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THE NUTRITIONAL ECOLOGY OF THE INFANT AND PRE-SCHOOL CHILD: NUTRITIONAL PROBLEMS IN LATIN AMERICA

by

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As in other parts of the world, the nutrition problems of Latin America are most evident in the infant and pre-school sector of the population. This presentation will focus on this age group and its problems firstly, because it has been seen to be more vulnerable to nutritional deprivation, both socially and physiologically, secondly, because it represents an increasing sector of the existing population in the developing areas, and finally, because it will represent the economically productive population within two decades.

The general factors of nutrition ecology in the developing areas of Latin America have been clearly described on many occasions. The rapid population increase is equalling and outstripping increases in food production. Physical resources are limited in terms of productive land, the quality of basic materials such as seed and stock and facilities for the effective storage and distribution of food. Low purchasing power, ignorance of basic culinary skills and dietary requirements further reduce the capacity of the individual to utilize effectively the available supply. Malnutrition resulting from these factors is frequently compounded by other endemic diseases which potentiate the effects of the existing dietary deficiency.

In reviewing the nutritional ecology of the pre-school child, it is important to remember that all other factors applicable to the population in general, also exert influence on this younger segment, and tend to be most severely felt by him. In this context, we will examine some of the general social conditions in Latin America and also specific nutrition factors as they relate to the problems of this group.

Social Priorities

In the developing areas of this hemisphere the social structure of the family differs in many respects from the better developed regions, especially among the poorer classes. In circumstances where there is no effective social security or relief system for vast

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numbers of the poor, the income of the family depends on the capacity of the father or other adults to earn sufficient money to provide food, shelter, and clothing. If this source of income is removed due to unemployment from illness, the entire family will suffer. Though there may not exist a clear comprehension of the scientific relationship between nutrition and health, there is implicit understanding in these families that the wage earner must be well fed. In consequence, feeding priority within the family tends to be related directly to the earning capacity of the individual; clearly the infant and the pre-school child rate very low under this system. Compounding this problem is the fact that, unlike their older siblings, the pre-school child is totally dependent on the mother and is incapable of any initiative to improve his lot. At the same time, they are passing through a phase of rapid growth representing considerable physiological stress, with a corresponding need for increased dietary intake of calories and essential nutrients.

At the national level, the infant and pre-school child again tend to be neglected in economic planning due to their apparent minor contribution to the productive force of the nation. Today, however, the under-five population in developing areas represents an increasing proportion of the total population often reaching as high as 18%. In the technically developed areas, on the other hand, this age group is only 10 to 12% of the total. This sector will represent the future productive force within two decades and it is clear that the physical and mental development and general health of these children will certainly influence their adult productive capacity. In this context, Table I shows population distribution figures for selected countries of the Americas.

In the first three countries the under-five year age group represents between 9 and 12% of the population and the 5 to 14 group ranges from 18 to 21%. In the succeeding group of developing nations the under-fives range from 16 to 18% and the 5 to 14 group from 28 to 30%.

Education

In nutrition, as in other fields, education is the vital process whereby scientific knowledge may be transmitted for application by the individual. The facility with which the population can be educated, however, will depend greatly upon the level of general literacy encountered. Illiteracy not only represents a barrier to contemporary methods of communication, but also sustains reliance upon traditional knowledge much of which may be entirely prejudicial to the individual and the community, especially in this era of rapid technological advances. In Latin America, there is considerable variation in general educational standards. The following table (Table II) gives comparative literacy figures for selected countries of the Americas.

In many countries illiteracy levels remain as high as 60% on a national average; such figures usually indicating levels of 80% or more in isolated rural communities. These compared with averages of ten and twenty per cent illiteracy rates in the technically developed areas of the hemisphere, which in some cases may be as low as 2-3% (U.S.A.). Though education does not directly affect the pre-school child, its influence through the parents, especially the mother, plays a significant role in the causation of malnutrition. Of increasing importance in this era of the transistor set, inacurate and irresponsible radio advertising of food and food products can do even further harm to questionable dietary customs of illiterate populations.

Health Services

Another general condition that influences nutrition conditions in developing areas is the coverage and the quality of the services available to assess local problems, undertake effective action for their correction, and to establish preventive measures. Though health services in Latin America have improved considerably during recent decades, there is still an acute shortage of manpower to provide basic services on a comprehensive scale.

Taking into account the comparative shortage of medical and para-medical personnel in the northern part of this hemisphere, it is clear that the scarcity is even more accentuated in Latin America. Of the limited resources available, the great majority are concentrated in urban centers. Considering that an estimated 55% of the population of Latin America live in rural communities of less than 2000 inhabitants, it is clear that health services, as an instrument for combatting malnutrition, are often a negligible asset.

These are some of the general conditions that influence infant and pre-school nutrition in Latin America. In order that we may study specific ecological elements, it is useful to review the entire developmental period from pregnancy up to school age and to identify the various factors that determine the nutritional status of the child.

Maternal Nutrition

There is no question that maternal malnutrition is found frequently in association with the same condition in infants and pre-school children. The relation between these may be a simple co-existence or a cause and effect sequence; this has yet to be scientifically tested. It is, however, worth considering some of the present knowledge on this subject.

In most undernourished populations of this hemisphere no special provision is made to improve the diet during pregnancy. This may result from economic pressures or simply from ignorance and indifference; and in some cases, tradition actually dictates unfavourable modifications of the diet during gestation. At the same time, the mother continues to carry out heavy physical work which absorbs her usual caloric intake. In consequence, there is often minimal weight gain during pregnancy, and occasionally, none at all. In view of the physiological priority for nutrients exercised by the fetus, maternal malnutrition must inevitably ensue. If the maternal diet remains inadequate, repeated pregnancies at short intervals

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will finally produce a state of maternal malnutrition which will, in turn, affect the fetus. Various studies have demonstrated that maternal malnutrition and failure to gain weight during pregnancy may result in a higher percentage of low birth-weight infants. This may be only an expression of shortened gestation, with or without physiological immaturity of the infant. However, it does appear to be related to a decreased survival rate. Though further research is needed to clarify this phenomenon, it emphasizes the importance of maternal malnutrition in determining the health and general resistance of the new-born.

Increasing attention is being given to the presence of anemia in pregnancy in Latin America. Iron-deficiency anemia is highly prevalent in this group, especially in areas of widespread parasitic infestation. It may be assumed that severe anemia in the mother under these conditions may lead to the formation of inadequate iron stores in the fetus and thus precipitate anemia in the infant if no dietary correction is made.

Dietary iodine deficiency and endemic goiter are widespread in Latin America and affect large masses of the population, especially in highland areas. Though the precise mechanism is yet to be determined, iodine deficiency in the mother may produce cretinism in the child. This fact is corroborated on an epidemiological basis by the occurrence of endemic cretinism and deaf-mutism in areas of endemic goiter in the sub-continent. For a variety of legal, administrative, and technical reasons, few effective programs of salt-iodization for goiter prevention have been initiated in Latin America and maternal iodine deficiency continues to represent a serious problem of infant nutrition.

Though not necessarily the result of maternal malnutrition, it is convenient at this point to mention the problem of vitamin A deficiency. A recent survey carried out by WHO indicates that eye disease in young children resulting from severe vitamin A deficiency is more common than previously supposed. The mortality rate in children

suffering from keratomalacia is extremely high and thus early death obscures the magnitude of the problem as measured by survivors with partial or total loss of sight. The mutual lack of comprehension of each others field by the clinical nutritionist and the opthalmologist maintains the present lack of awareness and indifference to this situation.

It can be seen from these examples that various factors affecting maternal nutrition can exercise an unfavourable effect on the fetus and the new-born. Perhaps, however, the most important aspect is that the mother weakened by severe malnutrition, is unable to fulfil her normal role and to provide the necessary attention to and interest in her child that will assure its favorable progress through infancy.

Lactation

In the design of nature breast feeding represents, in nutritional terms, a prolongation of the intrauterine security in order to give the infant a fair start in his new environment. Cultural changes occuring in the developing areas of this continent are seriously threatening this natural security by the untimely and unsuitable introduction of artificial feeding practices. The current trend towards complete or early introduction of artificial feeding has its origins in the more technically advanced areas of the continent where, for æsthetic, social and economic reasons it is convenient for the mother to employ artificial feeding techniques. It must be remembered, however, that the mother and child in these areas live in a relatively uncontaminated environment and have available all of the modern conveniences to carry out the procedure correctly. The practice is well within their economic resources, and they are sufficiently educated to understand the principles of health and hygiene involved. In developing areas artificial feeding is also gaining great

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popularity. The custom may have its origin in the more privileged classes in these areas, but it has spread with great rapidity to the impoverished. For the working mother it offers an opportunity to return to work earlier and to absorb partially the future increase in the family budget. Also, the concept of "advancement through imitation" is widespread and considerable prestige is attached to the customs of the socially privileged groups.

Unfortunately, the poorer sections of the community are often not equipped to undertake this truly "artificial" practice. The mother often has only a primitive knowledge of hygiene, either in its theory or practice and though she may be able to purchase the minimum equipment to start the procedure, she is often unable to continue it in a satisfactory form; one bottle and one nipple may have to serve indefinitely. Even if the formula is prepared in the correct concentration in the beginning, any financial restriction is met by progressively diluting the mixture. Despite the evidence of high infection rates and obvious undernourishment in the child, there seems to exist a blind faith in the process once the mother is committed to it. It is not necessary to elaborate on the consequence of this situation.

In areas where breast-feeding is generally practiced, the effect of maternal malnutrition upon lactation performance is yet to be determined. Itis probable that the situation is similar to that encountered in other parts of the world where severe malnutrition appears to influence the quantity of breast milk rather than quality. There is urgent need, however, for more detailed study of this subject in this hemisphere in order that we can more accurately predict the consequences of maternal deprivation and maybe focus our efforts more intensively on the mother in order to benefit the child.

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Weaning

In common with many other areas of the world, the weaning period is a critical one in the nutritional ecology of the infant and pre-school child. Successful weaning, progressively and carefully achieved will set the pre-school well on the way to optimal development, both physical and mental. In Latin America haphazard and uninformed replacement of breast-feeding with adult diet can and does produce disaster for the infant and pre-school child. The magnitude of this problem in Latin America is demonstrated dramatically in the association between the time of weaning and peaks of excess mortality. In countries where weaning takes place early, the peak mortality usually falls within the first year of life. In other areas where breast-feeding is prolonged, the excess mortality tends to be "postponed" and falls in the second or third year of life. The following table (Table III) shows the ratios of age-specific mortality rates in the infant and pre-school child in three countries of Latin America to those in the United States.

Though there are few specific studies of weaning time in these countries, it is generally recognized that in Chile it tends to occur in the first few months of life for the majority of children. In Guatemala, however, weaning usually takes place about one year of age or later. In Colombia an intermediate situation exists and weaning usually takes place at 6-9 months. It can be seen that the peaks of mortality, in relation to U.S. patterns, tend to occur in a time relationship to weaning. In Chile the peak is in the 6-11 month age group, whereas in Guatemala it occurs during the third year of life. Colombia demonstrates an intermediate situation with a probable peak during the second year. (Unfortunately, there is no breakdown available for the succeeding years).

The factors producing these phenomena are multiple. Weaning is often relatively short and the child may be passed abruptly to

a slightly modified form of the adult diet or, if this is unacceptable, passes to an intermediate diet of liquids, often with very low protein content. Cows'milk is an extremely rare or expensive commodity in many parts of the subcontinent and if the mother is not painstaking and conscientious in preparing special weaning foods, no other alternative exists. In all respects the situation is fraught with danger for the child. On the one hand the child passes to a diet which is not only of variable nutritional value but which, furthermore, may be poorly tolerated. On the other hand it is weaned onto a low protein diet which may be indefinitely prolonged if intestinal infection intervenes, as is usual with poor hygiene in food preparation.

Mortality rates are a reflection of severe malnutrition. Milder forms demonstrate similar phenomenon in the surviving child when a plateau occurs in its developmental process. It has been shown that the infant in Latin America tends to follow closely North American patterns for growth and development during the first six months of life. After this time, however, the rate of height increase diminishes or remains stationary and a leveling out of the growth pattern occurs. After an interval of some months normal or accelerated growth resumes and the curve begins to approach the original pattern again. Before it reaches this however it usually slows down again and runs a lower, parallel course to maturity.

The Pre-school Years

Without question protein calorie malnutrition represents the greatest problem during the pre-school period, in Latin America. It is widespread in the rural and urban fringes of the developing areas and appears both as classical kwashiorkor and marasmus and also, more commonly, in the intermediate forms.

In addition to dietary intake the most important conditioning factor is the common infectious disease of childhood. Physically

the child is now separated from the mother and may have been replaced by a subsequent sibling. Maternal supervision is thus reduced, while at the same time the child is in close contact with a highly contaminated environment namely the ground. If the child's weaning process has been unsatisfactory from the nutritional viewpoint then malnutrition will potentiate the infectious process. An expression of this situation is seen in studies carried out by INCAP in a rural population of Guatemala. This indicates that, at least in the case of diarrheal disease, the attack rate increases with the degree of malnutrition, as shown in Table IV.

Once disease is established, ignorance of correct dietary measures often further complicates the situation. In many areas the presence of diarrhea and other infections is countered by exclusion of solid foods in the diet and the introduction of liquid food, often a very dilute solution of some carbohydrate. Though this measure may help counteract dehydration, if prolonged, it will have a serious effect on the nutritional status of the child. Once the disease has been overcome, the child must face a prolonged period of recuperation on its customary diet, as ignorance and poverty may not allow for any improvement to hasten recovery. Frequently, another infectious process will intervene before recovery is complete, thus repeating the cycle at an even lower level of nutritional balance. This process thus repeats itself until death intervenes.

The exact magnitude of the nutrition problem is not always reflected in disease specific mortality figures. The following table (Table IV), however, gives some indication of mortality from malnutrition in certain countries of Latin America, and it can be clearly seen that the peak mortality from nutrition disease repeatedly occurs in the 1-4 year age group in the cited countries.

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The level of medical certification of death in Latin America is often very low, however, especially in rural areas. In consequence the cause of death is often reported by lay personnel whose skill is limited to identifying the common causes of death in the locality. As some infectious process usually precipitates death in the malnourished child, such diseases are usually the recorded causes of death. Furthermore, even if malnutrition is recorded as a contributing cause of death by lay or professional personnel, it is not considered in the national statistics. This fact is important in health planning and economics as the magnitude of a given problem, and thus its priority, tend to be determined on the basis of mortality rates rather than morbidity. This has the effect of excluding nutritional problems as a priority in health plans for the pre-school children.

If mortality from malnutrition is obscured by recording of the terminal infectious process, it is useful for the public health worker to employ other indices in order to estimate the extent of the problem. If the 1-4 year age group is taken as the most vulnerable in terms of nutrition, the pattern of measles mortality in this group is a useful index. It is probable that measles has the same attack rate and virulence throughout the areas of the world where it is endemic, and to date there is no specific therapy for the established disease.

If we accept these considerations it is of interest to note that the death rate from measles in this age group in populations where malnutrition is prevalent, for example Chile (104.7 per 100,000), Peru 145.8 and Guatemala 242.3, are often 100 to 200 times greater than in well nourished populations such as Canada (1.4) and the United States of America (1.2).

A similar situation is seen with diarrheal disease mortality in this age group. In areas where malnutrition is prevalent death rates from gastritis and enteritis, for example Colombia, 352.3 per 100,000 population, Guatemala with 661.4 and Mexico 392.9, are also 100-200 times higher than in better nourished areas of the continent such as Canada (4.4) and the United States (3.0). Though there is no question that environmental sanitation plays an important role in these diseases, it is generally acknowledged that nutritional status is an important factor in survival and recovery.

These examples serve to some extent to give us some impression of the magnitude and effect of malnutrition in the pre-school child. Furthermore, they indicate the importance of looking at nutrition in relation to the other endemic diseases of the area, and not as an isolated entity.

This presentation has attempted to look at the problem of nutrition disease in Latin America in the context of the total environment in which it is found. Some of these environmental factors are natural phenomena, others are problems of economic resources and others represent technical and administrative limitations. Many of these elements are general problems affecting all sectors of developing populations, and it cannot be expected that they will be rectified immediately, nor can it be hoped that they will be overcome merely to improve population nutrition status. Nutrition, however, probably more than any other human requirement, seems to embody some element of all the various problems that compose what is known as under-development today.

It is difficult, therefore, to contemplate any simple technique in confronting the problem of malnutrition. Our task lies in assembling and carrying out a multifaceted programme, utilizing all resources available at the national and supranational level. Given sufficient priority, this field may well serve to provide the necessary leadership and the common goal which will motivate the various agencies, national, bilateral and international to undertake an orderly, well planned and co-ordinated approach to the improvement of population welfare in this hemisphere.

TABLE I

PERCENTAGE DISTRIBUTION OF POPULATION BY AGE GROUPS IN SELECTED COUNTRIES OF AMERICA BASED ON CENSUSES TAKEN AROUND 1960

		Age in Years			
Country	Total	Under 5	5-14	15-24	25+
Canada	100	12.37	21.58	14.34	51.71
United States	100	11.33	19.78	13.39	55.50
Uruguay	100	9.80	18.03	15.40	56.77
Ecuador	100	16.98	28.13	17.97	36.92
Honduras	100	18.98	29.07	18.05	33.90
Mexico	100	16.54	27.70	18.56	37.20
Nicaragua	100	18.23	30.12	17.47	34.18

Note: Distribution based on sample for some countries

TABLE No. II

NUMBER AND PERCENTAGE OF LITERATE POPULATION 15 YEARS OF AGE AND OVER IN COUNTRIES OF THE AMERICAS, RECENT CENSUSES

Country	Year	Population 15 years and over	Literate population	
			Number	Percentage
Argentina (a)	1960	14,199,299	12,977,879	91.4
Chile	1960	4,440,800	3,723,400	83.8
Costa Rica (b)	1963	868,350	741,654	85.4
Ecuador	1962	2,478,133	1,667,799	67.3
El Salvador (b)	1961	1,694,880	c) 813,470	48.0
Honduras	1961	969,700	432,200	44.6
Jamaica	1960	947,306	775,943	81.9
México	1960	19,471,022	12,728,102	65.4
Panamá	1960	607,695	445,491	73.3
Perú (d)	1961	5,109,700	3,094,900	60.6
Uruguay	1963	1,854,800	1,659,700	89.5
Venezuela	1961	4,153,275	2,762,575	66.5

(a) Data for population 14 years and over. (b) Data for population 10 years and over. (c) Excludes 1,650 persons of unknown literacy condition. (d) Data for population 17 years and over.

TABLE III

Rations of Age Specific Mortality Rates Under Five Years of Age in Three Countries to Those in the United States, 1962

Age	Ratios		
	Chile	Colombia	Guatemala
Under 7 days	1.3	1.3	1.2
7 - 27 days	7.4	7.7	8.5
28 days - 5 months	10.6	5.7	5.7
6 months - 11 months	13.3	13.4	14.3
1 year	11.9	18.4	28.8
2 years	16.4		29.2
3 years	5.3	11.3	28.6
4 years	3.8		20.3

TABLE No. IV

Acute Diarrheal Disease Attack Rates per 100 persons per Year, by Age and by Degree of Malnutrition, in Santa María Cauqué, Guatemala February 1961 to June 1962*

Age (years)	No. of persons	Cases of diarrhea	Attack rate (cases/year/100)
Normal Nutrition			
Under 1.....	22	27	86.6
1.....	1	5	-.-
2.....	0	0	-.-
3.....	1	2	-.-
4.....	1	1	-.-
Ages 1-4.....	25	35	98.8
1st. Degree Malnutrition			
Under 1.....	16	55	242.6
1.....	14	40	201.7
2.....	20	29	102.4
3.....	12	31	182.3
4.....	12	17	100.0
Ages 1-4.....	74	172	164.1
2nd. Degree Malnutrition			
Under 1.....	2	31	-.-
1.....	20	93	328.2
2.....	16	57	251.5
3.....	16	56	247.0
4.....	17	17	70.6
Ages 1-4.....	71	254	252.5
3rd. Degree Malnutrition			
Under 1.....	1	1	-.-
1.....	3	20	-.-
2.....	3	11	-.-
3.....	2	3	-.-
4.....	0	0	-.-
Ages 1-4.....	9	35	274.5

* PAHO Scientific Publication No. 100

TABLE No. V

Deaths of Children Under 1 and 1-4 Years of age
per 1000 Population in the Three Regions of the Americas, (1962-1963)

Region	Deaths per 1000	
	Under 1 year*	1-4 years
Northern America	25.3	1.0
Middle America a)	71.5	a) 13.4
South America b)	77.8	12.0

* Rates per 1000 live births
a)Rates exclude data for three countries
b)Rates under one year exclude data for four countries and from 1-4 years for six countries.-

TABLE No. VI

AVERAGE ANNUAL DEATHS FROM AVITAMINOSIS AND OTHER NUTRITIONAL DEFICIENCY STATES (280-286) PER 100,000 POPULATION, BY AGE, IN COUNTRIES OF THE AMERICAS 1961-63

Age Group	Canada	Colombia	Costa Rica	El Salvador	Nicaragua	Panama	Trinidad and Tobago	United States	Venezuela
All ages	0.4	28.3	6.4	14.8	2.2	4.7	4.0	0.9	6.3
Under 1*	1.8	142.3	10.9	1.8	7.6	5.2	9.8	0.5	14.9
1-4	0.4	119.9	19.5	49.0	9.4	12.9	11.7	0.5	23.2
5-14	0.0	8.8	2.3	7.6	0.9	3.3	0.3	0.1	2.3
15-44	0.1	2.2	1.0	3.5	0.3	0.8	0.3	0.1	0.8
45-64	0.3	12.3	4.2	20.7	0.6	2.8	4.1	0.8	4.7
65-74	1.3	37.0	18.5	56.8	2.2	24.7	32.0	2.9	15.7
75 and over	7.2	93.2	100.0	95.7	4.2	52.4	48.5	14.2	70.2

*Rates per 100,000 live births.