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NUTRITION OF THE WEANING CHILD

by

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Introduction

The purpose of this Paper is to draw the attention of Governments to the urgent need for concentrated efforts in order to improve the nutrition of the pre-school age group. Especially the problems concerned with weaning and the lack of suitable food for the weaning period will be discussed, since this is the main reason not only for the high mortality rates in children between one and four years of age but also for the retardation of physical and mental development that can be observed in regions where protein malnutrition exists.

It has not until recently been possible to clarify these connexions and therefore it is not at all surprising that feeding of young children is still commonly regarded as the sole responsibility of the parents. This is clearly a misinterpretation with serious consequences since the general population lacks the basic knowledge for adequate infant feeding and cannot, in many cases, buy or produce acceptable foodstuffs for their infants.

It must therefore be made clear that as a consequence of our increasing knowledge in this field, the governments through the ministries of health, have to accept their responsibility for adequate nutrition in early childhood. If not, it will be found that much of the efforts to improve the efficiency of the health service will be ineffective and also that the educational system will meet with less success than if the majority of children are on a physical and mental development level, corresponding to their chronological age. One reason for the slow development in this field might be the multi-disciplinary approach needed to achieve results and to overcome the strong force of tradition.

The assessment of frequency and degree of malnutrition is clearly a medical and public health problem and so is also the treatment that must be given to clinical cases of malnutrition. The prevention of malnutrition

in general is, however, only partly a medical problem, although the medical authorities, due to their insight in the existence and consequences of the situation, must take the leadership in the planning of this part of the campaign against hunger and initiate production of protective foods for children, as well as changes in the food distribution pattern of the society, when needed.

Biostatistical Data

It has been estimated that the mortality rate in the age group 1-4 years in most developing countries, is about 20-50 times higher than in the developed countries.

In some of the nutrition surveys performed or under way within the Region, as much as 60-80 per cent of all children between six months and two years are found to be malnourished from the beginning of the weaning period, due to lack of suitable weaning foods. This widespread and early undernutrition, in combination with infectious diseases, constitutes the dominating reason for the high mortality rates. Another consequence is that the children who survive and reach school age, are fundamentally different from normal children[1] and retarded, not only somatically but also mentally[2].

Recent surveys within the WHO/FAO sponsored applied nutrition project in the Sudan, demonstrate, for example, that the overall prevalence of malnutrition in a group of 1 907 school children (7-20 years) was 49 per cent while the incidence in the youngest age group (7-10 years) was around 60-70 per cent.

It is regrettable that most of the food intake surveys performed earlier do not give any specific data for the intake of children under two years of age.

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[1] Bengoa, J.M., Malnutrition and Infectious Diseases - The "Surviving Child" UNESCO/WHO Second International Conference on Global Impacts of Applied Microbiology, Addis Ababa, 6-11 November 1967.

[2] Cravioto, J., "Paediatrics" - The Journal of the American Academy of Paediatrics, 38, No. 2, Part II, August 1966.

Recent surveys from six representative districts in different parts of Ethiopia[1] indicate however, that in the age group 1/2-2 years, the food actually given to the children usually is insufficient in calories, proteins, iron, calcium, Vitamin A and Vitamin C. Also, the fat content of the diet is in some districts so low, or of such composition, that risk for essential fatty acid deficiency can occur.

In this Ethiopian investigation, the weaning habits have been carefully covered, and it is concluded that proper infant food for the weaning and post-weaning period is almost non-existent. In Sudan, a study of weaning habits and traditional weaning foods is also going on, and from Lebanon, an extensive study of the weaning patterns in a periurban population was published in 1965 by Dr J.K. Harfouche[2].

It is of fundamental importance that baseline data of the different types exemplified above are collected in all countries of the Region, in order to make an improvement of the weaning practices possible and acceptable to the population. Nutrition surveys should not be carried out without separate analysis of the pre-school age group and weaning habits.

On the basis of available information, it can be said however, that the prevalence of early malnutrition is so high that it must constitute a serious handicap to national development not only because of the resulting ill-health and high mortality, but also because of the partial failure of expensive school education due to the lower learning capacity of school children, who still are, or earlier were, malnourished.

It seems, therefore, advisable to give the highest possible priority to the pre-school age group, and within this group the weaning group, where the malnutrition usually begins, should especially be considered. That the age from six months to two years is the nutritionally most vulnerable in human life, can be understood if we consider the nutrition requirements in

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[1] Supplementary Food for Ethiopian Children (Children's Nutrition Unit), International Conference, Addis Ababa, October 1967.

[2] Harfouche, J.K., Feeding Practices and Weaning Patterns of Lebanese Infants, 1965.

this period and the physiology of weaning, in relation to the possibilities to satisfy the requirements on basis of generally available foods.

Requirements in Relation to Age

The difference in vulnerability in different age groups, is directly related to the relatively higher requirements for most nutrients in the young individual. Protein as the most limiting factor of the diet is of special interest in this connexion. The requirement of protein in relation to age is given in Table 1. It should be observed that the figures given refer to milk protein for the first year and to "reference protein"[1] thereafter. The practical allowances are thus higher depending on the quality of the protein and other special conditions.

Table 1

The Protein Requirements of Infants and Children[2]

A g e	g. protein per kg
Months	
0 - 3	2,3
3 - 6	1,8
6 - 9	1,5
9 - 12	1,2
Years	
1 - 6	1,0
7 - 12	0,9
13 - 19	0,8

The requirements are thus closely related to age, being highest per kilogramme body weight for the youngest. The reason for this is demonstrated

[1] "Reference Protein" is a protein of high biological value, containing a specified pattern of amino-acids completely utilisable for anabolic purposes at maintenance level.

[2] FAO/WHO Expert Group TRS No. 301, 1965 (Protein Requirements).

in Table 2 where the growth rate is given in relation to age. The growth rate in the first year of life is thus very high. During the foetal period it is still higher.

Table 2

A g e (years)	Increase in Birth Length
0 - 1	50 %
1 - 2	16 %
2 - 3	10 %

From the qualitative point of view, the requirements are also different and more specific in the young. This is reflected by the way in which the biological nutrition is arranged, before birth via the blood of the mother and after birth by the mother's milk. It is not surprising, therefore, that artificial substitutes for the biological nutrition during this period are hard to design, as a matter of fact impossible for the foetal period and possible only under optimal conditions for the nursing period.

Physiology of Weaning

Any substitution of the biological nutrition is weaning. If the weaning starts when the biological nutrition is still sufficient (that is before six-seven months of age) it is an unphysiological weaning. When it starts after that period, it is a physiological weaning. In both cases, the food used as a substitute for the mothers' milk must provide nutrients qualitatively and quantitatively comparable to breast-milk. The period of weaning usually is defined as the total period during which breast-milk is being replaced by other foods but still available to some extent. From the practical point of view, the age under two years should be considered as an entity, however, since the special nutrition problems of the weaning period as defined above persists during the post-weaning phase, up to about this age.

Early (or unphysiological) weaning has since long been increasing in the developed countries and always based on the use of cow's milk. Also, under optimal conditions with regard to general hygiene and care, such artificial feeding involves certain risks as compared with breast-feeding. It is of interest to study the mortality figures for bottle-fed infants as compared with breast-fed in an investigation from the United Kingdom as late as 1951 (Table 3).

Table 3

Relation between Feeding and Mortality[1]

Feeding	No. of Infants	Mortality (per 1 000)
Breast-fed	971	10,2
Partly bottle-fed	1 441	25,7
Bottle-fed	854	57,3
T O T A L	3 266	29,3

Even if data of this sort are interpreted with great care and the differences found not uncritically attributed to the type of feeding per se, it is nevertheless quite clear that despite the most optimal conditions with regard to medical supervision and hygiene, early weaned children show higher frequency of certain acute infections and also notable differences in serum biochemistry, in comparison with normally weaned children[2]. This is not surprising, in view of the fundamental chemical and biochemical differences between the natural food for infants, breast-milk, and the natural food for calves, cow's milk. If performed under sub-optimal hygienic conditions, and especially, if no cow's milk or milk-based weaning foods are available, early weaning is a real disaster to the child and should be avoided by all means.

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[1] Robinson, M., Infant Morbidity and Mortality, Study of 3 266 Infants, The Lancet, No. 6658, 788-794, 7 April 1951.

[2] Mellander, O., Vahlquist, B., Mellbin, T., Breast Feeding and Artificial Feeding, Acta Paediatrica, 48, Suppl. 116, 1959.

Normal weaning (physiological weaning) starting between six and seven months, has traditionally been based on the use of cow's milk as main protein carrier, at least until after two years of age. Under appropriate supervision and if mixed foods are introduced successively, such normal weaning could be considered to be a safe and uncomplicated procedure.

For the majority of children, in tropical and subtropical countries, milk is however not available, and the mothers have traditionally to rely on home-made weaning foods, based on the same foods as used by the rest of the family.

As has been demonstrated by the surveys undertaken in Ethiopia, this usually means that the weaning diet will be based mainly on cereals and other vegetable material, low in protein and deficient in essential amino-acids. Furthermore, the methods used for cooking and preparation of the infant food often are very unsatisfactory. If milk was available, it would be used in too small amounts or too diluted, and fish and meat would not be used at all as weaning foods even if available.

It is therefore not surprising that calculation of the diets given during and after weaning, demonstrates extremely insufficient intake of the most important nutrients (protein, calories, vitamins and minerals).

If some sort of animal food (milk, meat, fish, eggs) is available, in the family diet, it would be possible to improve the weaning habits by education of the mothers. If this is not the case, or if such food is available only occasionally, then it will not be possible to improve the situation for the small children, since it is simply not possible for them to consume enough of these foods to cover their protein and other requirements. It is, therefore, essential to find suitable substitutes for milk to be used as weaning food and possible to produce domestically on the basis of raw materials available within each country. Several different foods of this sort are already in production, partly as a result of research initiated and supported by UNICEF/WHO and FAO.

There are thus several alternative ways to deal with the problem, and basic information must therefore, firstly be collected, in order to find the best solution in the region or country under consideration.

Collection of necessary baseline data have to be made by surveys of representative samples of the population. On the basis of such surveys, it will be possible to embark on an action programme, adapted to the situation and therefore efficient.

Baseline data

1. Assessment of the nutritional status of pre-school children in representative samples of the population. A simple clinical examination including height and weight data will usually be sufficient to obtain figures for frequency and type of malnutrition, provided that the survey is made by experienced physicians. The survey techniques are described in detail by Jelliffe (1966)[1].

2. Food habits and food composition by direct investigation in a representative sample of families from the same population.

The food used for pre-school children and the weaning practices should especially be surveyed in detail by trained nutritionists visiting a certain number of families in the community and making records of the amount of food of different types that is used. For small children, an individual record can often be made after they have been weaned, but for older children and adults it is usually not possible to obtain individual data. If each family can be followed daily for a week or so, and if this can be repeated once or more in a year, the average diet can be assessed with respect to calories, proteins, vitamins and other important components.

In order to make such calculations, it is necessary either to have reliable tables of the composition of the different foodstuffs used or to

[1] Jelliffe, D.B., The Assessment of the Nutritional Status of the Community, WHO Monograph Series No. 53, 1966.

have possibilities to do the necessary analytical work in order to obtain such data. If we want detailed information about the food as it is eaten in the families, it is almost always necessary to analyze the food after the cooking, baking, and so on, since even slight differences in such procedures from one country or region to another can be of fundamental importance for the nutritive value of the food served. The availability of different types of food in a community has also to be known. That means that we should have information about price levels and income levels and also know what can be produced locally and what is possible to obtain from other parts of the country. It is necessary to evaluate the possibilities of influencing food habits and food consumption. This means, for example, that we would like to know if there exist possibilities for health education in the community and if it will be possible to increase local production of one foodstuff or another, etc.

Let us illustrate how the results from surveys in three different regions represented by the average Families A, B, and C, can be used for planning of applied nutrition programmes for the improvement of weaning and post-weaning nutrition. Some of the survey data are given in Table 4.

Table 4

BASIC FAMILY DIET	ADULTS		CHILDREN 2-4 YEARS		CHILDREN 1/2-2 YEARS
	Vegetable Protein	Animal Protein	Vegetable Protein	Animal Protein	Weaning Foods Used
Family A Several cereals, peas, beans, milk, eggs and meat	g. 50	g. 20	g. 17	g. 3	Milk, bread, potatoes and eggs
Family B Several cereals, peas and beans	70	-	20	-	Pea water, bread
Family C Ensete, Kale corn	30	-	10	-	Corngruel

In all the examples, a high frequency of protein-calorie malnutrition was observed and in addition, a considerable amount of Vitamin A, iron and calcium deficiency.

In family A, the total protein consumption of the adults is about 70 g daily. This can be considered to be acceptable provided that the combined protein part of the diet, also from a qualitative point of view, is good. We can suppose this to be the case for two reasons, first because the diet contains a certain amount of animal protein, in this case meat, eggs and some milk, and also because there are several protein carriers of vegetable origin.

The children between two and four years in family A do not consume more than a total of 20 g protein per day, and from this only 3 g from milk or meat. This small amount of animal protein is not sufficient to balance the amino-acid deficit in the vegetable protein fraction, and the biological value of the diet is therefore low. The total amount of protein taken per day is also below requirements. The weaning food used seem to be good but the milk was given in diluted form and in very small amounts. Meat and pulses were not used at all during weaning.

It is apparently possible to improve the situation in this family, on the basis of what is available. The total amount of milk should be used as weaning food and as second priority for the other children below the age of four. Meat should be introduced in the diets of the children already before two years of age. Such changes in the distribution within the family, will not spoil the diet for the adults because they can still obtain some animal protein from meat and they can also increase the intake of vegetable proteins, somewhat over the original 50 g. It will thus, in this case, be possible to ameliorate the situation by educational means only.

In standard family B, the situation is different. Here we have the same mixtures of vegetables in the diet as in A above, and the total protein intake for the adults is the same. Since it is a rather well-balanced

vegetable protein mixture, the diet is also fairly acceptable from the protein point of view, although, naturally, not as good as in case A.

The children in family B, however, cannot eat more than an average of 20 g per day of the vegetable protein available to them. It is not possible to increase this amount in any significant way, since the cereals which constitute the main part of the diet are too bulky. We have thus in this community a real emergency situation and something has to be done to improve the diet of the children. The weaning foods used are highly unsatisfactory and the weaning, therefore, means the beginning of malnutrition.

Until the whole food production pattern of this community can be changed and some animal protein produced, there will be a need for a special food for the weaning period and for the children below the age of four. This food must contain a sufficient amount of good quality protein and other essential nutrients.

In family C, finally, there is a real starvation for adults, as well as for children. The weaning practices are highly unsatisfactory and no improvement can be induced on basis of the poor food available.

Here, a development programme for the whole community will be needed, but as an immediate emergency activity, a special food of the same type as in situation B above, has to be introduced.

From these surveys thus can be concluded that improvement of weaning and young children's nutrition can be achieved in two ways:

A. By education and redistribution of food within the family.

B. By introducing special protein-rich foods as weaning foods and supplementary foods for pre-school children.

Improvement of Weaning Nutrition

A. By Education

If the basic food used in the families consists of several cereals and pulses plus some sort of animal protein (as in Family A), it would be then

possible to improve the traditional weaning pattern by education and demonstration of new recipes for weaning foods worked out with regard to the nutritional value of available raw materials. As has been demonstrated in the programme of Children's Nutrition Unit in Ethiopia[1] it is possible, for instance, to calculate optimal protein mixtures based on pairs of a cereal and a legume if the amino-acid composition of each component is known. Some examples of such optimal proportions, according to these authors[1] are given below:

Tef[2]/Chick-peas	1/0,89 - 1,3	Barley/Peas	1/0,24
Wheat/Peas	1/0,38	Barley/Chick-peas	1/0,30
Wheat/Chick-peas	1/0,50	Corn/Peas	1/0,60
		Corn/Chick-peas	1/0,77

If knowledge of this type can be taken into account and if [redacted] same sort of animal protein food like eggs, meat or fish, is available, it would thus be possible to improve the traditional weaning habits by education and demonstration for mothers. It has been found preferable that the demonstrations are given in the form of a talk with the mothers. The number of each group should not exceed twenty, and the talk should be illustrated with food samples and by actual preparation of the food on the spot using equipment, known by the mothers.

The importance of breast-feeding must always be pressed on the mothers, and they should be left in no doubt that breast-milk and only breast-milk is the best food for the child up to six months of age. The habit to feed butter or any other food during that period, should be abolished. For each area, country or region with the same basic conditions according to the surveys made, a scheme for the weaning should be worked out as well as recipes for weaning foods adapted to the food available. Continuation of breast-feeding up to the age of one year and over, should be encouraged, but sufficient amounts of the weaning foods should be given. Abrupt weaning should

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[1] Agren, G. and Lieden, S.A., "Optimal Protein Mixtures Based on Cereals and Legumes", International Congress of Nutrition, 7th, Hamburg 1966.

[2] Tef is an Ethiopian grain (Eragrostis Abbysinica).

be avoided. Not until after the age of 2-3 years can the child be expected to eat of the usual family food.

The demonstrators must be carefully selected and provided with appropriate manuals and demonstration material. Mobile teams can be used but the demonstrations should whenever possible be integrated in existing maternal and child health services and eventually taken over by these.

B. By Production of Special Weaning Foods

Background

Improvement of weaning nutrition by education and change of habits is naturally not possible if the basic food available is insufficient or of poor quality (as in Families B and C). Early (unphysiological) weaning is not at all possible under such conditions. Other ways must thus be found to safeguard nutrition during weaning. One way is to increase the supply of milk either by increased production or by import of dry milk. Unfortunately, this way is often found to be impossible even if the price barrier could be overcome. If the amount of milk available can be reserved for families with small children, some improvement can be achieved but this seems to be a very difficult policy and a considerable part of the fluid milk is always consumed by adults and other non-priority groups. This erroneous distribution can be corrected if milk powder is produced instead of fluid milk and if this milk powder is used as a constituent in special weaning foods.

Since the milk powder content of a weaning food can be kept at a 5 or 10 per cent level depending on the other ingredients, this means a ten-fold or twenty-fold stretch effect with regard to milk. The available amount of milk powder should thus never be used for adults or older children as long as a situation of malnutrition in the pre-school age group exists. Some technical aspects on the production of artificial weaning foods with or without milk as a constituent will be discussed in the following section.

Technical Aspects

The development in recent years in this field has recently been reviewed by De Maeyer (1966)[1]. The reader is also referred to: "Supplementary Food for Ethiopian Children" 1967[2], and FAO/WHO/UNICEF Protein Advisory Group, 1967[3].

The guideline for development of these foods (also called supplementary foods, unconventional weaning foods, high protein foods etc.) has usually been to design a formula with acceptable protein content from a qualitative and quantitative point of view. If this can be achieved, is it not difficult to provide minerals, vitamins and other essential nutrients according to the requirements. The products so far tested usually consist of one part, that is rather low in protein content and another which is a protein carrier of high protein content (a protein concentrate). The first part is usually a mixture of milled cereals and flour of peas or beans of some sort. The protein content of these ingredients varies between around 10 per cent for the cereals and 20-25 per cent for the pulses. The amino-acid content can be better balanced than in the individual ingredients if these are chosen on the basis of their amino-acid spectrum. However, the total protein content might still be too low with regard to requirements, and therefore, a protein concentrate of high biological value should be added.

The protein content of this concentrate must be as high as possible and not only with a well-balanced amino-acid pattern, but in addition, with a surplus of those amino-acids that are limited in the low protein part of the mixture (usually lysin or methionin). The cereals and pulses for the low protein part of the mixture are naturally always available as domestic production. The protein concentrate on the other hand, is for the time being often imported, but should in the future also be based on domestic production.

The oldest and best known protein concentrate is the spray-dried skim milk with 35 per cent protein of highest quality. Used on a 10 per cent

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[1] De Maeyer, E.M.: Le Programme International des Aliments Riches en Protéines, Courr. Cent. Int. Enf., 16, 413-420, 1966.

[2] "Supplementary Food for Ethiopian Children" - International Conference in Addis Ababa - October 1967.

[3] FAO/WHO/UNICEF Protein Advisory Group Bulletin 7, 1967.

level in infant foods (as in the Ethiopian and Algerian Formulae) the dry skim milk provides a good amino-acid supplementation of the vegetable proteins in the mixtures. This way to use the limited amounts of dry milk available means a considerable stretch effect as compared with the use of milk powder as such, and makes it also possible to avoid misuse of milk by adults and other non-priority groups.

The use of whey protein as protein concentrate has been suggested but so far the problem has been the high content of lactose which is not well tolerated. Trials are going on to separate the protein of whey from the lactose by absorption on a technical scale. Other animal protein concentrates will soon be (or already are) available on the market in powder form and with protein contents of 70-80 per cent.

Fish protein concentrates are especially promising and already in production as taste and odour-free defatted products with 80-85 per cent protein. Five kilogrammes of fish is required to make one kilogramme of such protein concentrate. As at the present time only about 15 per cent of the production capacity of the oceans is utilized for human consumption, this source of high quality protein must be considered as one of the most important. The biological value of defatted fish flour is also as high or even higher than that of milk proteins. In a similar way, it is also possible to produce meat protein concentrate.

The vegetable protein concentrates are usually based on oilseeds or other crops for production of edible oil. The residue is high in protein and the protein quality is usually good. Defatted cottonseed and soya protein concentrates are already in use and sunflower is also considered to be one of the safest oilseeds to use as raw material. Other new types of concentrates, still in the research phase, are based on microbial production or on utilization of green plant material. All the concentrates need processing and more or less complicated technical equipment for large scale production.

The choice of protein concentrate to be used in a weaning food will have to depend on the possibilities for domestic production. Any product that is not traditionally used as human food must also be tested in different ways before it can be accepted. It is also possible that toxic components occurring in small amounts in vegetable material, can be concentrated during processing and, therefore, raw materials considered to be safe can result in a toxic concentrate. Also, some types of peas and beans can, when taken in higher quantities than usual, cause intestinal disturbances. These factors have to be taken into consideration when exploring domestic products as to their suitability for weaning food production. Proper analyses and acceptability test will have to safeguard that no undue effects result in particular from concentration of toxic factors in raw materials. Mention may be made in this context of favism, poisoning with micro-toxines and pesticides. Recommendations have been made as to testing procedures for weaning and supplementary foods[1].

The technological aspects on production of weaning or supplementary foods have been discussed extensively during the last few years, and reference is made to the literature[2]. One usually overlooked aspect will be mentioned briefly, however, and that is the bulkiness.

The cereal based formulae are rather bulky after cooking with the amount of water prescribed. The protein content might be around 3 per cent. This is the same as in cow's milk but the difference is that the bulk in the case of milk, consists of water which is not combined with or bound to any other substance and therefore quickly reduced when the water is absorbed in the stomach and upper part of the intestinal tract. In the cereal based foods on the other hand, the bulk is due to a combination of water and complex carbohydrates and is, therefore, not reduced as quickly, since the water is not absorbed, until after a certain time when the carbohydrate has been digested. The bulkiness thus remains for a longer time in the intestinal

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[1] FAO/WHO/UNICEF Protein Advisory Group Bulletin 7, p. 55-65, 1967.

[2] FAO/WHO/UNICEF Protein Advisory Group Bulletin 7, 1967.

tract, constituting a limiting factor for the amount of food possible to take per day (a child can drink one litre of milk in a few hours, but not eat one litre of porridge). It is thus necessary that the protein content of the prepared weaning food is high enough to cover the daily need of the infant with due regard to the amount possible to feed per day.

This is a weak point for many of the protein-rich food mixtures at present in production and under testing. On the other hand, these formulae are usually intended to be used as a supplement assuming that a certain amount of protein and other nutrients are provided by conventional food. This might be good as far as children over two years of age are concerned.

During the weaning period, however, the artificial foods should be fully comparable to milk and able to provide the same amount of proteins and other nutrients per day as is possible when milk is used as weaning food. The weaning foods should be a real "milk substitute" because of the high probability that for a good part of the weaning and post-weaning period it will be the main source of proteins as well as other nutrients.

To sum up the ideal artificial weaning food must thus be:

1. Acceptable to the child in quantities big enough to cover the daily requirements of all essential nutrients.

2. Possible to produce on the basis of domestically available raw materials.

3. Possible to produce at a price that does not prevent distribution on commercial basis to the target population.

4. Acceptable to the mothers and as closely adapted to traditional weaning foods as possible.

Weaning Food Production

A. Manufacturing

The practical implementation of any weaning food production programme would require close collaboration and co-ordination of the Government

departments concerned. The primary initiative could well be taken by the Ministry of Health or by the Ministry of Agriculture or by both in consultation. Existing supplementary food production programmes have been organized in different ways according to the circumstances and requirements. In most cases, the actual production and also the distribution and marketing has been performed by private food industries on licence basis.

In order to illustrate different ways to organize production of a weaning food in the initial phase the following examples are described:

1. In Algeria, a flavoured mixture of pre-cooked flours composed of hard wheat, chick-peas and lentils as low protein part and with 10 per cent skimmed milk powder as protein concentrate is produced at a state-owned couscous and pasta concern "SEMPAC" in collaboration and with the support of UNICEF, FAO and WHO. The product is marketed under the name of Superamin and the production capacity during the first two years of operation is calculated to 600 tons to benefit about 100 000 children. The market price for this product has been calculated to US $ 0.16 per 300 g. UNICEF's total investment in this project is around $ 306 000.

2. In Ethiopia, the Ethio-Swedish nutrition project has started production of a product called Faffa (Amharic: "to grow big and strong") after several years of field surveys and testing. The composition of the product is given below:

Tef (Eragrostis Abbysinica)	55 per cent
Chick-peas	25 per cent
Dried skim milk	10 per cent
Sugar	8 per cent
Iodized salt	2 per cent
Vitamin mixture	

Of these raw materials, the dried skim milk has been provided by UNICEF but the other ingredients, except the vitamin mixture, are produced locally.

The production department is located within the Children's Nutrition Unit project area in Addis Ababa, and in the first phase equipped for a production of one ton/day of Faffa covering 10 000 children daily when used as a supplementary food.

The following equipment is used for this production:

Equipment	Value (approximately)	Provided by
	US $	
Mixer, small	1 200	UNICEF
Mixer, large	4 100	UNICEF
Fillers, 2	7 300	UNICEF + SIDA[1]
Sealers, 2	2 650	UNICEF + SIDA
Balances, 3	1 050	SIDA
Air compressors, 2	370	UNICEF + SIDA
Mill with diesel engine	1 050	SIDA
Mill with electric motor	600	SIDA
Grain cleaner	875	UNICEF
Sack transporters	115	SIDA
Drums	130	SIDA
Four-wheel cart	185	SIDA
T O T A L	19 590	

After marketing surveys and test sales, the product was sold initially for 25 Eth. cents (US $ 0.10) per 500 g package which means that the subsidy on each package during the initial phase was 29 cents. Later the price was increased to 35 cents per 500 g and also smaller packages (300 g) introduced on basis of sales experiment. The price for a 300 g package is now 25 Eth. cents (US $ 0.10) and covers the need of one child for about three days.

[1] Swedish International Development Authority.

B. Distribution and Marketing

This is a practical problem of fundamental importance in any weaning food programme. Only a very limited number of children can be covered through free distribution to selected groups. The products must therefore be introduced through commercial channels. That this is possible, has been demonstrated for several products of this type such as Incaparina[1] in Guatemala, Colombia and Mexico; Pro-Nutro in South Africa; Superamin in Algeria; Faffa in Ethiopia, etc. The largest sales volume so far has been for Incaparina with about 2 000 tons in 1965. In Ethiopia, a marketing survey and test sales campaigns for Faffa have been carried out in 1966 and 1967 and the related problems and methodology have been described by B. Wickström (1967) and O. Lundberg (1967)[2].

Besides taste and general acceptability, the most important factors determining rate of sales growth are, according to Wickström, the following:

The consumer acceptance problem

1. Habit structure (purchasing, food habits etc.)
2. Product's functional properties
3. Product concept (product and brand image)
4. Economic factors (purchasing power, price)
5. Availability

The middleman acceptable problem

1. Storage and handling properties
2. Profit margin
3. Promotional support
4. Product and price concept
5. Availability

C. Role of Health Services

Any programme for improvement of weaning habits and weaning nutrition depends on the availability of basic health services to the target population.

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[1] Development by the Institute of Nutrition of Central America and Panama (INCAP) and in production since 1960.

[2] Wickström B., Lundberg O., Supplementary Food for Ethiopian Children, 1967.

This is true not only for purely educational programmes but perhaps still more when a new type of industrially prepared weaning food is introduced. The programmes have therefore to be closely integrated in already existing maternal and child health services and if such services do not exist, they should then be provided. The health workers concerned have to be trained and supervised according to the improvement programme and especially the introduction of new weaning foods in the beginning has to be assisted by mobile teams from the weaning food project, covering both the nutrition and general maternal and child health aspects.

Summary and Conclusions

1. Malnutrition and under-nutrition are prevalent in many countries of this Region. The most exposed and most vulnerable age group are the children below four years of age.

2. The first phase of malnutrition usually begins during the weaning period due to lack of suitable weaning foods.

3. Due to urbanization, to change of food habits, to sophistication of foods as well as to lack of knowledge about sound nutrition, families often are not in the position to maintain adequate diets.

4. To organize applied nutrition programmes and maternal and child health services in order to improve the situation is therefore the main responsibility of Governments.

5. A nutrition department (or institute if existing) within the health ministries is the appropriate body to plan the action programme.

6. The Governments assisted by multilateral or bilateral aid are in a good position to initiate and to support weaning food programmes and to arrange for the necessary integration of medical, agricultural, economical and industrial activities.

7. Concerted health education programmes with a particular view to nutrition education as well as production of weaning foods have already proved to be very good tools which could, if properly organized, improve the situation.

Recommendations

In order to develop a weaning nutrition programme it is recommended:

1. To survey the infant and pre-school population with regard to weaning habits, level of nutrition and frequency of malnutrition, especially protein-calorie malnutrition.

2. To survey the local production and availability of foods essential for the pre-school age group with special emphasis on protein-carrying foods.

3. To decide on an action programme adapted to the conditions found in the surveys and to arrange for the necessary inter-ministerial collaboration, in order to carry out such a programme.

4. To embark on the type of programme selected, requesting appropriate international assistance which can be provided in the form of:

   a. Experts for nutrition, maternal and child health, adult education, food production, marketing, administrative co-ordination, general impact evaluation, etc.

   b. Investment guarantees for private companies which participate in or build factories for production of weaning foods.

   c. Provision of equipment and machinery for weaning food factories.

   d. Provision of fellowships for the study of survey and laboratory techniques, food technology, marketing and distribution and related fields.

5. Expert advice and material assistance should be sought from international organizations as e.g. WHO, FAO, UNICEF, UNDP or WFP as well as from bilateral aid agencies.