dhal)	-	20 g (1½ tbsp.)
Roasted groundnut	-	10 g (1 tbsp.)
Roasted decorticated gingelly (til) seeds	-	5 g (1 tsp.)
Sugar	-	30 g (2 tbsp.)

Method:

1) Powder all the roasted ingredients individually; mix them in the proportions suggested, and store in airtight containers.
2) Mix with hot water or milk before serving to the child. It can either be made into balls or in porridge form.

5) Ragina

Ragi (dehusked, roasted)	-	45 g (3 tbsp.)
Roasted Bengalgram dhal	-	10 g (3/4 tbsp.)
Sugar	-	30 g (2 tbsp.)

Method:

1) Powder all the roasted ingredients individually; mix them in the proportions suggested, and store in airtight containers.
2) Mix with hot water or milk before serving to the child. It can either be made into balls or in porridge form.

6) Jowar Upma

Broken jowar (jowar rawa)	-	45 g (3 tbsp.)
Roasted groundnuts	-	15 g (1½ tbsp.)
Oil	-	7 g (2 tsp.)
Seasoning material	-	as required

Method:

1) Fry seasoning material in oil.
2) Add broken jowar and fry till slightly brown.
3) Add water and cook till soft.
4) Add broken groundnuts and cook for a few minutes more.

7) Bajra Kitcheri

Bajra	-	40 g (2 3/4 tbsp.)
Greengram dhal	-	25 g (2 tbsp.)
Carrot	-	20 g (1 small)
Oil	-	8 g (2 tsp.)
Salt	-	to taste

Method:

1) Grate carrot.
2) Boil bajra till half done.
3) Add dhal and the grated carrot and cook till the grains become soft.
4) Add salt.
5) Remove from the fire and season with cumin and oil.

(Note: Instead of carrot, sweet potato or tapioca can be used, if available.)

8) Barfi (Mishti Cheera)

Pressed rice	-	25 g (2 tbsp.)
Roasted groundnuts	-	20 g (2 tbsp.)
Jaggery	-	30 g (2 tbsp.)

8) Barfi (Mishti Cheera) - continued

Method:

1) Roast the pressed rice and mix with the broken groundnuts.
2) Prepare a sticky syrup with jaggery and water.
3) Add the beaten rice and nuts and mix quickly.
4) Spread the above on a greased plate and cut into pieces immediately.

9) Hyderabad Mix

Wheat	-	40 g (2 3/4 tbsp.)
Roasted Bengal gram dahl	-	15 g (1 tbsp.)
Roasted groundnuts	-	10 g (1 tbsp.)
Jaggery or Sugar	-	30 g (2 tbsp.)

Method:

1) Roast and powder the wheat.
2) Mix it with powdered Bengalgram, groundnuts, and jaggery.
3) Add the required amount of hot water and make it into a porridge or balls.

10) Groundnut Biscuits

Roasted groundnut	-	25 g (2½ tbsp.)
Roasted wheat	-	25 g (1½ tbsp.)
Sugar	-	20 g (1½ tbsp.)
Baking powder	-	a pinch
Salt	-	a pinch

Method:

1) Powder groundnuts and roasted wheat and mix them with sugar.
2) Add baking powder and salt and mix thoroughly.
3) Make stiff dough by kneading the mixture with hot water. Roll like chapatis.
4) Cut out any shape desired with tin-lids or any sharp instrument.
5) Place the biscuits on greased metal trays and bake them well, either in an oven or on heated sand in a degchi. (The degchi should be kept covered with a lid and piece of live charcoal kept on the lid to ensure uniform all-round baking.)
6) Remove the biscuits when they are golden brown; this usually takes about 20 minutes.

Annex I

AMUTHAM FOOD PRODUCED IN THE GANDHIGRAM INSTITUTE OF RURAL HEALTH AND FAMILY WELFARE TRUST IN COLLABORATION WITH THE WORLD BANK

Food Formula

Rice	15%
Ragi	15%
Bengal gram	15%
Sesame	10%
Edible oilcake (groundnut)	10%
Groundnut	10%
Brown sugar	25%

Vitamin Pre-mix

The food is enriched with the following vitamins:

Thiamin
Riboflavin
Pyridoxine
Niacin
Iron (as ferrous sulphate)
Calcium (as calcium carbonate)

Steps Followed:

1) Parboiled rice is cleaned and roasted.
2) Ragi is properly roasted after removing the husk & stones.
3) Similarly, the edible groundnut cake is roasted; it is ground twice.
4) The sesame seeds are cleaned and gently roasted.
5) The stones and husk are removed from the roasted Bengal gram and roasted groundnut.
6) Each of the above ingredients are separately floured.
7) Brown sugar is cleaned and solid particles are crushed to powder.
8) All these powdered ingredients are mixed in the prescribed ratio.

Nutritive Value

Protein	15.4	Vitamin 'A'	0.0013 MIU
Calories	389	Thiamine	0.013 mg
Fat	10.3	Riboflavin	0.4 mg
CHO	58.7	Pyridoxine	0.0034 mg
Minerals	4.6	Vitamin 'C'	10 mg
		Niacine	5 mg

Annex I

Nutritive Value - continued

Amino Acids	
Lysine	4.1
Methionine	1.5
Total S. Amino Acid	2.9
Threonine	3.1
Tryptopham	1.4

Cost: Rs. 6 per Kilogram.

Children	40 g/day
Lactating Pregnant	80 g/day

Annex II

THE GANDIGHRAM INSTITUTE OF RURAL HEALTH & FAMILY WELFARE TRUST:
PO AMBATHURAI RS: MADURAI DISTRICT: TAMILNADU: 624309

A Note on Winfood

Malnutrition is one of the most dominant problems in India in common with other developing countries. Though easily recognized in its gross forms, it is often missed and its prevalence in a community is grossly underestimated. The most important malnutrition is protein calorie deficiency disease. About half of the children under five years of age are affected.

Research carried out in India and abroad has shown that this condition is caused by deficiency not only in protein but also in calories over a relatively long period. The condition affects not only physical development but also causes some irreversible changes in mental and emotional development. Unless corrected early, children are denied the full potential of physical and mental growth and carry the imprint of such permanent changes for the rest of their lives. The result is inevitable in lower productivity and consequent low economic condition. Investment in education is to some extent wasted if today's children are being mentally scarred in this way.

Malnutrition can be easily prevented by supplementing breast feeding with a judicious mixture of locally grown and available vegetable proteins such as cereals, legumes, and oilcakes from the beginning of the second six-month period through the second and third years of life

before the child is put on an adult diet, provided the mothers are taught accordingly.

Nutrition programmes have been organized among pre-school children, mostly through the distribution of foods, given as aid by external agencies. These programmes are not self-generating and therefore, they are not likely to make any significiant impact on the community.

A study was undertaken by this Institute in association with the Indian Council of Medical Research with the primary objective of evolving suitable and acceptable feeding programmes for infants and children for the correction and prevention of protein malnutrition by utilizing locally available protein-rich foodstuffs. The survey conducted in three villages in Athoor Block indicated that more than one-third of the children up to five years of age suffer from moderate to severe malnutrition. The infants are breast-fed up to about three years, and beyond that are given a small portion of the adult diet from one or two meals a day which most families have. No supplementary or weaning food is given. The pre-school children's diet is deficient to nearly one-third in calories.

The foods grown and eaten locally were studied as was the diet pattern. On the basis of the types of locally grown and locally used cereals and pulses, 23 types of protein-rich foods were formulated with four kinds of cereals: cholam, ragi, cambu, and millets; seven kinds of pulses: field bean (Mochai), Bengalgram, red-gram, foxgram (naripayaru), horsegram (Kollu), cowgram (thattai payaru), and blackgram; and two kinds of oilcakes: groundnut and gingelly seeds. (100 gms. of each food costing 10 paise were tried in 261 families having at least one weaning child and one or more older children.)

The key factor to any nutrition programme is health and nutrition education. Acceptance of the food depended on use of foodstuffs which are culturally associated with strength and growth. Preparation of food similar to that made in homes and not requiring any special utensils facilitates its acceptance. In the village, it is called "Sathu Mavu" which means a food for strength and growth.

Finally one food was selected. This has been named "WINFOOD" (W - Weaning; IN - Infants).

Composition of Winfood

1. Cambu flour (roasted)
2. Greengram dhal flour (roasted)
3. Groundnut cake flour (roasted)
4. Jaggery

100 grams of this food provides about 20 grams of protein and 400 calories. The Winfood was tried in a village. Intensive and extensive nutrition education was provided. Preparation of food was demonstrated in small groups, street by street, in each street daily

for a month, followed by group discussions with mothers and other women. After feeding for a month, the mothers were requested to purchase the food from local shops where it was made available at 10 paise a packet. During the last three months the sale rose from 500 packets to over 1500 a month. The study is continuing. Anthropometric evidences will be supported by biochemical investigations. The report will be ready towards the end of August 1982.

Relevance to Family Planning Programme

The consequences of malnutrition in young children are precipitated and aggravated by infection. In fact, an infectious disease and malnutrition may form a vicious circle, which often results in a fatal outcome. Thus malnutrition can be held directly or indirectly responsible for most important causes of death under five years of age. "Large family size" is associated with high prevalence of malnutrition in young children. Parents' concern over the uncertainty of the survival of their children leads them to opt for a large family. A reasonable guarantee to the survival of existing children through nutrition and immunization programmes may motivate parents for a smaller family.

Food for All

Winfood is suitable also for adults, particularly for expectant and nursing mothers, convalescents, and old people.

Requirements

One packet is sufficient to supplement an infant and take care of a child from the sixth month to one year and beyond that a little bit of addition may be necessary.

Birth to six months	- ½ a packet (50 g) is sufficient to replace or supplement breast milk.
Six months to one year	- One packet (100 g) per day with two or three feedings of breast milk.
Pre-school and school children.	- One packet (100 g) with their normal diet.
Adolescents and adults	- One to 1½ packets (100 to 150 g) supplement to their diet.
Expectant and nursing mothers, convalescents, and old people	- 1-2 packets (200 g) per day in addition to their normal diet.

Cost

Winfood is the cheapest infant food. Per paise, it provides two grams of protein as against 0.8 g in the cholam kanji, 0.6 g for ragi kanji, and 0.5 g in rice kanji. A chart showing the comparative composition and cost of Winfood and other commonly used food in this part of the country is enclosed (Appendix I).

Annex II

Preparation of Recipes and Dishes

Birth to six months	- Preparation of porridge with or without milk.
Six months to one year	- Kali, Iddli, Dosai (this flour is added to iddli, dosai, butter) and biscuits.
Pre-school and school children, adolescents, and adults	- Savouries like Chappathi, Uppuma, Kozhukattai, Rotti, Iddli, and Dosai. Sweets like Mysore pak, Laddu, and cakes.
Old people	- Iddli, Dosai, Pittu, Payasam, and cakes.

Annex III

THIRD TYPE OF SUPPLEMENTARY FOOD

Ingredients:

Rice	20%
Ragi	20%
Cholam	20%
Roasted Bengalgram	5%
Groundnut	5%
Greengram	5%
Brown sugar	25%

Nutritive Value

Calories	400
Protein	80 g per 100 g

This supplementary food is now under experiment at ten villages, given for the children under five years of age.

This project is being conducted by the Gandhigram Institute of Rural Health & Family Welfare Trust, Gandhigram, Tamilnadu, India.

Cost: 40 paise per 100 g.

A FEASIBILITY STUDY OF THE DEVELOPMENT OF A LOW COST HIGH CALORIE/HIGH PROTEIN WEANING FOOD

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A FEASIBILITY STUDY OF THE DEVELOPMENT OF A LOW COST HIGH CALORIE/HIGH PROTEIN WEANING FOOD

INTRODUCTION

Weaning foods are high protein formulated foods. They are generally fed to children over 5 months of age until such time as they are able to get on to the adult diet. At weaning, the child is fast growing and needs much higher levels of protein per unit body weight than adults. The weaned child cannot take sufficient volume of the adult diet that gives the required quantity of protein at weaning. Therefore, a high protein supplementary diet becomes necessary. In the local context, where the adult diet in the low income group is low in protein content, the need for weaning foods for low income groups is even more acute.

At present, nutrition intervention programs such as the THRIPOSHA program, which is assisted by CARE, cater to the nutritionally vulnerable groups. Before these programs are completed, it is essential to think of developing national capability in the area of weaning foods. This has to be done by developing a suitable technology to produce weaning foods at reasonably low cost, depending on locally available raw materials.

Several proprietary brands of weaning foods are presently imported to the country. Their costs are high and, therefore, are beyond the reach of the average income-earner who is mostly in need of such foods. High cost of imported weaning foods could be attributed to the sophisticated technology used in their preparation, cost of freight, expensive packaging and high rate of duty. Deprivation of the weaning child of supplementary foods leads to protein undernutrition and protein/calorie malnutrition; especially in the low income group. It is known that such situations could lead to irreversible damage to the child's physical and mental development. The provision of locally produced economical weaning foods is therefore of national importance.

CRITERIA FOR LOCAL PRODUCTION OF WEANING FOODS

Two basic criteria should be considered in formulating a project for weaning food production:

1. Quality
2. Economy

Since weaning foods are meant for children, the quality of the product is extremely important. Two quality criteria, namely nutritional quality and microbiological quality have to be maintained at satisfactory levels. The Protein Advisory Group of the FAO/WHO/UNICEF, in a guideline for low cost weaning foods has made the following recommendations in this regard. (PAG Guideline No. 3, 1971)

Guideline for the Composition Expressed on Dry Weight Basis

	Units per 100 grams
Protein	Not less than 20 grams *
Fat	As much as feasible, up to 10 g
Crude Fibre	Not more than 5 grams
Moisture	Preferably 5-10 grams
Total Ash	Not more than 0.05 grams
Acid Insoluble Ash	Not more than 0.05 grams
Vitamin A	1200 IU (as viatamin A palmitate equivalent to 400 mcg retinol

*This protein level assumes an NPU not less than 60 and PER not less than 2.1. If these values are higher, the level of protein may be reduced accordingly.

Maintenance of high microbiological quality is a function of both adequate processing of ingredients and exercise of strict sanitation in the production unit. The use of sophisticated,automated,self-cleaning production systems is ideal for maintaining high microbiological standards. However, there has to be a satisfactory compromise on the technology in order to meet the economic considerations and local constraints of financial and other resources.

TECHNOLOGY

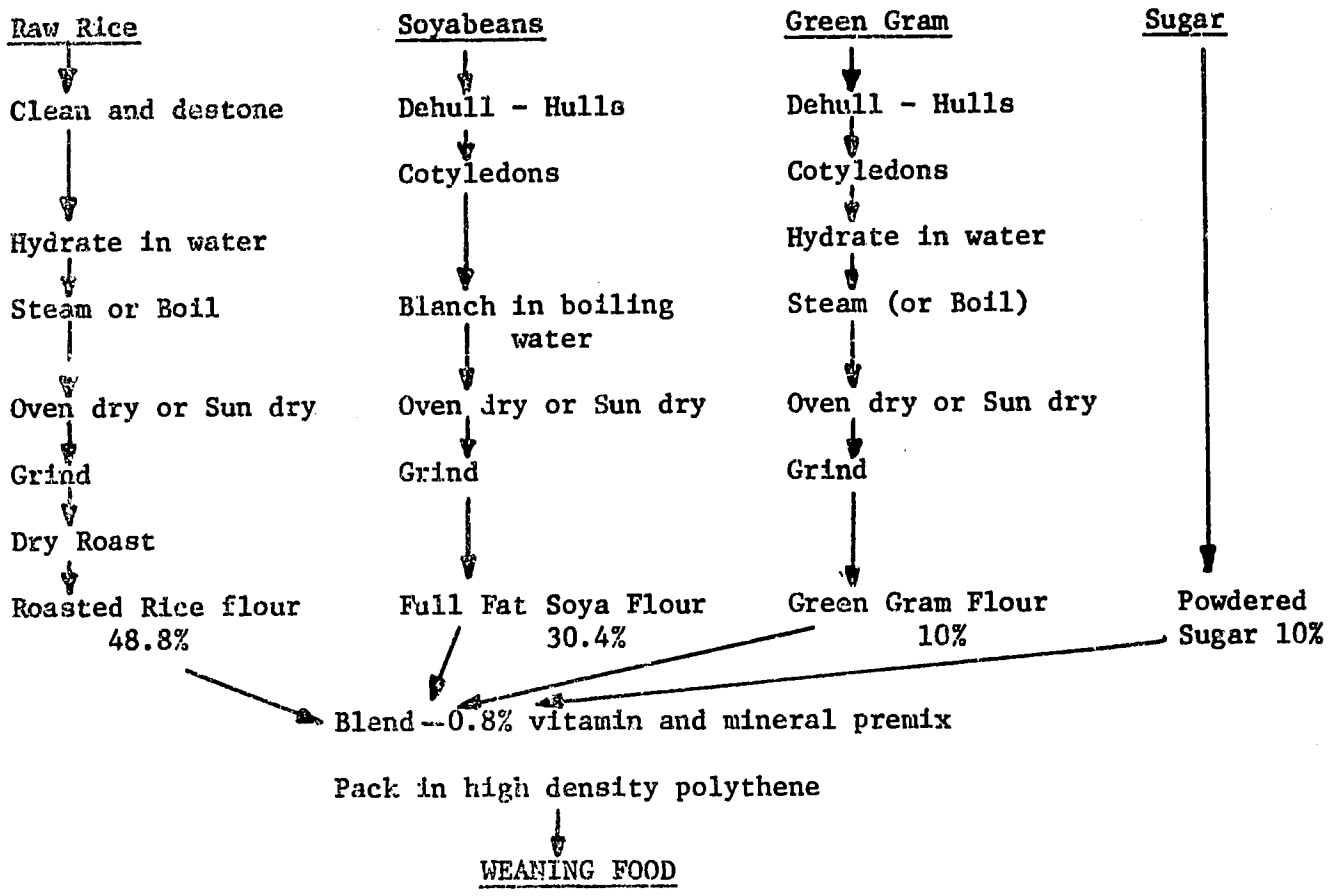
The method reported here is essentially a process of dry mixing of the individually processed ingredients. The process is a labour-intensive method avoiding high technology, yet retaining the nutritive value of the final product. Raw ingredients are prepared, partially hydrated, cooked and sun-dried. The dry ingredients are separately ground and mixed in suitable proportions to obtain the desired formula. It is essentially a batch process, which could be labour-intensive (rather than capital-intensive) and would require relatively simple processing devices. The process is flexible in the sense that any scale of operation can be adopted according to a given set of conditions.

RAW MATERIALS

Weaning foods are concentrated formulations containing high protein and calorie levels and fortified with vitamins and minerals. The search for cheaper protein sources has revealed that properly processed legumes and oil seeds are good sources of protein, especially in combination with cereals. Soya bean was selected as the source of protein since it has 40% protein, apart from its contribution of good quality fat. It is locally produced and is already being used in nutrition intervention programs.

Rice has been selected as the carbohydrate (energy) ingredient in the formulation. Rice in combination gives an excellent amino acid complementation. A small proportion of green gram has been included in the formulation, mainly to improve acceptability of the product because green gram has a characteristic pleasant flavour. Sugar has been added on consideration of acceptability and to make the product ready to eat on hydration. However this item is optional, and the sugar can be left out of the formulation and the product cost would be that much less. The vitamin and mineral premix is the only imported ingredient in the formulation, but there is no option in this case.

THE PROCESS



COMPOSITION AND NUTRITIVE VALUE

1. Raw material composition of the formulation

Ingredient	Percentage
Rice flour	48.8
Soya flour	30.4
Green gram flour	10.0
Sugar	10.0
Vitamin mineral premix	0.8
	100.0

2. Vitamin/mineral content of the formulation
(Per 100 grams Product)

Vitamin A	1300 IU as Vitamin A - Palmitate
Thiamin (B_1)	0.28 mg
Riboflavin (B_2)	0.38 mg
Niacin	5.00 mg
Pyridoxine hydrochloride	4.00 mg
Folate	0.2 mg
Cyancobalamine (B_{12})	1.98 mg
Vitamin D	400 IU
Ascorbic Acid (C)	35.00 mg
Calcium	300 mg as carbonate
Iron	10 mg as Ferrous sulphate
Salt (Sodium Chloride)	200 mg
Iodine	70 mcg as Potassium iodide
Magnesium	0.02 mcg as magnesium sulphate

3. Proximate Composition

Moisture	- 4.82
Protein (Nx6.25)	-20.69
Fat	- 8.40
Fibre	- 1.28
	- 2.57
Carbohydrate (by difference	-62.24
	100.00

4. Net protein utilization NPU (st) as reported by the Medical Research Institute 79.

FINANCIAL CONSIDERATIONS

Cost estimates for the ingredients for the production of 100 kg of weaning food and packaging materials:

Rice	55 kg (unprocessed)	Rs. 5.50 per kg.	= Rs. 302.50
Soya Bean	35 kg (")	Rs. 5.50 per kg.	= Rs. 192.50
Green Gram	12 kg (")	Rs. 14.00 per kg.	= Rs. 196.00
Sugar	10 kg (")	Rs. 16.50 per kg.	= Rs. 165.00
Vitamin & Mineral premix x 0.8 kg			= Rs. 30.00
Polythene			= Rs. 12.00
			Rs. 898.00

Overhead costs have not been calculated and added to the product cost, and depending on the type of equipment used and scale of production; the cost of the final product may vary.

BENEFITS

The formulation has 20.69% protein; 8.40% fat; 62.24% carbohydrates, 1.28% fibre and added vitamins and minerals. A baby of 6 months of age requires about 17 grams of protein per day, which increases to about 20 grams at the age of 12 months. By feeding about 50 grams per day in the form of a thick porridge, i.e., about two tablespoons, the formulation provides 50% of the infant protein requirements per day. In addition it provides carbohydrates, fat, vitamins and minerals. The requirements of a baby per month is 1.5 kg. of weaning food.

CLINICAL TRIALS

The product is being given to a selected group of 300 babies attending the well-baby clinic at the General Hospital Colombo. The progress of the babies will be studied for a period of six months. The clinical trials started in December 1980 and will continue for a period of one year. Based on the data available, the clinical trials have shown the product is suitable as a supplementary food for infants.

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The above project is a joint effort of the Food and Nutrition Policy Planning Unit of the Ministry of Plan Implementation and the Soya Bean Food Research Centre, under the guidance of the Professor of Paediatics, University of Colombo to evaluate the feasibility of the development of a soya based low cost weaning food.

APPROPRIATE TECHNOLOGY WITH REFERENCE TO INFANT WEANING FOODS

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APPROPRIATE TECHNOLOGY WITH REFERENCE TO INFANT WEANING FOODS

Introduction

The causes of malnutrition in India are complex; among them, the low purchasing power of the poor families is crucial. Recent studies indicate a relationship between the income of the mother and the nutritional status of her children. Where nutritious foods are available, they are not often used properly due to lack of knowledge of their nutritive value. Children of malnourished mothers start with the handicap of low birth weight, which increases their vulnerability to illness and death. Wrong weaning practices without the benefit of supplementary foods result in increasing the levels of malnutrition, morbidity, and mortality. Under such conditions, children become victims of easily preventible deficiency diseases like goitre, anaemia, and keratamalacia.

Various strategies have been evolved to reduce the incidence of malnutrition among children. Among those, production of suitable weaning foods is an important step. Nutritious Ready-to-Eat (RTE) foods formulated from indigenous raw materials are urgently required in the tribal and rural areas and urban slums. Decentralized processing of supplementary foods through small plants has great relevance to development. Use of appropriate technology and low-cost modern strategies for meeting the energy and nutritional needs of the vulnerable groups through the development of nutritious and palatable weaning foods, prepared at the local level, is the need of the hour.

Introduction of appropriate technology in rural areas will help to reduce the drudgery of women and increase the time they can spend earning and attending to the needs of their children. Improved post-harvest food technology can increase both the quantity and quality of foods available for home consumption.

During the last two decades, considerable efforts have been made to develop, produce and distribute infant weaning foods to alleviate malnutrition. Food legumes, cereal grains, and nuts provide a large part of the calories and protein for most of the people of Africa, Asia, Latin America, and the Near East. For a long time to come, cereals and legumes will occupy the central role in the diets of the poorest people in the third world. Almost all cereal proteins are deficient in the essential amino acid, lysine. The nutritional value of cereal grains can be improved by the addition of synthetic lysine or by the addition of a food which is rich in lysine.

Nutritional Complementarity of Cereals and Legumes

Food legumes are comparatively rich in lysine, and therefore a combination of cereal and legume gives a protein mix which comes close to providing an ideal source of dietary protein. The comparatively low levels of methionine and cystine in legumes are largely offset by the

higher proportions of these amino acids in most cereals. Hence cereals and pulses can complement each other. This nutritional complementarity of cereals and legumes is of great importance for the people of the less developed world.

Formulation of Supplementary Foods

How to give the vulnerable groups the additional calories and nutrients they need? The type, quantity, and proportion of the ingredients of low-cost food formulations should be assessed in terms of calories, proteins, and other nutrients. Locating and using low-cost indigenous nutrient-rich foods appears to be the answer, since foods of animal origin, such as milk, meat, and egg, are expensive and beyond the reach of most families. The urgency of the development of nutritionally balanced food products within the purchasing power and reach of large segments of the poorer sections of the population is great.

Several nutritional recipes based on inexpensive local foods, involving minimal processing, have been developed by the National Institute of Nutrition (NIN) , Sri Avinashiligam Home Science College, Gandhigram, and other centres under the auspices of the Indian Council of Medical Research (ICMR). The Central Food Technological Research Institute (CFTRI) has also developed some nutritional formulae. In all these efforts, the processes employed lend themselves to low-cost technology in the home or at the village level. The nutritional status and health of children can improve considerably if mothers are persuaded to feed their young children the required quantities of the cereal-legume recipes evolved in these institutions. The low-cost energy- and protein-rich food mixtures are especially valuable for children during the weaning and preschool periods.

It has been estimated that the daily diet of the preschool children in India needs supplementation of 80 g of a balanced, nutrient-rich formula carrying 11-12 g protein, to meet one-third of their daily caloric and protein requirements. A "Ready-to-Eat" nutrient-rich weaning food formulated by Devadas et al. (1974), in the form of a flour, is "Kuzhandai Amudhu."

Table I gives the composition of several formulations of this infant weaning food, based on different cereals and pulses.

TABLE I

COMPOSITION OF THE INFANT WEANING FOOD 'KUZHANDAI AMUDHU'

Ingredients	Amount (g)	Kcals	Protein (g)	Cost* paise
Sorghum, Bengal gram-based				
Roasted sorghum flour	30	105	3.12	0.04
Roasted Bengal gram dhal flour	20	74	4.50	0.06
Defatted groundnut cake	10	[illegible]	3.15	0.03
Jaggery	20	76	0.08	0.06
	80	311	10.85	0.19

continued...

TABLE I (continued)

Ingredients	Amount (g)	Kcals	Protein (g)	Cost* paise
Sorghum, green gram-based				
Roasted sorghum flour	30	105	3.12	0.04
Roasted green gram flour	20	70	4.90	0.06
Defatted groundnut cake	10	56	3.15	0.03
Jaggery	20	76	0.08	0.06
	80	307	11.25	0.19
Maize, Bengal gram-based				
Roasted maize flour	30	103	3.33	0.05
Roasted Bengal gram dhal flour	20	74	4.50	0.06
Defatted groundnut cake	10	56	3.15	0.03
Jaggery	20	76	0.08	0.06
	80	309	11.06	0.20
Maize, green gram-based				
Roasted maize flour	30	103	3.33	0.05
Roasted green gram dhal powder	20	70	4.90	0.06
Defatted groundnut cake	10	56	3.15	0.03
Jaggery	20	76	0.08	0.06
	80	305	11.46	0.20
Ragi, Bengal gram-based				
Roasted ragi flour	30	90	2.19	0.03
Roasted Bengal gram dhal flour	20	74	4.50	0.06
Defatted groundnut cake	10	76	3.15	0.03
Jaggery	20	76	0.08	0.06
	80	304	9.92	0.10
Ragi, green gram-based				
Roasted ragi flour	30	90	2.19	0.03
Roasted green gram dhal flour	20	70	4.90	0.06
Defatted groundnut cake	10	56	3.15	0.03
Jaggery	20	76	0.08	0.06
	80	300	10.32	0.18

*Paise is 1/100 of the Rupee, the unit of Indian currency.
One U.S. dollar is equivalent to nearly nine Rupees.

Kuzhandai Amudhu can be fortified with vitamins and minerals in order to be complete. Table II gives the amounts of vitamins suggested for the purpose.

TABLE II

QUANTITIES OF VITAMINS AND MINERALS NEEDED FOR FORTIFICATION OF THE 'KUZHANDAI AMUDHU'

Ingredients	Quantity
Vitamin A	2.6 Ug mg/100g
Vitamin B_1 (Thiamine)	0.3
Vitamin B_2 (Riboflavin)	0.4
Niacin	5.0
Iron (as ferric sulphate)	5.0
Calcium (as calcium phosphate)	3.0

The acceptability of the six mixtures was tested on selected preschool children and all the mixtures were found to be acceptable. Children relished the food and did not manifest any digestive problem.

The data on the heights and weights of 100 infants who received the Kuzhandai Amudhu, in comparison with those of 50 children in a control group, who did not receive the supplement, are presented in Table III.

TABLE III

MEAN INCREASE IN HEIGHT AND WEIGHT OF INFANTS RECEIVING KUZHANDAI AMUDHU (Duration 12 months)

Groups	No. of children	Mean height (cm)		Difference	Mean weight (kg)		Difference
		Initial	Final		Initial	Final	
Experimental	100	80.15± 4.52	86.17± 3.71	6.02±0.81	8.58±1.04	10.72± 1.51	2.14± 0.61
Control	50	79.97± 3.21	82.60± 4.51	2.63±0.71	8.37±1.12	9.56± 1.61	1.19± 0.32
t value for height		21.6*			t value for weight	4.56*	

*Significant at one percent level.

Children in the experimental group were heavier and taller than their counterparts in the control group at the end of one year. The mean differences in the increases in height and weight between the two groups were significant at one percent level.

Production of Kuzhandai Amudhu at the Village Level

Kuzhandai Amudhu is a low-cost, indigenous food, prepared utilising the less costly locally available foodstuffs. The techonology involved in the preparation is simple and of low level, thus making it viable for adoption by the rural women. Except for grinding the coarse cereal (maize or Jowar) into a fine flour in a mill, all the other operations such as cleaning the ingredients, winnowing, pounding, sieving, roasting, and mixing could be done through manual labour. After mixing the flours in correct proportions, the Ready-to-Eat food may be hygienically packed in polyethylene envelopes, sealed, and suitably labelled.

A demonstration arranged for the members of Mahilir Manrams (Women's Club) in the selected villages on the preparation and use of Kuzhandai Amudhu kindled the interest of a few members of Kottaipalayam village to venture into the production of this food on a commercial basis. Thus the production unit of Kuzhandai Amudhu was begun as a maiden effort, on the Tamil Nadu Year's day, on April 13, 1977. The Manram at Kottaipalayam was registered under the banner and registration number of the Bharatiya Grameen Mahila Sangy, with a capital investment of Rs. 1000/- contributed as a loan by the Social Service Association of Sri Avinashilingam Home Science College, Coimbatore. Necessary permission and licence for the preparation of this product were obtained from the Block authorities concerned.

Various agencies were approached for help in the marketing of Kuzhandai Amudhu. A demonstration cum sales campaign was conducted at Chinthamani, the Cooperative Supermarket, Coimbatore, for twelve days, in order to assess the responses of the public of Coimbatore to the introduction of this new food in the market.

A Kuzhandai Amudhu demonstration cum sales stall was put up in the exhibition conducted in Madras in connection with the Twenty-Seventh World Vegetarian Congress from December 2, 1977 to December 5, 1977. The infant food attracted the attention of the public owing to its low cost, taste, and patent by Sri Avinashilingam Home Science College.

The project staff utilised another opportunity to popularise Kuzhandai Amudhu by putting up a stall in the 'All-India Tourist Trade Fair' at Madras from December 12, 1977 to January 13, 1978. This experience also was highly encouraging.

A stall was also put up as part of the Rural Development section of the Government of Tamil Nadu, in the Tamil Nadu Government Exhibition held at Coimbatore in the summer months of 1979.

The paediatricians of Coimbatore city and Coimbatore Medical College were approached for recommending the use of Kuzhandai Amudhu to the mothers of malnourished infants and children. In the same way, the nursery schools and residential schools were contacted to try Kuzhandai Amudhu with the children in their schools. It was highly encouraging to note that the orphanages and schools run by certain Christian missionaries came forward to continuously use Kuzhandai Amudhu for feeding their children at least a few times a week and

thus offered financial and moral support for the project of Kuzhandai Amudhu.

Devadas and Murthy (1974) conducted a study to ascertain the effect of feeding younger children, 18 to 30 months of age, diets with high-lysine maize (Opaque-2 maize) on their growth, and to serve as an educational programme in the popularisation of the new maize variety. Two hundred children were selected and divided into four groups: 50 for the ordinary maize diet, 50 for the Opaque-2 maize, 50 for skim-milk diet, and 50 to serve as control. The diet provided 450 calories and 10 g protein per child per day. The duration of the feeding was six months. Table IV shows the changes in weights and heights of the children who participated in the study.

TABLE IV

MEAN INITIAL AND FINAL BODY WEIGHT AND HEIGHT OF THE TARGET CHILDREN

Diet	Weight in kg		Difference	Height in cm		Difference
	Initial	Final		Initial	Final	
Ordinary maize	11.25	12.11	0.86 ± 0.01	86.20	88.77	2.57 ± 0.0001
Opaque-2 maize	10.90	12.09	1.19 ± 0.01	87.60	90.50	2.90 ± 0.66
Skim milk	11.10	12.27	1.17 ± 0.14	83.36	86.50	3.14 ± 0.19
Control	10.83	11.59	0.76 ± 0.01	80.20	82.30	2.10 ± 0.08

The differences between the increments in body lengths and weights of the groups of children receiving the supplements were found to be significantly higher than those registered by the control group. However, the differences between the increments among the children in the Opaque-2 maize diet and the skim-milk diet were not significant. The Opaque-2 maize was found to be better than ordinary maize in promoting the weight of the preschool children. This finding is of great significance from the economic standpoint. Opaque-2 maize can play an important role as a rich and low-cost source of good quality protein and calories.

Incorporation of Leaf Protein in Weaning Foods

Green leaves are the world's largest source of protein (Kohler, 1970). But the use of leaves as food protein is limited by the presence of indigestible fibre. Forage crops such as alfalfa (lucerne), water hyacinth, some weeds and grasses are promising for economic production of edible leaf protein (Pirie, 1971).

Harvested lucerne plants, purchased in the local market, were sequentially washed, chopped, pulped with the IBP belt press, and

filtered to separate the green juice carrying the protein. Live steam was injected through the filtered juice, to raise the temperature to 90°C, when the protein present in the juice coagulated. This coagulum was filtered, using standard cloth stockings, washed with 2N sulphuric acid to avoid any bacterial growth, and pressed by a beam press. The product was air-dried at 40°C-50°C, and ground to a fine powder. On a dry-weight basis, the Leaf Protein powder contains approximately 60 percent protein, which is rich in lysine, but deficient in the sulphur-containing amino acid methionine. Figure 1 gives the Operational Flow in the preparation of supplementary food mixtures incorporating Leaf Protein.

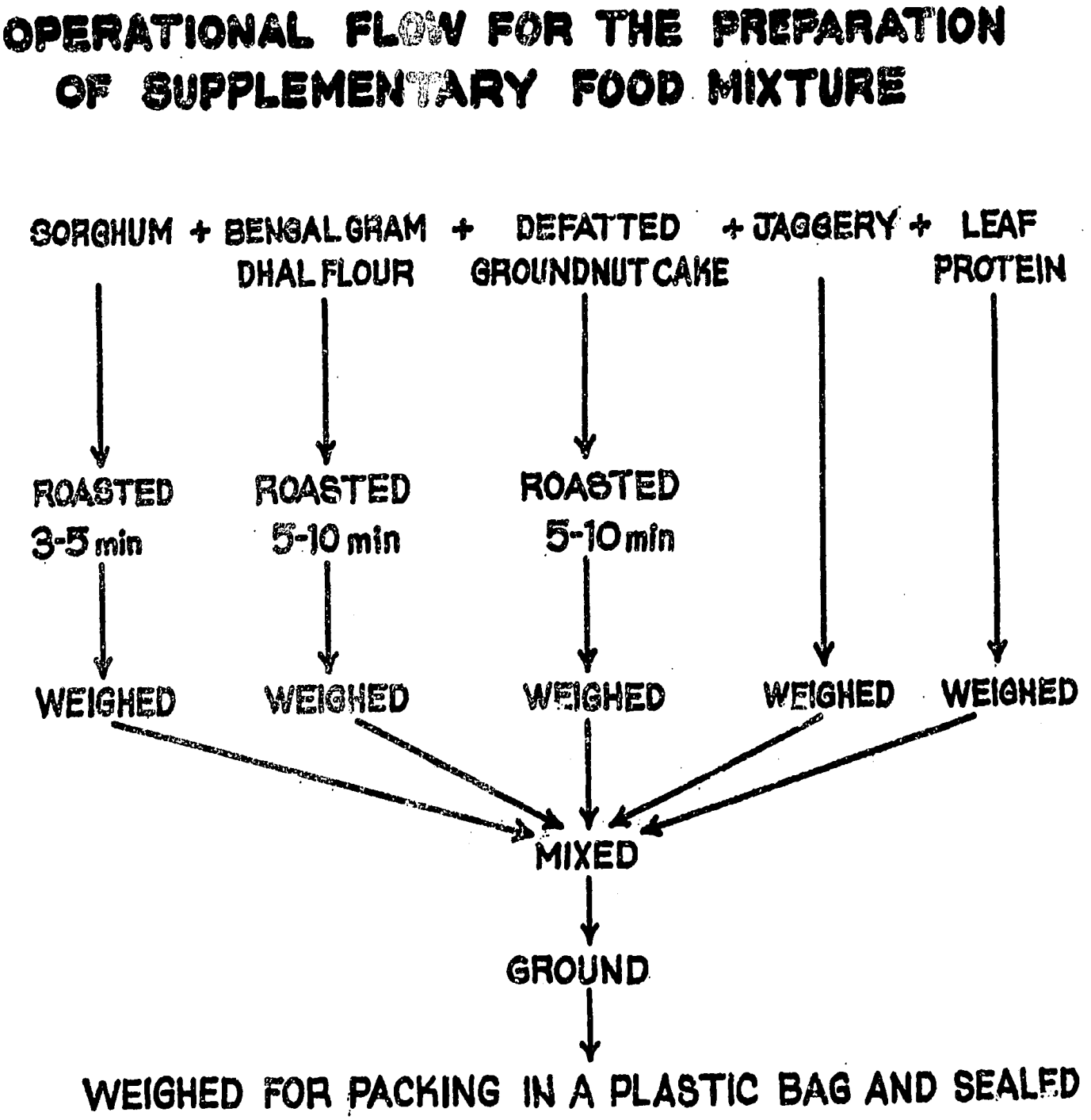

FIGURE I

Conducting the feeding trial

Three hundred and sixty preschool children belonging to families in the low-income group (Rs. 50-190/month) in five villages were selected. The dietary intake of twenty-five preschool children randomly selected, five from each village, was found out by the three-day weighing method as the benchmark. The basal diet was planned in such a way that it was similar to the home diets of the children studied, and given to the children in the control group who received only the basal diet. All the other groups were given different supplements, the composition and nutritive value of which are presented in Table V (see next page).

Impact of the supplementation

The nutritional status of the preschool children was assessed through the following parameters:

a) Anthropometric measurements (every month)
   i) Heights
   ii) Weights

b) Clinical examination every three months

c) Morbidity rates

d) Biochemical estimations
   i) Nitrogen retention (terminal)
   ii) Serum retinol values (terminal)
   iii) Haemoglobin levels once in three months

Table VI and Table VII present the mean heights and weights at the beginning and after 24 months.

TABLE VI

THE MEAN HEIGHTS (in cm) OF THE CHILDREN AT THE BEGINNING AND AFTER 24 MONTHS

Dietary Group	Control	Tapioca	Skim milk	Leaf Protein	Horse-gram	Cereal-pulse mixture
	A	B	C	D	E	F
Initial height	85.25 ± 0.79	86.5 ± 0.58	85.5 ± 0.61	87 ± 0.66	85.8 ± 0.71	86.8 ± 0.78
2-year height	97.25 ± 0.6	98.75 ± 0.6	99.7 ± 0.53	100.25 ± 0.63	98.8 ± 0.75	100.3 ± 0.75
Increase	12.0	12.25	14.2	13.25	13.0	13.5

TABLE V

COMPOSITION AND NUTRITIVE VALUE OF THE SUPPLEMENTS GIVEN TO CHILDREN IN THE DIFFERENT VILLAGES

Groups	Composition of supplements	Quantity per child	Energy (Kcal)	Protein (g)	Calcium (mg)	Iron (mg)	Retinol (mg)
Tapioca	Tapioca (fresh)	150	307	1	91	3.5	8
	Jaggery	20					
Skim milk	Skim milk powder	25	301	10	408	1.4	-
	Tapioca (fresh)	135					
Leaf Protein	Leaf Protein	18		10	481	13.3	86
	Tapioca (dry)	40	308				
	Ragi	10					
	Sesame	2					
	Jaggery	30					
Horsegram	Horsegram	40		10	181	6.6	19
	Tapioca (fresh)	30	304				
	Maize	10					
	Jaggery	25					
Cereal-pulse mixture	Maize	30		10	80	6.4	18
	Roasted Bengal gram	20	306				
	Groundnut	10					
	Jaggery	20					

TABLE VII

INITIAL MEAN WEIGHTS (in kg) AND WEIGHTS AT 24 MONTHS AND RESPECTIVE INCREMENTS

Dietary Group	Control A	Cassava B	Skim milk C	Leaf Protein D	Horse-gram E	Cereal-pulse mixture F
Initial weight	10.3 ± 0.19	10.3 ± 0.19	11.3 ± 0.16	10.9 ± 0.17	11.55	10.75
24-month weight	13.60 ± 0.2	13.7 ± 0.15	15.2 ± 0.16	14.6 ± 0.16	15 ± 0.16	14.5 ± 0.18
2-year weight increase	3.30	3.40	3.90	3.70	3.55	3.75

The mean increments in heights indicate that next to the skim milk (14.2 cm), cereal-pulse mixture (13.5 cm) and Leaf Protein (18.3 cm) produced the highest effect.

With regard to the mean increments in weight registered by the children in the various groups, the skim-milk group (3.9 kg) had registered the highest values. Next in the order were the cereal-pulse mixture (3.75 kg)- and Leaf Protein (3.7 kg)-supplemented groups.

Clinical examination at regular intervals showed that there had been considerable improvement in the health of the children. At the end of the 24 months, symptoms of mild and moderate malnutrition had largely disappeared, though a few persisted.

In all the groups, third-degree morbidity had disappeared after attending the balwadies. The proportion of children with the first-degree morbidity score increased in all the supplemented groups, indicating decreased severity of illness.

Table VIII presents the serum retinol and carotene levels at the end of the 24 months of the feeding trial.

TABLE VIII

MEAN SERUM RETINOL AND CAROTENE LEVELS
AT THE END OF 24 MONTHS OF THE TRIAL

Dietary group	Number of children	Retinol ug/100 ml	B. Carotene ug/100 ml
Control	12	21.3	92.5
Tapioca	11	22.9	102.5
Skim milk	10	31.0	112.0
Leaf Protein	12	35.7	112.0
Horsegram	11	27.9	104.0
Cereal-pulse mixture	11	31.3	108.0
Normal low-risk levels	-	20.00	113-126

Leaf protein had registered highest value with reference to retinol, followed by the cereal-pulse mixture group. Skim milk, horsegram, cassava, and control were next in that order.

Table IX presents the mean haemoglobin levels of the children fed with the different supplements.

TABLE IX

MEAN TWENTY-FOURTH MONTH HAEMOGLOBIN LEVELS OF PRESCHOOL CHILDREN

Supplement	Number of children	Initial g/100 ml	24th-month g/100 ml
Control	37	6.8	9.5
Tapioca	30	6.8	9.8
Skim milk	31	7.0	10.4
Leaf Protein	32	7.4	10.8
Horsegram	37	6.7	10.0
Cereal-pulse mixture	36	7.2	10.4

While there was a general increase in haemoglobin levels in all the groups after 24 months feeding, the skim-milk group and Leaf-Protein group had registered highest increments.

These encouraging results brighten the prospects for Leaf Protein as a low-cost protein supplement. However, to arrive at a final conclusion, more studies have to be carried out on larger groups. The

economics of Leaf Protein need to be investigated from various angles. Further, more people need to be motivated to produce and use Leaf Protein, which can find a place in village industries. This project is the first of its kind in the world with some valuable pointers.

Conclusion

In the current tempo of rural reconstruction, nutritionists and food technologists face many challenges and great opportunities. Effective nutrition programmes need to be developed for the young children, to multiply and reinforce the existing services economically, simply, and effectively, and to reach the poor in the urban and rural areas.

Preventive measures, more than curative ones, should receive priority. Food production, food preservation, food preparation (well-balanced meals), development of proper food habits, and behaviour and nutrition education are extremely important. These should be directed not only to mothers, but also to other adult family members, village leaders, and school teachers, and should be incorporated into the basic training of the various groups of national and local workers. Priority should be given to cleanliness, pest elimination, breast-feeding, homemade weaning foods, and immunization programmes.

References

1. Alvin, Siegel, and Brian, Fawcatt. "Food Legume Processing and Utilization." IDRC-TSI, pp. 1-3.

2. Devadas, R.P., and Murthy, N.K. Supplementary Value of Opaque-2 Maize: Report Submitted to the Food and Nutrition Board, Government of India. Unpublished (1974).

3. Devadas, R.P., Jamala, S., Usha Chandrasekhar, and Murthy, N.K. "Nutritional Evaluation of a Maize-Based Indigenous Infant Food, 'Kuzhandai Amudhu'." 11, 257-263 (1974).

4. Kamalanathan, G., Usha, M.S., and Devadas, R.P. "Evaluation of the Acceptability of some Recipes with Leaf Protein Concentrate." Ind. J. Nutr. Dietet., Vol. C., 1969, pp. 12-14.

5. Kohler, G.O., and Bickoff, E.M. "Leaf Protein," presented at the SOS/70 Third International Congress of Food Science and Technology, Washington, D.C., Aug. 9-14, 1970.

6. Kraisid, Tontosrin, Benjawan Moaleekoon Pairoj, Sakorn Dhanamitte and Aree Valyasevi. "Formation of Supplementary Infant Foods at the Home and Village Level in Thailand." Food and Nutrition Bulletin, 3, 1981, pp. 37-41.

7. Pirie, N.M. "Leaf Protein." In I.B.P. Hand Book No. 20. London: Blackwell Scientific Publications, 1977, pp. 1-2.

DEVELOPMENT OF APPROPRIATE TECHNOLOGY FOR THE MANUFACTURE OF WEANING FOODS AND FOOD SUPPLEMENTS

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DEVELOPMENT OF APPROPRIATE TECHNOLOGY FOR THE MANUFACTURE OF WEANING FOODS AND FOOD SUPPLEMENTS

INTRODUCTION

The present population of Indonesia is 147 million which is unevenly distributed; 65 percent of the people live on Java Island. Nearly 81 percent of all people live in the rural areas, some two-thirds of these being engaged in agriculture (Table 1).

The high incidence of infant mortality in Indonesia (100/1,000/year as compared to 38 in neighbouring Malaysia and 68 in the Philippines) is ascribed to the widespread protein-calorie malnutrition (PCM), also called protein-energy malnutrition (PEM). Other forms of malnutrition prevalent in Indonesia are caused by deficiencies of vitamin A, iodine and iron in the diet. Inadequate and nutritionally poor foods, too frequent child bearing, improper health environment, inadequate and unhealthy environment have been identified as the contributory causes of malnutrition.

According to a World Bank estimate, about 33 percent of all children under the age of 5 suffer from moderate to severe PCM (Table 1). The severe form, affecting 2-5 percent of young children, ranges from PCM of kwashiorkor type (due to inadequate protein intake) to marasmus type (resulting from continued restriction of both calories and proteins). In Indonesia, the majority of the severe PCM cases belong to the latter category. Mortality rate in severe cases is significant. Moderate cases are only underweight and/or undersized but they always run the risk of turning into severe ones since they have little resistance to infections and easily become prone to gastro-intestinal and respiratory diseases.

The average Indonesian diet is plain boiled rice. When it is insufficiently available, rice is supplemented with corn, cassava or sweet potatoes. The main source of animal protein is fish, usually consumed in a salted and dried form (consumption of all forms of fish, 23.5 g/day/caput). The consumption of other meats and eggs is low (meat 3.02 g/day/caput; eggs 2.3 g/day/caput). Legumes are a readily available source of vegetable proteins which are processed into nutritious foods like tahu, tauco, tempe and germinated beans but these are infrequently consumed and do not constitute an average daily menu. Occasionally leaves of cassava, sweet potato and papaya are part of the menu. The average Indonesia diet is thus markedly imbalanced and is protein-deficient (Table 1).

Fortunately, breast-feeding is still practised widely with occasional supplementation of mashed rice or banana. But once the weaning takes place (usually between the first and the second year), the child shares the normal family food which is deficient in proteins and is otherwise insufficiently nutritious to meet the physiological demands of a growing child. The problem of PCM gets further compounded since the expectant women and nursing mothers also consume insufficiently nutritious food.

The government of Indonesia has been fully aware of the implications of widespread PCM. In line with the basic concept that development and health go together, the government has been implementing a comprehensive national nutrition programme (Fig. 1). Through a World Bank-aided Indonesia Nutrition Development Project (INDP), several institution building, educational and field programmes have been undertaken. Among these are the establishment of Food Technology Development Center (FTDC) and strengthening of Center for Research and Development of Nutrition (CRDN) and Nutrition Intervention Pilot Project (NIPP) in several areas of the country, and initiation of several other related programmes, including improvement of village-level food storage.

FOOD SUPPLEMENTS AND WEANING FOODS DEVELOPMENT AT FTDC

Besides being nutritious, a supplementary food must meet the local acceptability of taste, flavor and form. The target population must accept it as a fortified food which it is and consume it along with the normal foods. In the case of children being nursed by their mothers, it serves both as a supplementary food as well as weaning food with some modification where necessary.

Background information on food availability and food habits of the people living in selected villages of NIPP areas was collected through a survey which covered initially 18 villages, 9 each in the districts of Bojonegoro (East Java) and West Lombok (NTB) and later extended to another 18 villages, 9 each in Karang Anyar (Central Java) and OKI (South Sumatra). Data on areas under cultivation, the nature and quantum of food production in and around these villages, food habits during abundance and scarcity of food and their variation according to social status, food balance sheets of each village and the manner of food consumption, were collected.

The data were analyzed and several compositions, based on local food materials and habits were developed. Each of these formulations was evaluated by CRDN. The approved ones were introduced in the selected NIPP villages by the Project authorities. Simultaneously, equipment for the manufacture of food supplement/ weaning foods was designed and fabricated by FTDC. The prototype equipment was later installed in NIPP areas to serve as village-level production units. This equipment has also been used at Banjarnegara (Central Java) and Cicurug and Cirebon (West Java).

The basic concept of these food supplements is that a combination of cereals and legumes has higher protein efficiency ratio (PER) due to the complementary nature of their essential amino acids. Legumes are also known to be rich in proteins. Low-protein tubers like cassava and sweet potato can also be supplemented with legumes, enhancing their nutritional status.

These cereal-legumes based food supplements as weaning foods are, however, too bulky for the child's stomach. Germination has been found to render these grains more assimilable by the child and also makes the resultant weaning food more nutritious. The current work at FTDC is therefore directed towards germinated-grain-based supplementary and weaning foods involving a study of various processing steps like germination, dehulling, grinding, mixing, etc., and the development of appropriate equipment to manufacture weaning foods.

FOOD SUPPLEMENTS IN NIPP AREAS

Several food supplement and weaning food recipes developed by FTDC which are based primarily on soybean and rice, are currently in use in Bojonegoro and West Lombok NIPP areas (Table 2). The production is entirely by a dry process, eliminating the spoilage and quality control risks that are inherent in wet processing in a tropical environment. The dry processing, which involves roasting of soybeans as one of the steps, helps to deactivate growth-retarding trypsin inhibitor, to adjust the moisture to a safe storage level and to impart more acceptable beany flavor in the resultant flour, called Bahan Makanan Campuran (BMC), obtained after grinding and mixing of the ingredients.

The recipients of food supplement/weaning food cook it (generally steaming) according to their tradition and taste. The distribution is done through specially appointed village officials (Vanpo) under the supervision of health officials (Anpo) who maintain all records of distribution, periodic weight and height gain/loss

by the individuals. Periodically FTDC sends a team to check the production and storage problems and to collect samples for evaluation. Such feedback has helped FTDC to improve the equipment where bottle-necks and other production and storage problems manifested themselves. In this way, the earlier grinding equipment (Burr mill) was replaced by the FTDC developed hammer mill (Gilham) which increased the grinding capacity several-fold.

The flow-chart (Fig. 2) describes the process for the production of BMC in the Bojonegoro area.

Under ideal conditions, 10 kg of raw material mix (7 kg rice, 3 kg soybean) should yield 8.2 kg of BMC (1.5 kg rejects).

The BMC formulation in West Lombok follows the same pattern except that powdered sugar is added to the mix to suit the local tastes (rice : soybean : sugar = 7 : 3 : 2; daily production of BMC 190 kg). Other formulations which have been developed and which are at various stages of trial are tabulated below (Table 2).

New formulations based on germinated grains are under development. These, as stated earlier, will be specially suitable as weaning foods. Also under development is tape flour produced from fermentation and subsequent drying and grinding of cassava to be used in BMC formulations.

FOOD SUPPLEMENT AND WEANING FOOD IN PULAU GALANG REFUGEE CAMP

Till November, 1979 over 40,000 refugees from Vietnam had arrived at the outlying islands of Indonesia. They were organized into 7 refugee camps. The Pulau Galang camp was among the largest with a population of 12,032 refugees. FTDC was asked to assist in the organization of a production program of weaning foods and food supplements, especially for children under 5. Since dried skim milk powder (DSM) was being made available through UNHCR and FAOs WHP, it was included in the recipes.

FTDC also provided the manufacturing equipment which comprised two hammer mills (Gilham), two mixers (Pumix), two bag sealers and weigh balance (cap. 100 - 200 kg). Hammer mills and mixers were fabricated at FTDC, and later installed and demonstrated at Pulau Galang. The recommended recipe (Table 2) has since been used at the Camp to control PCM.

The manufacturing process consists of grinding (Gilham) 9 kg of rice with 1.5 kg of sugar. The pulverized material is mixed with 3.75 kg of DSM and ground again (Gilham). To the mixture 0.75 kg of oil is added and thorough mixing (10 min.) is carried out in Pumix. BMC flour is then packed (50 g packets) and sealed.

BMC flour (50 g) is mixed with 200 ml of water, the batter is heated for 7 minutes and fed to the children.

EQUIPMENT DEVELOPMENT

From the start of this development program, FTDC was aware that its responsibility did not end with the development of recipes. The formulation must also be produced at the village level in an easy-to-operate equipment by the local people. Design and fabrication of equipment thus became an important component of the program. The principal equipment which has been developed and is being used at various centers are:

Hammer Mill (Gilham SS'79) (Fig. 3) - for grinding of grains, legumes, sundried cassava, etc.; in use at Bojonegoro, West Lombok and Pulau Galang; capacity 45-150 kg/hr depending on the nature of feed (rice 75 kg/hr; roasted soybean 60 kg/hr; cassava chips 103 kg/hr); 5 HP motor, RPM 3,500 or diesel engine.

Drum Roaster (Gasingray) (Fig. 4) - for roasting of cereals and legumes; horizontal, slightly inclined, gas stove heated rotating drum; MS construction; rotation through hand-driven bicycle chain and gear arrangement; capacity 60-120 kg/hr (corn 60 kg; soybean 85 kg; peanut 75 kg; mungbean 85 kg; rice 120 kg/hr).

Mixer (Pumix'79) (Fig. 5) - for mixing of powdery materials like flours, salt, DSM, etc.; capacity 90 kg/hr; motor 3 HP.

Cassava Chipper (Rasingko) (Fig. 6) - for cutting peeled cassava and other tubers into chips; pedal driven (bicycle type); capacity 150-200 kg/hr.

Storage Bin (Kaleng Pedaringan) (Fig. 7) - for storage of cereals, grains, DSM and BMC; cylindrical; GI construction, provided with a compartment for quicklime or ash; suitable for fumigation; capacity 150 - 300 kg.

Licenses have been issued for the commercial manufacture of this equipment.

ORGANIZATION, DISTRIBUTION AND FEEDBACK IN NIPP AREAS

The production and distribution of BMC and monitoring is organized by NIPP authorities (Ministry of Health). There are 3 production units in Bojonegoro area (combined daily capacity 276 kg) and one in West Lombok (capacity 190 kg/day). Each unit is managed by a staff of 3, two operators and one supervisor. The sealed packets of BMC are put in a large polyethylene bag which is collected by Vanpo once every week in Bojonegoro and transported on bicycle to the nutrition centers. In the unit itself, the polyethylene-bagged BMC is stored in metal bins. In West Lombok, BMC packets are stored in gunny bags and delivered every week by the supervisor of the unit to the nutrition centers in a Land Rover. In all units, the raw materials and finished products are stored in one place. The raw materials which are supplied by the local KUDs appear to be highly infested as evident from high rejects during the cleaning operation. There is no pest control practice.

Each village under NIPP program has 2 - 5 nutrition centers, each taking care of 40 - 50 persons, and 12 Vanpos who work by rotation (2/d). Vanpo collects people at the center and distributes one week's ration of BMC to each of them. He also records weight, height and other measurements under the supervision of Anpo. In Bojonegoro different-sized packets are prepared and distributed on the basis of daily intake (children 60 g; pregnant women 80 g; lactating mothers 150 g) but in West Lombok packets of uniform size of 120 g each are prepared and distributed (weekly ration - children 30 packets; pregnant women 6 packets; lactating mothers 9 packets).

The study on the addition of 0.1 percent non-toxic protectant (NTP) to the weaning food which has been conducted in FTDC and CRDN showed that the final product can be stored for six months without any deterioration due to insects.

The NTP Primex consists of tricalcium phosphate 94 percent, glucose 5 percent and thiamine/riboflavin 1 percent. This addition of 0.1 percent NTP could be recommended for the production of the weaning food in the NIPP area.

BMC is generally consumed in the popular porridge or bubur form where it is mixed with 2-3 times water; the batter is heated for about 10 minutes; salt or sugar is added if desired and consumed. It is also converted into various snacks.

During the harvest season, very few people turn up at the nutrition centers. This results in a gap in PCM treatment. Also during a period of economic stress, BMC meant as a supplement for a few, is consumed by the whole family as a meal, depriving the needy of the regular supply as can be seen from a 9-month evaluation (Table 3).

Health, sanitation and nutrition go together. Little attention is, however, paid to sanitation either in the production units or in the village homes despite efforts made through nutrition education. An evaluation program at Pulau Galang shows that when the number of children suffering from ailments, especially ENT, chest and intestinal diseases, increased, the incidence of PCM among them also increased (Table 4).

TECHNOLOGY TRANSFER

The cost of production of BMC at Bojonegoro by FTDC process (Table 4) shows that the processing cost is relatively low and BMC can be produced at a cost of Rp. 405.68 (US 65 cents)/kg. The processing cost is only Rp. 17.35/kg. And if BMC is produced in the backyard of a village home, the cost goes down still further by saving on the rent. A comparative cost of production by other methods is shown in Table 6.

When BMC manufacture was initiated in Bojonegoro areas, 3 plants were installed by FTDC. Today, several hundred are operating in the area due to people's own initiative. BMC was found useful by the community. This created a market. The technology was simple and appropriate. The two factors together brought in local entrepreneurs to apply their ingenuity. The result was the "multiplier effect" in the technology of transfer. In fact, the manufacture of BMC appears to be an excellent example of appropriate technology development and its transfer.

CONCLUSION

A number of formulations of food supplements and weaning foods designed to counter widespread PCM in Indonesia have been developed and field tested for nearly 3 years. The appropriate equipment for the manufacture of these foods, called BMC, has also been designed, fabricated and installed in some village locations. Several hundred units are now operating in the areas by the people's own initiative, the transfer of technology taking place through the "multiplier effect".

FTDC is developing improved weaning foods based on germinated cereals and legumes which are expected to be more nutritious, less bulky and more easily assimilable by the child.

REFERENCES

Anonymous, 1977. Buku Saku Statistik Indonesia 1977-78. Biro Pusat Statistik. Jakarta.

Anonymous, 1977. Indonesia : An Appraisal of Nutrition Development Project. World Bank Report No. 1373-IND.

Anonymous, 1981. Nusantara Development News. FTDC-IPB, (19):6.3, Bogor.

Haryoko, 1979. Bul. Penelitian dan Pengembangan Teknologi Pangan. FTDC-IPB (3), 79. Bogor

Machfud, 1979. ibid (1), 1

Sunaryo, E.S., 1980. ibid, (2), 13

Sunaryo, E.S. dan J. P. Simarmata, 1980. ibid, (2), 25.

Sunaryo, E.S. dan S. Harsoyo, 1979. ibid (2), 1

Winarno, F.G., 1979. ibid, (3), 7.

Winarno, F.G. dan B. Bhushan, 1980. Development of Weaning Foods and Food Supplements at FTDC, Bogor - A Review.

APPENDICES

Table 1

NUTRITIONAL DATA

INDONESIA

AREA 1.9 million km^2

POPULATION 147 million[+]; 81% rural; 65% in Java

FOOD COMPOSITION/CAPUT/DAY

	CALORIES	PROTEINS, g	FAT, g
CEREALS	1,451	29.06	7.48
TUBERS	262	1.92	0.35
SUGAR	105	0.03	0.01
LEGUMES	203	7.06	15.68
FRUITS	39	0.48	0.20
VEGETABLES	10	0.66	0.12
FISH	15	2.76	0.47
MEAT & EGGS	23	0.26	0.26
MILK	5	0.27	0.27
FAT	118	-	0.19

CALORIES	2,231
PROTEINS (g)	43.72
VEGETABLE	39.21
ANIMAL	4.51
FAT (g)	39.64
VEGETABLE	36.94
ANIMAL	2.70

INFANT MORTALITY 100/1,000

PCM INCIDENCE[++]

CHILDREN UNDER 5 33%

SEVERE CASES 2 - 5%

SOURCE : Buku Saku Statistik Indonesia, 1977 - 78

[++] World Bank Report No. 1318-IND (1977)

[+] Census, 1980

Table 2

BMC FORMULATIONS

Recipe	Ingredients	Composition/100 g			NDP %	Calories/ 100 g
		Weight, g	Protein, %	Protein score		
Bojonegoro	Rice	70	16.1	69.8	9.2	363
	Soybean	30				
West Lombok	Rice	60				
	Soybean	25	13.6	59.3	7.3	363
	Sugar	15				
A	Corn	60				
	Tolo bean	30	13.5	61.5	7.2	355
	Sugar	10				
B	Corn	60				
	Soybean	25	13.5	65.5	7.3	370
	Sugar	15				
C	Corn	50				
	Dried Cassava	10	12.0	61.5	7.0	370
	Soybean	30				
	Sugar	10				
D	Sorghum	70	13.5	60.5	7.4	350
	Tolo bean	30				
E	Corn	30				
	Dried Cassava	30				
	Mungbean	30	17.0	66.8	8.3	370
	Soybean	10				
F	Sorghum	70				
	Mungbean	25	12.0	65.0	7.3	370
	Sugar	5				
Pulau Galang Camp	Rice	60				
	D S M	25				
	Oil	5	16.0	79.8	9.8	400
	Sugar	10				

Table 3

NUTRITIONAL EVALUATION

BOJONEGORO NIPP AREA

FOOD SUPPLEMENTATION PROGRAM

PCM CASES	CYCLE I (Oct - Dec 78)	CYCLE II (Jan - Mar 79)	CYCLE III (Apr - Jun 79)
Children under 5			
No.	1203	1867	2103
Recovery	411	438	249
% Recovery	34.16	23.46	11.84
Expectant women			
No.	153	228	247
Recovery	111	126	71
% Recovery	72.55	55.26	28.74
Nursing mothers			
No.	543	645	879
Recovery	347	227	115
% Recovery	63.90	35.19	13.08

SOURCE : CRDN (Bull FTDC, 1979 (3):22)

Table 4

NUTRITIONAL EVALUATION

PULAU GALANG

FOOD SUPPLEMENTATION PROGRAM

(August 1980 - February 1981)

	Aug'80	Sept	Oct	Dec	Jan'81	Feb
CHILDREN UNDER 5						
Total No.	868	721	750	461	533	509
PCM Incidence, %	2.76	0.83	0.42	2.16	1.50	0.59
SCHOOLGOING CHILDREN						
Total No.	387	481	307	466	650	542
PCM Incidence, %	-	-	0.97	1.93	1.08	1.48
TOTAL PCM INCIDENCE, %	2.76	0.83	1.39	4.09	2.58	2.07
AILING CHILDREN,						
% of total	15.42	10.81	7.50	27.61	7.22	NA
BREAKUP OF DISEASES, %						
ENT & CHEST	1.14	2.46	2.76	14.09	2.11	NA
INTESTINAL	4.15	0.58	1.05	3.12	0.83	NA
DEFICIENCY	7.72	0.73	2.46	2.14	1.43	NA
SKIN	0.80	1.93	2.28	4.07	2.18	NA
EYE	-	0.08	0.09	0.62	0.08	NA
TEETH	-	2.98	-	-	-	NA
MISCELLANEOUS	1.60	2.21	2.37	3.42	0.59	NA

SOURCE : CRDN

Table 5

B M C

COST OF PRODUCTION

(at Bojonegoro)

BASIS :

BMC/DAY	300 kg
RAW MATERIALS/DAY	
RICE	260 kg
SOYBEANS	110 kg
KEROSENE	5 l
DIESEL OIL	6 l
EQUIPMENT COST	Rp 65,300 (Ca. US $105)
BUILDING	Rental

COST OF PRODUCTION

	Rp/Day	
Rice 260 x Rp 300	78,000	
Soybean 110 x Rp 350	38,500	
Kerosene & diesel oil	360)	
Wages 3 x Rp 1,000	3,000)	
Depreciation	295)	Rp 5,205 + 300
Rent	350)	= Rp 17.35/kg
Packaging	1,200)	
TOTAL Rp	121,705	

Cost of production/kg Rp 405.68 (Ca US $0.65)

1 US $ = Rp 625

Table 6

B M C

COMPARATIVE PROCESSING COST

(Raw material costs not included)

EQUIPMENT	Rp/kg of BMC
TRADITIONAL (Sangan)	29.48
EXTRUSION (Imported)	24.82
GASINGRAY (FTDC)	17.35

CHARACTERISTICS OF BMC

PER	2.21
Protein, %	14.69
Fat, %	8.61
Moisture, %	8.40
Calorie/100 g	403

Trypsin Inhibitor absent

FOOD SUPPLEMENTS & WEANING FOODS

- MUST BE NUTRITIOUS, E.G. CEREAL - LEGUME COMBINATION
- MUST BE ACCEPTABLE TO LOCAL TASTE & FORM
- MUST BE CONSUMED ALONG WITH NORMAL FOOD
- SHOULD BE BASED ON LOCALLY AVAILABLE RAW MATERIALS
- MUST BE ECONOMICAL TO PRODUCE

HENCE

- DATA ON FOOD AVAILABILITY
- DATA ON FOOD HABITS
- SOCIAL & ECONOMIC BACKGROUND
- AVAILABILITY OF TRAINED MANPOWER
- VILLAGE-LEVEL FOOD STORAGE SYSTEM

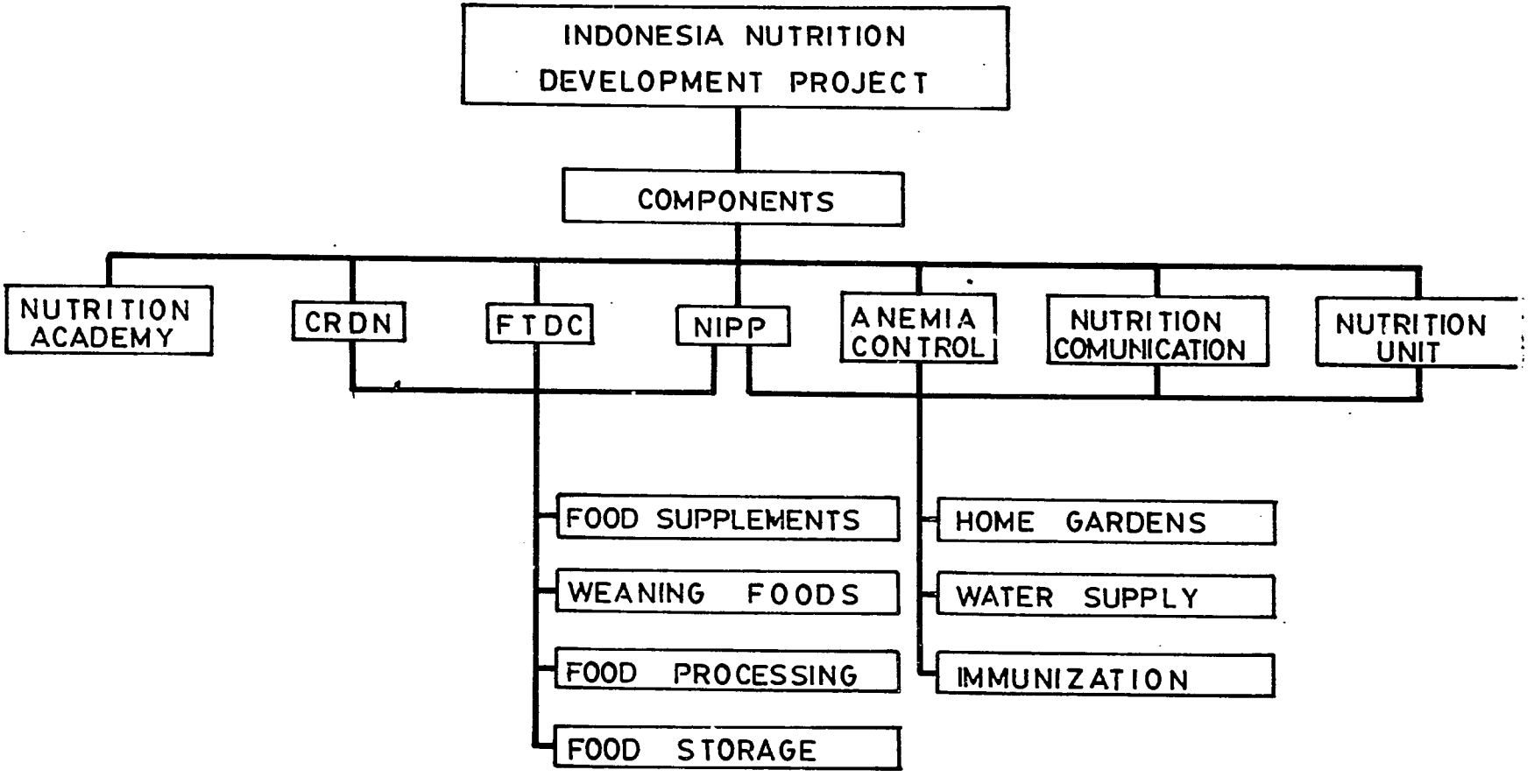
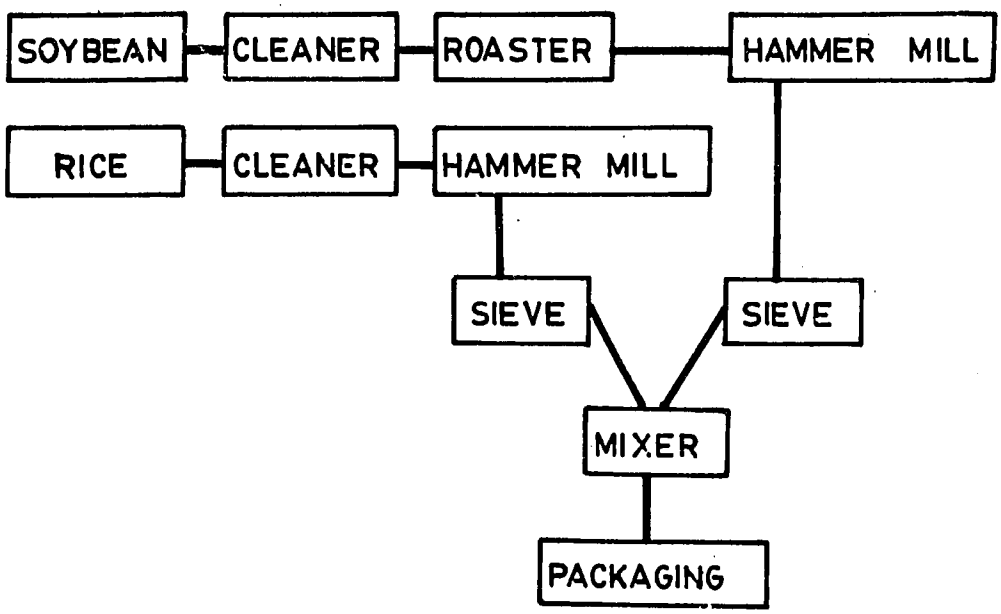
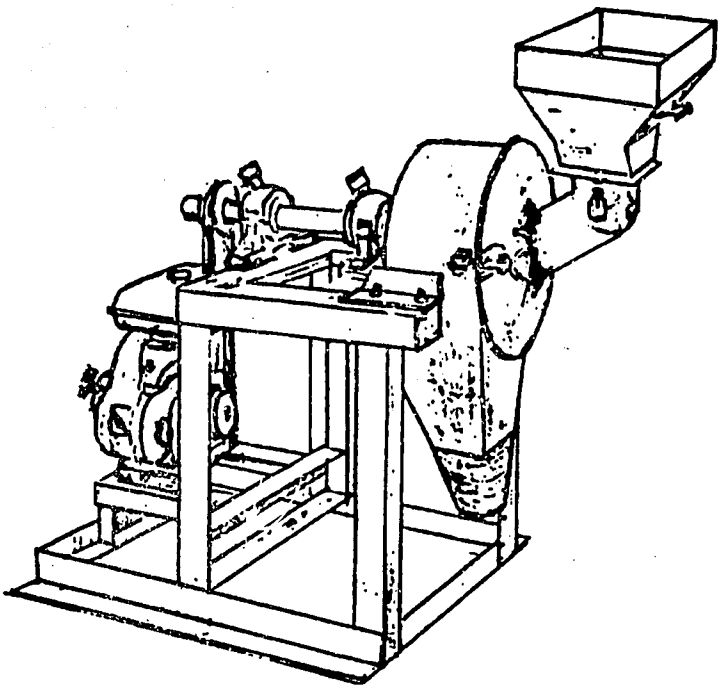


Fig. 1 Organization Chart



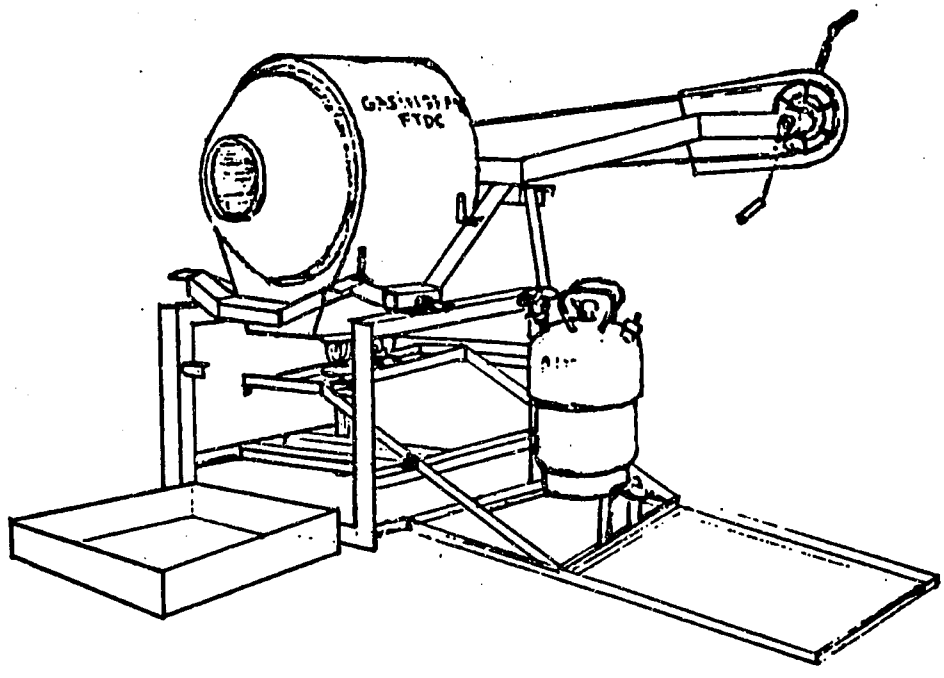
Food Supplement Manufacture in NIPP Areas

Fig. 2



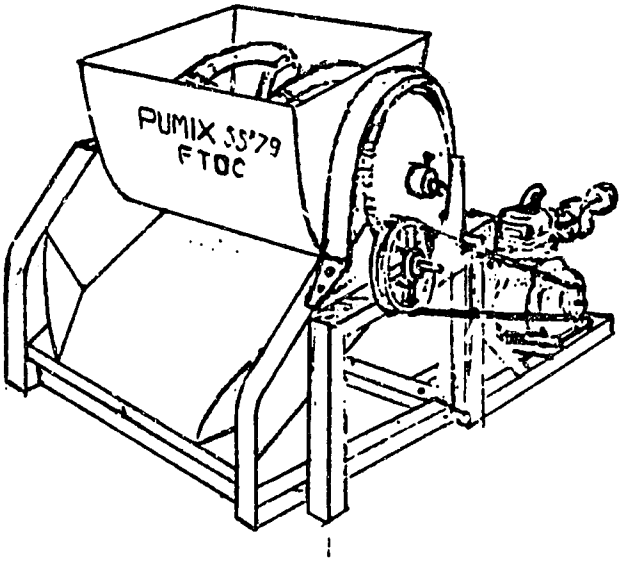
GILHAM (ALAT PEMBUAT TEPUNG DARI BIJI-BIJIAN)

Fig. 3



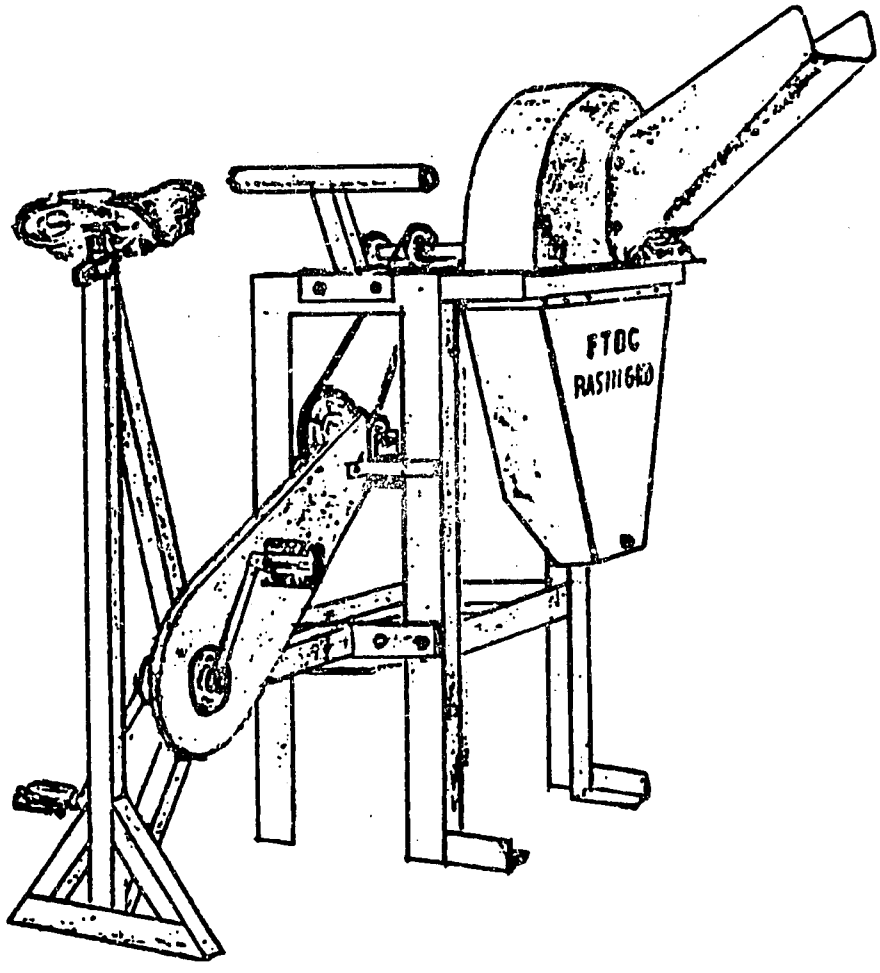
GASINGRAY (ALAT PENYANGRAI BIJI-BIJIAN)

Fig 4



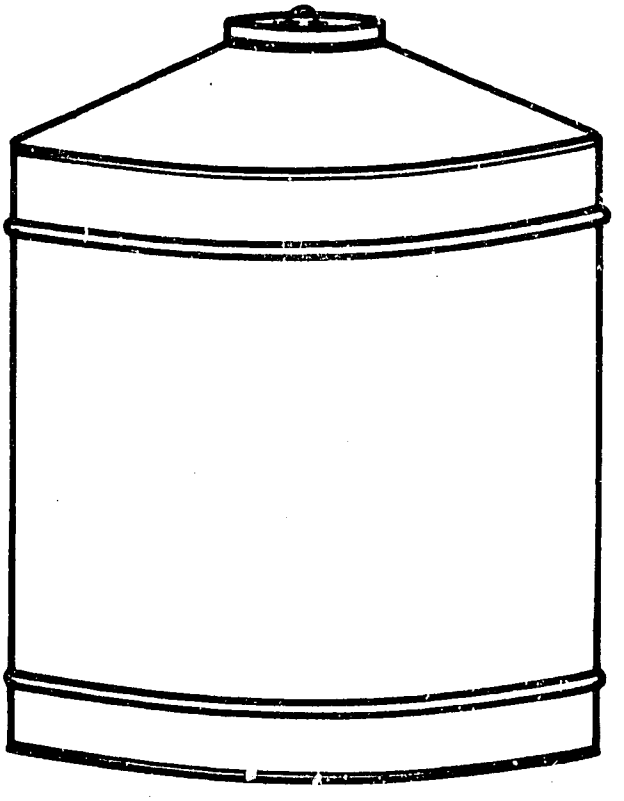
PUMIX (PENCAMPUR TEPUNG)

Fig. 5



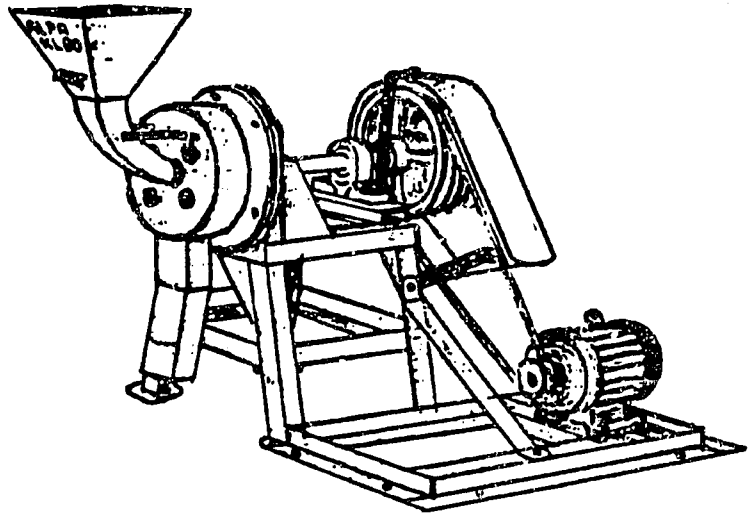
RASINGKO (PERAJANG SINGKONG)

Fig. 6

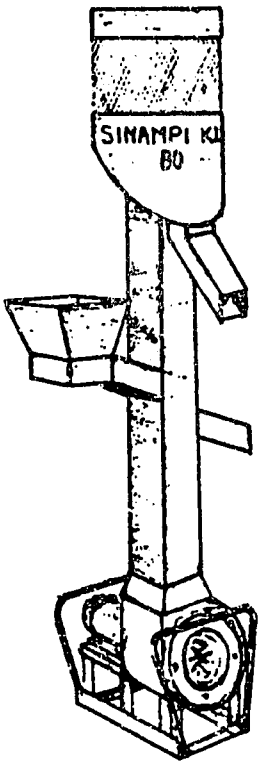


Kaleng Pedaringan

Fig. 7



ALPA KL (ALAT PENGUPAS KULIT BIJI)
Fig. 8



SINAMPI KL (ALAT PEMBERSIH DAN PENAMPI KULIT)

Fig. 9

NEED FOR AN APPLIED APPROACH AS WELL IN FOOD AND NUTRITION POLICY PLANNING

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MACRO APPROACH

The major project activity undertaken by the Food and Nutrition Division is the development of a Food and Nutrition Policy Plan for Sri Lanka. It is expected to develop a food strategy for Sri Lanka in relation to malnourished and poverty groups by 1982.

The Division is involved in several complementary projects such as the review and monitoring of:

- ongoing food subsidy and food aid programmes,
- nutrition-targeted supplementary feeding projects,
- food production, management and pricing,
- technology development of low-cost weaning foods and village-level food processing,
- food-control infrastructure development,
- consumer education and other areas associated with the Food, Nutrition and Socio-economic sectors which are likely to influence or re-orient Food and Nutrition Policy considerations.

The Division is also attempting to give an impetus to the Ayurvedic or Indigenous system of Medicine in terms of alerting this system to current approaches that are necessary to be followed in food and nutrition programmes. You will note that the Ayurvedic Medical hospitals service almost 30% of the rural population and it is vital for this system to be represented in the district health committees.

DISTRICT SURVEILLANCE

The Project involving Food Policy Development to fulfill basic nutrition needs and objectives is being funded by the UNICEF. The organization provides a grant of US$ 50,000 annually to the Food and Nutrition Division. A major portion of the grant is committed to nutrition and socio-economic status surveys covering the entire 24-districts and related research projects.

The objective of this surveillance programme is to assess the current nutritional status of the pre-school population since the findings of the CDC survey in 1975/76 and also to identify the socio-economic factors which may either directly or indirectly influence malnutrition in the context of Sri Lanka's development perspective.

The above surveillance programme has been completed in 12-districts which include 8-districts (Kurunegala, Matale, Nuwara Eliya, Mullaitivu, Vavuniya, Moneragala, Hambantota, Matara) identified under the Integrated Rural Development Projects which is a lead project of the Government. The detailed results of this survey are reported in the Interim Report submitted to Government in October 1980, by the FNPPD on Nutritional Status, its Determinants and Intervention Programmes.

SUMMARY FINDINGS

According to findings, chronic undernutrition (stunting) affects almost 40% of the pre-school population; the proportion increases steadily from infancy through the pre-school years. It is likely to be worse in the estate sector especially in the Nuwara Eliya district where 49.2% of the pre-school children are affected. However, the patterns discernible in these districts are somewhat similar to tne 1975/76 CDC survey, subject to the fact that the CDC survey was done on the basis of SHS areas rather than on a district basis. It was necessary to adopt this methodology because in the future all sectoral programmes will be planned and implemented at the district level.

A relatively high prevalence of acute undernutrition (wasting) was observed in children belonging to the 12-24 months age-category except in Vavuniya and Nuwara Eliya districts where the highest prevalence rates were observed in the first year of life. The reasons may relate to problems of environmental sanitation together with improper primary health care. It was observed that the incidence of acute undernutrition had risen significantly in quite a few districts. A slightly higher incidence of concurrent acute and chronic undernutrition (stunting and wasting) is noticeable in the nutrition profile when compared to the CDC survey.

According to the results of the socio-economic survey conducted by the Dept. of Census and Statistics in 1969/70, about 25% of the population during that period were not able to consume the calorie requirement of 2200 calories per day while only 5% of the population in the country consumed less than 1900 calories per day. The provincial data based on the recent FNPPD survey suggests a further drop in calorie intake.

This is an aspect which deserves closer examination on the basis of the food consumption patterns revealed by the FNPPD Current surveys and the Central Bank Consumer Finance Survey of 1978/79. The socio-economic indices relating to nutritional status such as income distribution, cost of living index, employment, housing, sanitation, water supply, population and family planning, etc. are assessed on the basis of FNPPD survey findings and current research information available on these aspects.

MAHAWELI NUTRITIONAL STATUS

The FNPPD also conducted a quick assessment of nutritional status in the H-area of the Mahaweli Project which is Government's top priority investment project using a pilot methodology tried out in similar projects in Nepal, Philippines and Haiti. The survey methodology and results are reported in the Survey Report on Nutritional Status of the H-area of the Mahaweli presented to Government in December 1980.

According to the survey data, it would appear that chronic undernutrition is widely prevalent in the pre-school population of the Mahaweli H-area which finding is comparable to the results observed in the pre-school population surveyed in the overlapping SHS areas of the region in 1975/76. The estimate obtained for acute undernutrition was remarkably high (19.6%). The socio-economic findings* suggest that pre-school children of settlers over a period

* This data is subject to confirmation since the methodology used for the evaluation was an experimental one.

of 2 years in settlement were comparatively better in nutritional status than those under 2 years in settlement due to the former having better incomes, greater experience in highland and irrigated agriculture and involved in comparatively more stabilized systems of farming.

DATA BANK PROJECT

While the work on the nutritional and socio-economic status surveys are in progress, the Division is also in the process of building up its Data Bank which will monitor short-and long-term critical indicators in respect to food, nutrition and socio-economic sectors that are likely to influence Food and Nutrition Policy. A Research Panel with representations from all key agencies is assisting the FNPPD in strengthening the project organization, data gathering and information systems, data processing and other inputs required to structure the project.

It is expected that this project will help to bridge the gap that exists in conducting costly and time-consuming surveys -- the results of which are generally not available at the appropriate time for policy formulation levels. The end objective of this exercise would be to assist in developing simple surveillance procedures and models for use in formulating and structuring the food and nutrition components of the District Development Plan.

The Data Bank on the one hand will provide the districts with critical information relating to the development of its food consumption strategies, while on the other hand it will attempt to develop the district capability to develop simple monitoring systems to measure nutrition status, economic growth, impact on food aid utilization programmes, supplementary feeding, etc. The UNICEF will provide the hardware necessary for this project in August 1981. The FAO and WHO are two other agencies which have provided financial and technical support towards the development of this project.

RELEVANT AREAS OF RESEARCH

Some of the recent work completed on the various sub-sectors which constitute the overall Food Policy Matrix include a Cabinet Paper presented to Government in June, 1980 on Nutritional Status in Sri Lanka; study on Food Grain Security and Information Systems in Sri Lanka, project on the re-structuring of the Food Grain Information and Management Systems of the Paddy Marketing Board and the Food Commissioner's Dept. and the role of the National Food Policy Committee; impact study of the Food Stamp Scheme; evaluation of the supplementary feeding projects, specifically the Thriposha and the School Biscuit Feeding Programme; feasibility study for the establishment of a 10,000 ton capacity Soya Plant for fortifying wheat and rice flour to complement nutrition intervention feeding projects; and the development of a Marketing Code for the promotion of breast feeding and marketing of breast milk substitutes and complementary food products.

The formulation of a National Nutrition Education Policy for Sri Lanka to integrate the service capabilities of all agencies responsible for nutrition

education and also to rationalize the present methodologies and techniques practiced by different institutions is underway. These various policy documents have been formulated with the technical assistance of different expert panels (8), comprised of subject matter specialists from both governmental and non-governmental organizations.

APPLIED APPROACH

DISTRICT FOOD AND NUTRITION COMMITTEES

Although the major focus is on policy issues, a substantial financial and technical input is also identified for the development of applied nutrition-oriented projects in rural areas with a view to direct assessment. The FNPPD's ultimate objective is to initially trigger off these applied programmes and set the pace for the subsequent takeover of these projects by the newly created District Food and Nutrition Coordinating Committees which are represented by district level agencies and institutions involved in most of these functions. By this means, better inter-sectoral coordination and direction of these programmes can be achieved, while at the same time provide the necessary feedback and backstopping for formulation of practical policies.

FIELD PROJECT

The Nutrition Communications Programmes currently implemented are the Adult Nutrition Education Project, School Farm Project, Rural Film Screening Programme, Production of a Documentary on Low Cost Weaning Foods, Radio Programmes highlighting the Schools Oratorical and Essay Competitions on the food and nutriton theme, Nutrition Jingles and the publication of a Quarterly Newsletter for the public on nutrition.

An area that is engaging much attention of the FNPPD both from the policy and implementation angle is the development of low-cost weaning foods and village level production and processing of low-cost nutritious foods for poverty groups. The FNPPD is now testing a soya/rice based complementary food on target groups with the research assistance of the Paediatrics Dept. of Agriculture. Besides these aspects of the food chain, the hitherto neglected fields of food control infrastructure development at the regional level is now becoming a reality with the proposed establishment of the Food Control Laboratory in Kandy with UNICEF assistance.

EVALUATION OF NUTRITIONALLY-ORIENTED APPROPRIATE TECHNOLOGY PROGRAMMES

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EVALUATION OF NUTRITIONALLY-ORIENTED APPROPRIATE TECHNOLOGY PROGRAMMES

INTRODUCTION

Approaches to the problem of malnutrition through application of the appropriate technology concept at community and family level represent a fairly recent innovation. Such approaches do seem to offer considerable potential but, as yet, there is an insufficient volume of documented experience to allow a proper assessment of their potential effectiveness. For this reason, and for the purpose of refining and enhancing the quality of the overall approach, it is essential that this form of intervention should be properly evaluated and documented.

PERFORMANCE EVALUATION OF INDIVIDUAL INNOVATIONS

Before any specific "tool" or technique is put into use, it should be evaluated for functional efficiency, e.g., the throughput of a thrashing device, or the fuel consumption of a domestic stove. In addition, it should be evaluated in the community or family life situation in relation to its acceptability and its relevance to the cultural, social, and economic parameters of that situation.

Such assessments will provide the basis for decisions as to the appropriateness or otherwise of that particular innovation. If this decision is positive, and the innovation is introduced, it will then become necessary to assess its performance as a component of the overall process of community or family life. This will involve observation of its attractiveness, i.e., whether its use is widely adopted; and it's pragmatic effectiveness, i.e., whether it is sustainable within the limits of community or family resources, whether it can be adequately maintained, and the extent of benefit in economic terms, or in terms of energy-saving or health improvement which can be directly attributed to its use.

Many of these assessment factors may be susceptible to direct measurement, e.g., the rate of proliferation in its use, or in the case of, say, an improved grain storage method, the extent of reduction in storage losses. Others such as, for example, the nutritional or economic benefits resulting from reduced storage losses may be more difficult to quantify. Such assessments should, however, be pursued to the extent possible, and, where possible, should be carried out by the community under suitable guidance.

EVALUATION OF THE TOTAL INTERVENTION

Bearing in mind that the ultimate objective of A.T. programmes will be the achievement of a significant reduction in malnutrition incidence, the pragmatic evaluation of such programmes will, inevitably, depend on this criterion. It might well be felt, therefore, that a simple "before and after" measurement would suffice and, in many cases, this might be all that is needed. In such cases the effects of the concurrent impact of other "non-programme" factors such as, for example, the benefits accruing from increased use of family planning, or, perhaps, an improved economic situation resulting from an improved market for cash crops, should, of course be taken into account.

The A.T. intervention, if it is to be effective, will need to embody many components related to the multi-factional nature of the problem to which it is directed. These individual components will, in many cases, be mutually interactive and mutually supporting, and it will, therefore, be very difficult to attempt to assess the contribution of any one of the individual components to the overall improvement achieved.

It should be possible to assess the effects of mutually supportive interventions on particular areas of improvement. For example, improvements in sanitation of water supplies and of the home environment will be likely to result in a reduced incidence of diarrhoea, and use of this criterion should allow assessment of the overall effectiveness of the "package" of sanitation measures employed. It will not necessarily allow assessment of the relative contribution made by the individual components of this package. Similarly, although increases in food production and improvements in storage practice may result in a significant increase in food availability, this may result in increased sale of food, with a resultant reduced spin-off in terms of actual nutritional improvement.

It is clear, therefore, that attempts to achieve a quantitative assessment of the impact of individual components in the multi-factorial intervention would require a very intensive investigative approach. The conduct of such investigations would inevitably result in a, perhaps, intolerable interference with the life pattern of the community.

NUTRITIONAL SURVEILLANCE AS AN EVALUATION TECHNIQUE

Measurement of the pragmatic impact of the intervention "package" must involve assessment of the overall improvement of the nutritional status of the vulnerable sectors of the population. This could be attempted through the use of point-prevalence surveys prior to, and at successive points in time following the introduction of the programme. This technique should provide an overall and fairly gross measurement as to the value of the programme, but cannot provide the detailed information required in order to achieve a proper understanding of the mechanism by which the overall outcome was achieved. Such gross assessments may also fail to provide fully accurate data since reduction of mortality rates, with resultant inclusion of more survivors in the child population, and shifts in the distribution pattern of the various degrees of severity of malnourishment may escape attention.

It would seem, therefore, that an ongoing system of surveillance covering nutritional status, morbidity patterns, and mortality could provide a more useful picture. Such surveillance could be carried out by community-level workers assigned specifically to this task. However, the dilemma arising from such an approach would be that the surveillance system itself would be likely to exert a positive influence on the morbidity and malnutrition problem. Detection of malnourishment or illness during the surveillance would automatically result in remedial action. This in itself would be no bad thing and, indeed, it could be cogently argued that community-level surveillance would, in itself, represent an appropriate technique for controlling malnourishment, and that it should, in any case, form a normal component of the A.T. intervention package. Such inclusion would render the system self-evaluating, but it would not be easily possible to determine the extent to which the evaluation technique had contributed to the overall improvement achieved.

DESIGN FOR EVALUATION

The need to achieve an adequate evaluation of the impact of any A.T programme should be kept firmly in mind during the planning phase and such criteria as relate directly as possible to the overall objectives of the programme should be identified and the necessary provision made for their application.

This would in all cases predicate a pre-project baseline study. A study of this nature would form part of the neccessary process of learning about the community,

learning from the community and planning with the community.

PRACTICAL IMPLICATIONS

The nature of the A.T. application process is, in itself, likely to facilitate the task of achieving a reasonable degree of evaluation of the contribution made by individual components.

This is because there will rarely be any situation in which the total package will be simultaneously applied. The most likely process will be one of staged sequential introduction of innovations according to the priorities chosen by the community. The rate at which additional components will be added will also depend on the wishes of the community and upon its capacity (in both social and economic terms) to accept and apply particular approaches. Thus, provided there is an ongoing process of continuous surveillance of health and nutrition status, it should be possible to observe the impact of the initial innovations and, therefore, the cumulative impact of successive additions.

CONCLUSIONS

Planning for evaluation of A.T. nutrition projects is a necessary element in the design of programmes. Ideally, programmes should be designed to become self-evaluating through the inclusion from an early stage of a simply operated ongoing system of nutritional and health surveillance.

Whilst there is a need to produce accurate evaluation data for the purpose of assessing the feasibility and validity of specific innovations and of the overall approach, the activity involved in evaluation should not be allowed to overburden the projects or, in any way, to obscure the basic and essentially pragmatic objective of achieving a significant impact on the malnutrition problem. In general, it is felt that detailed evaluation might well be confined to a few fairly representative projects, and that the majority of projects initiated should be allowed to proceed naturally without curtailment of the sometimes unwieldy systems needed to achieve detailed evaluation.

It should also be borne in mind that the people will make their own subjective evaluation of the innovation process - using their own criteria as to what they consider to be appropriate and beneficial. Such evaluation will be the acid test of the validity and usefulness of the appropriate technology concept.

APPENDIX I

CURRICULUM DESIGN FOR TRAINING

The following outline of modules for training of extension workers at an intermediate level are only suggestions for the development of detailed curricula including learning objectives, tasks, skills, teaching aids, exercises, and evaluation:

MODULE 1: Get to Know Your Community

1) Physical, socio-economic, and demographic information of the target community.

2) Food production and consumption of household and nutritional status of high risk group.

3) Institution and infrastructure existing in the community.

4) Needs and resources for introducing household nutrition-appropriate technologies.

5) Techniques to approach people.

MODULE 2: Nutrition Education

1) Nutrition common sense.

2) Preparation, use, and evaluation of teaching aids (posters, flip-charts, flannel cutouts, puppet play, etc.).

3) Application and evaluation of different teaching methods (demonstration, role-playing, group discussion, field visit, etc.).

4) Evaluation of nutrition education program at a community level.

MODULE 3: Home Gardening

1) Soil, plant nutrients, and garden plots preparation.

2) Tools and equipment used for gardening.

3) Compost-making and other sources of plant nutrients and soil conditions.

4) Selection of vegetables, legumes, and fruit trees.

5) Planting materials (seed storage and exchange, cuttings and seedling bed).

6) Designing year-round garden for sustained supply of vegetables and fruits, with special emphasis on legume intercropping and crop rotation.

7) Route care of garden -- watering, mulching, weeding, cultivation and harvesting.

8) When the garden program is sufficiently developed -- organizing vegetable cooperative for efficient marketing and introducing small animal raising and agriculture as an integrated part of gardening program.

9) Recording and evaluation.

MODULE 4: Food Storage

1) Evaluate and improve traditional food storage practices.

2) Rat and insect proffed low-cost containers for food storage.

3) Education on pesticides.

MODULE 5: Food Preservation and Processing

1) Solar dryers -- applicable to local environment.

2) Underground storage.

3) Fermenting and drying of starchy roots and tubers.

4) Grain storage.

5) Storage of seed potatoes and sweet potatoes.

6) Processing of grains, starchy foods, vegetables and fruits, and meat, fish, and eggs.

7) Conservation and improvement of nutritoinal value of different foods.

MODULE 6: Food Preparation and Culinary Technology
(Maternal feeding, breast-feeding, young child feeding)

1) Methods of pre-cooking and cooking of cereals, root crops, pulses, vegetables, fruits, milk, egg and first and third products.

2) Improvement in the traditional methods in soaking, washing, boiling, frying, seasoning, and storage and use of left-over foods.

3) Types of oven/stove, utensils, working vessels used for boiling, steaming, frying and roasting.

4) Improving fuel efficiency of stoves.

5) Shortening the time of cooking different major dishes.

6) Effects of cooking techniques on nutrition value of foods.

MODULE 7: Food Sanitation

1) Prevent contamination by dirty hands, flies, cockroaches, rats, and other rodents.

2) Prevent contamination of food by keeping it away from insecticides, herbicides.

3) Prevent contamination of food by disease carriers (sick people cooking and handling food).

4) Use clean vessels to feed infants and young children.

5) Prepare infant foods in more hygienic manner.

6) Keep home and garden clean and orderly.

7) Burn or bury rubbish from home and garden or use for compost-making.

8) Build latrine far from water well.

9) Encourage the construction and use of water-sealed latrines.

10) Fill up water holes or raise fish in such holes.

11) Keep livestock away from house if possible.

12) Keep livestock shed clean.

13) Protect wells from contamination and keep the surroundings of the well clean.

14) Provide water drainage.

15) Build soaking pits near kitchen to provide water and nutrients for growing vegetables.

16) Practice mosquito control.

MODULE 8: Evaluation, Supervision and Follow-up

1) Pre- and post-test curriculum.

2) Progress evaluation of different activities in the above modules.

3) End result evaluation of household nutrition-appropriate technologies introduced to the target community.

4) Supervision from the extension workers and self-supervision by community.

5) Plan and design follow-up activities including the introduction of new technologies.