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Food Intake of Guatemalan Indian Children, Ages 1 to 5[1]

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PREVIOUS REPORTS (1, 2) have described the malnutrition problem which prevails in Guatemala, especially among infants and preschool children, and the scarcity of good quality protein sources as an important epidemiologic factor. The social and economic life of rural areas, particularly in the western part of the country, inhabited by pure Mayan Indian families, have been extensively studied by sociologists and anthropologists. The nutriture of some of these population groups has been assessed by clinicians and biochemists (3, 4), and growth retardation in nearly all the children studied has been the dominant clinical finding. At the family level, the food intake has been estimated in some towns by means of dietary surveys. Findings have indicated markedly low intakes of vitamin A and riboflavin, in addition to a lack of animal protein in the diet (5-8).

Quantitative information is still limited in regard to the nutrient intake of young children, those most affected by nutritional deficiencies. Efforts were made, therefore, to investigate the actual food consumption of children from one to five years of age on an individual basis. Investigations in some of the towns had already been performed at the family level. Since the intake of protein at an early age is of particular importance, an attempt was made to rate the protein quality of the children's diets. With suitable information already available on the amino acid content of foods, it was feasible to obtain a quantitative estimate of the amino acid intake of these children (9, 10).

The dietary surveys were repeated each year, during a four-year period from 1959 through 1962, among different families in the same town, as part of a larger project designed to study the possible relationship between nutrition and infection. Mean figures for intakes of family and child obtained during this period have been published (11); the results remained consistent from year to year. In the present paper, information is confined to intake of the children by age groups.

Subjects and Procedure

The type of population as well as the cultural aspects of the communities have been described in another publication containing general information on the environmental condition of each town (11). The three towns investigated were: Santa Catarina Barahona, where a supplementary feeding program was established; Santa María Cauqué, in which an attempt to improve sanitary conditions was made; and Santa Cruz Balanyá, which served as a control town. Seasonal variations were not considered, because the surveys were done during the same period of the year (the rainy season: April, May, and June).

The food intake of the children was recorded simultaneously with the total amount of food for the entire family. A combination of the weighing and recall methods—a technique familiar to workers involved in collecting data, in which data obtained by weighing food is supplemented with infor-

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mation obtained by recall or memory from the subjects—was applied to estimate the food consumption of each family during a period of three days. Quantities of food given to the children were weighed, using the dishes on which the child was fed. Sometimes nibbling made it difficult to measure actual intake, because it would require the constant supervision of the child by the investigator. However, observation indicated that the amounts of these sporadic intakes would not greatly alter the figures.

Since practically no differences were encountered in the food intake of the children from year to year, the data for all the children investigated during the four years were combined, and a total of 300 diets were studied. The nutrient content of the diets was calculated using the food composition table of the Institute of Nutrition of Central America and Panama (INCAP) (12). The figures given in the United States Department of Agriculture tables were applied to calculate amino acid content (13). The results of the nutritive content of the diets from each town were not combined with those from the other towns because the differences among the towns were found to be statistically significant. Intake levels were compared with the Recommended Dietary Allowances, as adapted to the area (14).

Children under one year old receiving both mother's milk and some food were not included in the calculation for average figures, because of the well known difficulty of measuring accurately the quantities of mother's milk received by the child. Consequently, the tabulated data represent less than the entire group of 300 children on whom general observations were made. For children older than one year, no attempt was made to estimate the mother's milk intake. The nutrient intake for this group was derived only from the other foods received during the survey period.

The methods of the chemical analysis of the diet, as well as the results of the animal trials, have been described (10).

Results

All children in the communities studied were breastfed at least during the first year of life. Mother's milk constituted the sole source of food for about five to seven months, even during periods of a mother's illness. In such cases, it is the custom for a relative or a friend to breast-feed the child.

The time between breast-feeding by mothers and the child's birth differed among the towns. The general custom in Santa Cruz Balanyá was to start breast-feeding immediately after birth. In the other two towns, this was delayed from 48 to 62 hr. after birth to avoid the colostrum period. During such periods, the children were breastfed by another woman. In all three towns, children were given olive oil or some kind of medicinal sirup after birth, such as achicoria *(Cichorium intybus)*, tolú *(Tolnifera balsamum)*, and ipecacuana *(Cephoelis ipecacuana)*. These were given alone or, in some instances, as a mixture of the three sirups, in order "to clean the child internally."

In many cases, breast-feeding ceases completely around eighteen to twenty months, usually because of another pregnancy. In other instances, it may be continued for as long as twenty-four to twenty-six months. One or two cases were reported where the child continued suckling the breast for up to three years.

Foods are introduced gradually into the diet of these children; the most commonly consumed were: white bread, coffee, corn tortilla, black bean broth, oat meal; later—banana, rice, green pear *(Sechium edule)*, and tomato. If some milk and eggs were available, small amounts were given to the children usually after one year of age. In exceptional cases, when there had been some incidental influence of a pediatrician whose advice the mother accepted, an occasional child might be fed powdered milk during the first months of life.

FOOD INTAKE

All children studied were classified into four groups according to age. For each group, averages of foods consumed per child per day were calculated (Table 1). Some food items, such as animal products, were found only once or twice in the records. Therefore, the averages obtained for these items are very small. Because the combination of all items is included in the tables, the appearance of diets with good variety is given. However, the amounts consumed of many of the foods was negligible except those given daily, such as the corn tortilla.

Figures obtained for fresh cow's milk, even though few families were able to obtain it, illustrate an important aspect of feeding practices. Smaller children, from one to two years, received the milk. After the second year, the amounts decreased according to the increment in age. Comparing the three towns, cow's milk consumption was greater in Santa Cruz Balanyá and Santa María Cauqué than in Santa Catarina Barahona. In the latter, a combination of dry skim milk and INCAP Vegetable Mixture 9 was offered to small children daily as part of a feeding program which began in the second year of the investigation. Not all of the families were included in the feeding program, but the food averages in the table include all of the children studied.

In the three towns, consumption of foods such as beef, beans, vegetables, and cereals increased in relation to age, except for the broths prepared with beans or beef. According to the differences among the figures presented, a change in the dietary pattern can be assumed, which was established after the

TABLE 1 Foods consumed per child per day in Santa Catarina Barahona (A), Santa María Cauqué (B), and Santa Cruz Balanyá (C)*

FOOD	AVERAGE FOOD INTAKE											
	1 to <2 yr.			2 to <3 yr.			3 to <4 yr.			4 to 5 yr.		
	A (25)†	B (13)	C (8)	A (26)	B (24)	C (24)	A (22)	B (35)	C (40)	A (22)	B (22)	C (29)
Milk and Milk Products												
	gm. edible portion											
Fresh cow's milk	23	74	100	21	18	2	13	23	10	2	6	1
Dried skim milk	7	—	—	11	—	—	14	—	—	14	—	—
Dried whole milk	1	—	—	—	—	—	—	—	—	—	—	—
Condensed milk	2	—	—	—	—	—	—	—	—	—	—	—
Goat's milk	—	—	—	—	—	2	—	—	3	—	—	4
Cheese	1	—	1	1	—	1	1	—	1	1	—	1
Eggs and Meat												
Eggs	6	—	1	6	2	2	4	4	2	8	7	4
Meat and sea food												
Beef broth	14	5	11	11	1	4	8	2	3	9	2	1
Beef	5	5	—	8	9	5	9	10	4	8	12	6
Chicken	—	—	—	—	—	1	1	1	—	—	—	—
Crab	—	—	—	2	—	—	—	—	1	—	—	—
Blood sausage	—	—	—	—	1	—	—	—	—	1	—	—
Pork	—	—	—	—	1	—	—	—	—	—	1	—
Fish	—	1	—	—	—	—	—	—	—	—	—	—
Sausage	—	—	—	—	—	—	—	—	1	—	1	—
Sardine	—	—	—	1	—	—	—	—	—	—	—	—
Pulses												
Black beans	4	2	2	9	16	6	14	23	10	12	22	11
White beans	1	—	—	—	—	1	2	—	—	2	—	1
Red beans	—	1	—	—	3	2	—	2	1	—	4	2
Bean broth	17	38	29	11	10	9	7	1	4	—	—	—
Chickpeas	—	—	—	1	—	—	1	—	—	—	—	—
Fresh Vegetables												
Tomatoes	12	6	5	22	13	10	21	12	11	30	18	12
Green leaves	7	3	4	8	5	19	9	8	22	13	4	26
Onions	1	—	—	3	1	1	2	1	2	2	2	2
Carrots	3	—	—	1	1	—	2	1	—	1	1	—
Avocado	1	1	2	1	2	2	2	4	4	4	2	2
Squash	—	3	2	—	1	7	—	1	5	—	1	4
Cauliflower	—	—	5	—	—	—	—	—	1	—	—	—
Others	4	—	1	4	5	3	5	3	3	4	1	5
Fruits												
Oranges	10	—	—	19	1	—	24	4	—	23	3	2
Mangoes	4	—	4	3	5	—	5	4	3	2	1	2
Bananas	29	14	12	46	12	5	37	11	11	34	6	11
Plums	—	—	—	—	—	16	—	—	13	—	—	12
Others	1	1	5	—	1	—	2	2	4	7	1	—
Starchy Roots and Cereals												
Potatoes	3	2	—	3	1	2	3	2	3	6	5	4
Cereals												
Tortilla (corn)	61	63	116	153	224	234	235	270	268	297	333	340
Sweet roll	6	7	1	15	6	3	10	9	3	15	3	3
French roll	16	15	3	22	13	2	26	9	4	17	12	1
Rice	5	5	—	8	8	2	9	6	2	9	9	3
Spaghetti	1	—	2	—	—	—	1	1	—	1	1	1
Oats	—	—	—	—	1	—	—	—	—	—	1	—
Sweets and Fat												
Sugar												
White	12	1	9	16	5	3	12	4	1	15	5	2
Raw	12	20	26	23	35	25	25	29	32	26	30	34
Lard	1	—	—	1	1	—	1	1	—	2	1	1

TABLE 1—Concluded

FOOD	AVERAGE FOOD INTAKE											
	1 to <2 yr.			2 to <3 yr.			3 to <4 yr.			4 to 5 yr.		
	A (25)†	B (13)	C (8)	A (26)	B (24)	C (24)	A (22)	B (35)	C (40)	A (22)	B (22)	C (29)
Miscellaneous												
INCAP Vegetable Mixture 9	4	—	—	5	—	—	4	—	—	6	—	—
Ice cream	2	—	—	1	—	—	1	—	—	1	—	—
Coffee	3	3	3	6	4	4	7	4	4	7	4	5
Carbonated beverages	—	—	—	3	—	5	—	—	—	—	—	—

*Data from 4 consecutive annual dietary surveys, conducted from 1959 to 1962.
†Figures in parentheses indicate number of children studied.

child reached the age of two. He then received a larger amount of food and the pattern tended to conform to that of the older children and adults. Therefore, the greatest restriction of food intake was observed to occur between the first and second years of life.

As a general rule, no special foods were prepared for the children after weaning. The only difference was in the size of portions served from the same food items consumed by the adults. None of the children had received vitamin supplements, the source of all nutrients being their foods. The frequency with which these foods were given to children was tabulated by meals. Coffee, boiled with raw sugar, and corn tortillas were the only items that reached 100 per cent for breakfast, lunch, and dinner, at all ages from one to five years. Tomatoes and other green vegetables, beans, and some fruits followed in importance, according to the percentages of frequency with which they are served to the children.

NUTRIENT INTAKE

In Table 2, average figures for calories and nutrient intake are presented by age groups from one to five years for each town. For most of the nutrients, intakes increased in relation to age in each town; only riboflavin remained at the same level for all age groups. Some differences were encountered when comparing nutrient intakes between towns. Animal protein in Santa Catarina Barahona was higher than in the other two towns.

Comparing intakes with the recommended allowances for each age group, the low percentages suggested marked deficiencies in all nutrients, even calories, especially at the age range of from one to two years. In the other age groups, two-thirds or more of the allowances for calories, thiamine, and niacin were sufficiently covered by intakes. The most drastic deficit among all ages was in riboflavin in terms of the percentages of recommended allowances. In Santa Catarina Barahona, where food supplements were given, intakes of animal protein, calcium, vitamin A, and ascorbic acid were greater than in the other towns. The two main sources of vitamin A, as carotene, in the diets of all children in the three towns were green vegetables and corn tortillas. Yellow corn was used by most of the families in preparing the tortillas. Green vegetables are also responsible for the larger percentage of the ascorbic acid intake, as well as that derived from the fruits consumed. Total fat intake among the children only reached from 6 to 12 gm. and was derived from the fat contained in corn and other foods.

The distribution of calories shows that carbohydrates were the main energy source, supplying approximately 80 per cent of total calories. The percentage of calories derived from fats and proteins only reached 9 and 10, respectively. The proportion of calories from animal protein contributed little to the total caloric intake, from 1 to 3 per cent.

AMINO ACID INTAKE

To assess the nutritive value of the protein consumed by the children, total amounts of the essential amino acid content of the diets were computed, as well as the proportions in which they were present per gram of nitrogen. The pattern of amino acids obtained for each group was compared with the amino acid reference pattern of the Food and Agriculture Organization (FAO) (15), and protein scores were calculated on the basis of tryptophan content. Results are given in Table 3 by age groups in each town.

Mean intakes of essential amino acids in each town for the age group one to two years were lower than the minimal requirements given for infants in the National Research Council's report on *Protein Evaluation* (16). No exact data are available to assess the adequacy of mean intakes for those preschool age groups. Tryptophan and sulphur-containing amino acids were exceptionally low in these diets when compared with diets investigated in other areas of more advanced economic development. On the other hand, the leucine:isoleucine ratio was not as poor as in other corn diets illustrated in the

TABLE 2 Mean intake per child per day of calories and nutrients compared with Recommended Dietary Allowances

NUTRIENT	1 to <2 YR.		2 to <3 YR.		3 to <4 YR.		4 to 5 YR.	
	Intake	Per cent Recommended Allowances	Intake	Per cent Recommended Allowances	Intake	Per cent Recommended Allowances	Intake	Per cent Recommended Allowances
Santa Catarina Barahona*								
Calories	498	44	883	77	1065	93	1215	80
Total protein (gm.)	15.0	38	25.8	64	32.1	80	34.9	70
Animal protein (gm.)	5.2	—	7.2	—	7.9	—	7.5	—
Fat (gm.)	6.6	—	10.4	—	10.9	—	12.7	—
Carbohydrates (gm.)	96.1	—	174.9	—	213.1	—	244.3	—
Calcium (mg.)	313	31	540	54	665	66	755	76
Phosphorus (mg.)	323	—	568	—	707	6	788	—
Iron (mg.)	4.9	71	8.6	123	10.5	150	11.5	144
Vitamin A (I.U.)	1270	64	1777	89	1757	88	1997	80
Thiamine (mg.)	0.3	44	0.4	73	0.6	92	0.6	80
Riboflavin (mg.)	0.4	36	0.5	53	0.6	60	0.6	52
Niacin (mg.)	3.3	58	6.0	105	7.1	125	7.9	104
Ascorbic acid (mg.)	28	80	38	109	41	117	52	104
Santa Maria Cauque†								
Calories	417	38	869	76	978	86	1110	73
Total protein (gm.)	11.9	31	22.8	57	27.1	68	31.4	63
Animal protein (gm.)	3.6	—	2.6	—	3.5	—	3.7	—
Fat (gm.)	6.5	—	8.2	—	10.2	—	9.6	—
Carbohydrates (gm.)	78.9	—	178.4	—	197.2	—	227.0	—
Calcium (mg.)	293	30	421	42	508	51	569	57
Phosphorus (mg.)	245	—	479	—	572	—	655	—
Iron (mg.)	4.3	62	8.7	124	9.9	141	11.2	140
Vitamin A (I.U.)	453	23	877	44	1067	53	1160	46
Thiamine (mg.)	0.2	42	0.5	78	0.6	92	0.6	80
Riboflavin (mg.)	0.3	30	0.3	28	0.3	34	0.3	28
Niacin (mg.)	2.7	48	5.1	89	5.8	101	6.8	89
Ascorbic acid (mg.)	10	29	19	54	23	66	20	40
Santa Cruz Balanya‡								
Calories	525	46	723	63	847	74	1023	67
Total protein (gm.)	12.8	32	18.9	47	21.9	55	26.7	53
Animal protein (gm.)	3.7	—	1.8	—	1.8	—	2.1	—
Fat (gm.)	7.2	—	6.5	—	7.3	—	8.5	—
Carbohydrates (gm.)	104.5	—	149.8	—	176.5	—	213.3	—
Calcium (mg.)	388	39	420	42	492	49	587	59
Phosphorus (mg.)	288	—	409	—	483	—	587	—
Iron (mg.)	4.1	59	7.5	107	8.6	123	10.2	128
Vitamin A (I.U.)	667	33	1297	65	1387	69	1593	64
Thiamine (mg.)	0.3	48	0.4	68	0.5	78	0.6	72
Riboflavin (mg.)	0.4	37	0.2	24	0.3	30	0.3	28
Niacin (mg.)	2.8	50	4.5	79	5.2	92	6.2	81
Ascorbic acid (mg.)	18	51	25	71	35	100	36	72

*Number of children: 1 to <2 years old, 25; 2 to <3 years, 26; 3 to <4 years, 22; 4 to <5 years, 22.
†Number of children: 1 to <2 years old, 13; 2 to <3 years, 24; 3 to <4 years, 25; 4 to <5 years, 22.
‡Number of children: 1 to <2 years old, 8; 2 to <3 years, 24; 3 to <4 years, 40; 4 to <5 years, 29.

bulletin of FAO Protein Committee (15).

The intake of all essential amino acids in the three towns increased with age, while the protein score decreased. On the basis of the calculated figures on amino acid content per gram of nitrogen, the most limiting amino acid was tryptophan when compared with the FAO reference pattern. Even though tryptophan intake increased with age, the increment was not enough to raise or to maintain the protein score. Differences in methionine, or the total sulphur-containing amino acid proportions between the FAO reference pattern and the amino acid patterns of these diets were of less magnitude than the one for tryptophan. For the rest of the essential amino acids, the concentrations are sufficiently high to meet the proportions given by the FAO reference pattern, including lysine where the 270 mg. per gram nitrogen of the FAO pattern was exceeded in all age groups except in Santa Cruz Balanyá in the two- to five-year age group. The difference, however, was negligible. Among the older children, the leucine, phenylalanine, and tyrosine levels reflect the high corn intake. Comparing the three towns, the highest protein scores were obtained in Santa Catarina

TABLE 3 **Average amino acid intake on average diet of preschool children in three Guatemalan towns**

AMINO ACID	AVERAGE INTAKE							
	1 to <2 yr.		2 to <3 yr.		3 to <4 yr.		4 to 5 yr.	
	Total grams	Milligrams per gram nitrogen	Total grams	Milligrams per gram nitrogen	Total grams	Milligrams per gram nitrogen	Total grams	Milligrams per gram nitrogen
Santa Catarina Barahona*								
Tryptophan	0.159	66	0.242	61	0.288	58	0.299	55
Threonine	0.556	232	0.895	224	1.119	225	1.183	219
Isoleucine	0.742	310	1.207	302	1.511	303	1.608	298
Leucine	1.136	474	1.935	484	2.448	492	2.739	508
Lysine	0.816	341	1.282	321	1.560	313	1.581	293
Sulphur-containing								
Methionine	0.312	130	0.519	130	0.628	126	0.675	125
Total	0.475	198	0.780	195	0.936	188	1.004	186
Phenylalanine	0.691	289	1.112	278	1.381	277	1.467	272
Tyrosine	0.551	230	0.920	230	1.154	232	1.234	229
Valine	0.809	338	1.323	331	1.657	333	1.760	326
Arginine	0.714	298	1.180	295	1.455	292	1.565	290
Protein score (%)†	73		68		64		61	
Santa Maria Cauque‡								
Tryptophan	0.116	62	0.185	52	0.219	52	0.244	50
Threonine	0.437	233	0.792	220	0.943	222	1.076	220
Isoleucine	0.577	307	1.062	296	1.272	300	1.453	298
Leucine	0.885	471	1.747	486	2.091	493	2.452	502
Lysine	0.629	335	1.065	296	1.294	305	1.412	289
Sulphur-containing								
Methionine	0.251	134	0.431	120	0.505	119	0.586	120
Total	0.373	199	0.646	180	0.752	177	0.879	180
Phenylalanine	0.528	281	0.979	273	1.154	272	1.321	271
Tyrosine	0.456	243	0.816	227	0.955	225	1.104	226
Valine	0.633	337	1.191	332	1.433	338	1.633	334
Arginine	0.541	288	1.091	304	1.290	304	1.498	307
Protein score (%)†	69		58		58		56	
Santa Cruz Balanya#								
Tryptophan	0.113	58	0.135	45	0.158	46	0.189	46
Threonine	0.446	229	0.626	211	0.710	209	0.865	210
Isoleucine	0.616	317	0.859	289	0.976	287	1.186	288
Leucine	1.063	546	1.569	528	1.785	525	2.194	532
Lysine	0.605	311	0.776	261	0.881	259	1.051	255
Sulphur-containing								
Methionine	0.247	127	0.341	115	0.395	116	0.477	116
Total	0.348	179	0.502	169	0.577	170	0.699	169
Phenylalanine	0.526	270	0.757	255	0.866	255	1.051	255
Tyrosine	0.488	251	0.666	224	0.764	225	0.929	225
Valine	0.678	348	0.940	316	1.087	320	1.312	318
Arginine	0.512	263	0.868	292	0.976	287	1.195	290
Protein score (%)†	64		50		51		51	

*Numbers of children: 1 to <2 yr., 25; 2 to <3 yr., 26; 3 to <4 yr., 22; 4 to 5 yr., 22.
†On the basis of tryptophan content of FAO reference pattern (15).
‡Numbers of children: 1 to <2 yr., 13; 2 to <3 yr., 24; 3 to <4 yr., 35; 4 to 5 yr., 22.
#Numbers of children: 1 to <2 yr., 8; 2 to <3 yr., 24; 3 to <4 yr., 40; 4 to 5 yr., 29.

Barahona, where the small amounts of dry skim milk and the INCAP Vegetable Mixture 9 appeared in the average daily consumption and, thus, increased the protein value of the diets.

The weights of all children were taken in each home at the time of the survey and averages for each age were calculated to establish the protein intake per kilogram of body weight. The results are given in Table 4 for each age group. The table separates out animal protein to illustrate also the quality of the protein. It should be indicated, however, that the weights of these children were below those generally accepted as the standard for such ages (3).

TABLE 4 **Protein intake per kilogram body weight in three Guatemalan towns**

AGE OF CHILDREN	SANTA CATARINA BARAHONA			SANTA MARIA CAUQUE			SANTA CRUZ BALANYA		
	Actual mean weight	Total protein intake	Animal protein intake	Actual mean weight	Total protein intake	Animal protein intake	Actual mean weight	Total protein intake	Animal protein intake
yr.	*kg.*	*gm.*	*gm.*	*kg.*	*gm.*	*gm.*	*kg.*	*gm.*	*gm.*
1 to <2	9	1.7	0.6	8	1.5	0.4	9	1.4	0.4
2 to <3	10	2.6	0.7	10	2.3	0.3	9	2.1	0.2
3 to <4	12	2.7	0.7	11	2.5	0.3	11	2.0	0.2
4 to 5	14	2.5	0.5	13	2.4	0.3	12	2.2	0.2

Discussion

The food habits of the cultural groups studied here showed great resemblance to those described for other developing areas of the world in relation to food practices before and after the weaning period (17-20).

Young children were fed during lactation on demand whenever they cried. Later, as soon as the child accepted semi-solid food, he kept eating small amounts of different cereal products throughout the day. Consequently, consumption was calculated mainly from food given at meals and by questioning the mother about the small portions of foods offered to the child between meals. In many instances, the mother forgot those foods or was unable to estimate the amounts the child consumed.

Breast milk was not considered in evaluating the nutritive value of the children's intake on a mixed diet in the one-to-two-year age group. Quantities of mother's milk production after twelve months are generally so small that they can be overlooked. However, in some instances, this could constitute an important food supplement to the poor carbohydrate diet of the weaning child.

The family dietary surveys conducted in these towns (21) indicated that the nutrient intake, especially that derived from animal protein, varied somewhat according to the day of the week and was related to market visits by the mothers. There is a slight possibility that mean intakes of animal protein were actually higher than the quantities presented in the tables, since not all of the children were surveyed during the market days. Nevertheless, at least six days of the week, including week-ends, were evenly represented for the total groups studied.

In view of the diversity of items recorded, it might appear that these diets would be of good quality. Nevertheless, the main problem lies in the limited amounts and infrequency with which the protective foods were given to these children. Some weaning practices are due to erroneous beliefs with regard to the nature of the child's organism, and it would be desirable if they could be changed. The consumption of certain foods was limited because they are associated with certain diseases. However, the major factors were the poor economic condition of the people and the scarcity of animal protein.

Data on essential amino acid intake of young children from different cultural groups are still meager, due to the limitations implied by applying average values for the amino acid content of foods as given in the literature. There is not enough information available for the items consumed in the different areas with respect to the type of food, its chemical composition, availability of certain amino acids, and the alteration or destruction of nutrients during cooking. Regardless of these limitations, calculations were made to obtain mean intake values of essential amino acids among the children investigated, leading to the same conclusion that the quality of the protein was poor.

The average minimal requirements of the FAO reference protein pattern, estimated as grams per kilogram body weight for nine months, two years, and five years, are 1.40, 1.10 and 0.8, respectively. The protein score, calculated from intakes of the children, fell within the limits of 50 to 73 per cent. An average of 62 per cent was reached when all scores were averaged, which, by coincidence, is the same percentage suggested by FAO for country C (15). The requirements already mentioned would need to be increased to 2.24, 1.76, and 1.28 as they were multiplied by the coefficient 1.6 which corresponds to the 62 per cent score. Protein intakes as given in Table 4 show that values obtained in the three towns for all ages were sufficient to cover these requirements except for children in the one-to-two-year age group. Practical allowances recommended by FAO for this type of diet are 3.36 gm. per kilogram for nine months, 2.64 for two years, and 1.92 for five years. The intakes of these children were in the vicinity of such values, with the exception of children in the one-to-two-year age group. Therefore, the quantity of protein intake per kilogram body weight was adequate for the children from two to five years. Nevertheless, it has been well established that they were behind their normal weight in relation to their age (3). Also, the caloric intake cannot be considered adequate, even taking into consideration the small size of the children. The lack of activity of these young children was striking, and it may be possible that this could be a result of the low food energy available in their diets. The most seriously affected age, dietetically

speaking, is from one to two years. On the basis of animal trials, it has been shown that supplementation with small quantities of skim milk will make up for the deficiencies encountered in these diets (9).

Summary

A total of 300 children from one to five years of age were studied to measure their food consumption during three consecutive days and to assess the nutritive value of their diets, especially with respect to protein intake. The children were from families whose ancestors belong to the Mayan Indian ethnic group, living in three rural towns in Guatemala.

Inadequate food intake was noticeable among all children studied, especially those from one to two years old. Caloric and protein intake, as compared with recommended allowances for normal children, was deficient.

The quality of the total protein intake was determined by calculation of the protein score, which was around 62 per cent. Mean protein intakes per kilogram body weight were apparently adequate on the basis of the FAO requirements, except for children in the one-to-two-year age group, but body weight of all children was below accepted standards. The most marked deficiencies were in vitamin A and riboflavin. In Santa Catarina Barahona, where a supplementary feeding program had been established, the dietary intake was better, especially in protein, due to the dry skim milk and INCAP Vegetable Mixture 9 in the diets.

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