

Nutritional status of people in isolated areas of Puerto Rico

SURVEY OF BARRIO DUEY ALTO, SAN GERMAN, PUERTO RICO

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SUMMARY

A nutritional survey was carried out in the rural area of Duey Alto, San Germán, Puerto Rico, during March, 1964. The survey included the collection of clinical, biochemical, and dietary data. A total of 461 subjects were examined clinically. In 99 per cent of these, biochemical studies were also made.

The dietary survey, included selected families representing 13 per cent of the total population, and was done using the 24 hour individual weighed intake method. Stools for ova and parasites were also examined.

The diet was basically deficient in calories, calcium, vitamin A, and riboflavin. Children and women were receiving the poorest diets. The intake of protein, iron, and niacin was low in small children and women. In terms of foods, a lower consumption of starchy vegetables and codfish, and higher intake of fresh fruits and beef was observed as compared with our previous surveys.

The prevalence of clinical signs associated with undernutrition was very low. Signs roughly related to vitamin A and riboflavin deficiencies were observed. Height and weight data revealed moderate undernutrition, and retardation of growth in children and adolescent. Average blood pressure readings were consistently below U. S. averages, but within normal limits in all age groups.

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Hematologic studies revealed moderate anemia of the hypochromic type. Plasma protein values were satisfactory, in general, although some low total plasma protein levels were observed. Ascorbic acid plasma values were adequate. A relatively small prevalence of low vitamin A and carotene plasma concentrations was found.

Urinary excretion rates of thiamine per gram of creatinine were adequate. N-methylnicotinamide was low in 15 per cent of the subjects studied. Thirty eight per cent had low-deficient excretion rates of riboflavin.

Intestinal infestation with *Trichuris* and Hookworm was common, but severe cases were very rare.

I.—INTRODUCTION AND DESCRIPTION OF THE AREA

A nutrition survey was done during March 7-13, 1964, in the rural area of Duey Alto, San Germán, Puerto Rico. A research team was organized with personnel from the Department of Biochemistry and Nutrition, School of Medicine, University of Puerto Rico; the University Hospital; the Commonwealth Departments of Health and Education; the Veteran's Administration Hospital; the U. S. Army Tropical Research Medical Laboratory; and the Commission for the Improvement of Isolated Communities.

Duey Alto is located in a low mountain range in the southwestern part of the island, and within the municipality of San Germán. The population was 571 persons divided into 108 families with an average of 5.3 individuals per family. This community was not as much isolated as those previously studied by our group (1) (2) (3). While the dirt roads were not very adequate, they were passable by jeep and even by small cars except in very wet weather. Access to the town of San Germán was rather easy and the city of Mayaguez was not much farther away. There was regular public transportation service to San Germán.

The community was relatively prosperous. Many families owned jeeps, horses were common, and most families had domestic animals. Only 20.4 per cent of the families had an annual income under \$500.00, and 45.4 per cent earned over \$1,000.00. Few families (21.2 per cent) were receiving social welfare assistance. Electricity was available to most families.

The area was served by five small stores. These had a small assortment of canned goods, flour, rice, beans, soap, scouring

powder, candies, and sundries. Because of the easy access to San Germán, it was not profitable for the stores to stock fresh or smoked meat. The only meat products stored locally were a few cans of tinned luncheon meat. All other meat products were bought in town.

Some coffee, bananas, and oranges were raised locally by the small land owners, but these were chiefly for home consumption. Many of the men worked in the cane fields of neighboring communities. A sizable fraction of the men lived permanently in the United States returning for visits at Christmas, while other travelled to the United States annually as migratory workers in agriculture.

A summary of the socio-economic conditions of the community are given in Table 1.

II.—METHODS

In this community 461 persons were examined clinically representing 81 per cent of the total population. The group examined proved to be highly representative of the whole community. Biochemical tests were done in 456 subjects or 99 per cent of the examinees. A dietary study was carried out in 15 representative families including 74 individuals. Families were selected according to size, annual income, and geographic location within the community. The exact food intake of each individual was weighed for one 24 hour period by the dietary team. Food consumption was obtained by the recipe method. The ingredients entering in the composition of each dish were weighed separately as well as the final cooked dish. Individual portions and refuse were also weighed. Nutrient consumption was calculated using the Department of Agriculture Handbook No. 8 (4), and supplemented by data from a number of local nutrient analysis figures (5).

Physical examinations were done in 5 half days at the community school house. Heights were measured without shoes. Children under 6 years were measured supine on the examining table. Individuals were weighed in their under-clothing and without shoes. Blood pressure levels and pulse rates were taken with the subject in sitting position. The clinical data was recorded in punch cards similar to the I.C.N.N.D. detailed examination forms.

TABLE 1

SOCIO-ECONOMIC CONDITIONS *

Total Population	571	Family Living Conditions:	
Number of families	108	Need a new house	22%
Family Size:		Acceptable house made	
Mean	5.3	wood or cement	57%
6 persons	57%	No kitchen	6%
6-9 persons	33%	One or two room house ..	31%
10 or more	9%	Inadequate sleeping facil-	
		ities	57%
Annual Family Cash Income:		Inadequate eating facilities	13%
Under \$500.00	20%	Electricity	91%
\$500 to \$999.00	34%		
\$1000 or more	45%	Disposal of excreta:	
Receiving Welfare Assist-		Latrine	93%
ance	21%	Soil	7%
Transportation:		Use of land:	
On foot alone	73%	No use	61%
Own motor vehicle	15%	Grow something	39%
Horse	7%	Home garden	5%
School Age Children in		Fruit tree	64%
School	57%	Domestic animals:	
Adult Education Level:		Cows	26%
Illiterate	22%	Chicken	71%
1st. to 3rd. grade	26%	Water supply:	
House and land ownership:		Pond	88%
Own house	24%	Cistern	10%
Own house and lot	52%	Over 1 km. away	18%

* Data provided by the Commission for the Improvement of Isolated Communities.

Biochemical tests included hemoglobin, hematocrit, and plasma values of total protein, albumin, carotene, vitamin A, and vitamin C. Urinary excretion rates of thiamine, riboflavin, and N-methylnicotinamide per gram of creatinine were done in casual urine specimens. Stools for ova and parasites were examined quantitatively. Laboratory specimens were analyzed using the same techniques of our previous surveys (1) (2) (3).

III.—RESULTS

A. *Dietary Findings:*

Diet, in terms of actual foods, is presented in table 2. The average consumption of milk was low, being under one cup per person per day in all age groups, except infants who averaged $1 \frac{2}{5}$ cups daily. Breast feeding was not included. Various forms of cow's milk (fresh, evaporated, dried whole, and skim) were consumed by individuals in all the age groups in varying amounts. Whole dried and evaporated milk were fed preferably to infants and small children, while adults preferred fresh cow's milk. Persons over 60 yrs. consumed considerable amounts of dried skim milk. In the whole group of 74 individuals included in the dietary survey the average daily per capita intake of milk was 182 grams or approximately $\frac{3}{4}$ of a cup daily.

Beef (fresh and canned) was the main type of meat consumed. Sausages, pork, and ham were the other meat products consumed in that same order of amount. Chicken was absent from the diet. The average consumption of eggs was low in general. The intake was repeatedly below $\frac{1}{3}$ of an egg daily, and in several groups the consumption was negligible or none.

In regard to legumes, beans were eaten the most. A significant preference for kidney beans of the "rosita" variety was observed. Approximately 60 per cent of the consumption of beans was of this type. Red and white navy beans were also eaten in lesser amounts. No chick peas were consumed, but pigeon peas were eaten in considerable amounts particularly by adults.

The fruits consumed were oranges, bananas, custard apples, soursops, and peach nectar. Oranges were consumed regularly by all the age groups, except infants.

TABLE 2
FOOD CONSUMPTION
(Grams per person per day)

Age Group	0-1	2-5	6-9	10-14		15-19		20-39		40-59		60 +	
Sex	MF	MF	MF	M	F	M	F	M	F	M	F	M	F
Number	7	11	6	3	6	2	7	7	6	7	6	3	3
MILK (TOTAL)	340	185	156	162	108	109	93	225	148	147	224	273	158
Fresh	0	37	27	99	74	29	47	139	33	78	188	17	0
Evaporated	130	26	44	0	0	80	46	0	26	34	36	0	0
Dry Whole	130	106	53	34	15	0	0	38	64	0	0	0	0
Dry Skim	80	16	32	29	19	0	0	48	25	35	0	256	158
MEAT AND EGGS (TOTAL)	3	18	56	23	54	84	25	65	43	150	52	91	49
Meat and meat products	0	18	49	20	45	45	22	52	40	121	46	60	49
Codfish	0	0	0	0	0	21	0	0	0	12	12	31	0
Eggs	3	0	7	3	9	18	3	13	0	17	14	0	0
VEGETABLES & FRUITS (TOTAL)	15	186	219	280	227	144	217	245	205	499	280	257	106
Legumes	2	17	35	73	56	118	25	30	58	118	60	61	31
Starchy vegetables (1)	2	38	54	7	69	26	81	70	36	218	145	159	9
Fruits	6	97	116	142	73	0	92	131	69	101	41	33	33
Yellow and Green Vegetables	5	25	0	12	0	0	5	0	10	0	0	0	0
Tomatoes	0	9	12	46	29	0	9	14	13	34	27	0	0
Other (2)	0	0	2	0	0	0	5	0	19	28	7	4	33
CEREAL PRODUCTS (TOTAL)	17	121	173	281	230	335	135	289	131	271	159	215	183
Rice	8	72	115	229	165	254	76	219	111	223	124	176	89
Wheat	5	48	52	52	65	71	53	70	20	39	29	39	94
Other (3)	4	1	6	0	0	10	6	0	0	9	6	0	0
FAT (TOTAL)	2	16	26	54	40	79	25	46	37	71	34	35	25
Animal	2	15	26	50	35	74	23	43	29	60	28	30	17
SUGAR AND SUGAR PRODUCTS	11	34	63	132	73	108	51	55	37	106	104	46	95
COFFEE	1	9	10	18	15	23	8	17	12	32	18	18	33

- (1) Includes potatoes, green bananas, yams, dasheens, taniers and plantain.
 (2) Includes canned vegetable soup and eggplant.
 (3) Includes oats and corneal.

Squash and lettuce were consumed in small amounts. Tomato was almost exclusively consumed in the form of tomato sauce as a seasoning for cooking. Canned vegetable soup was eaten by some individuals. Another vegetable eaten in small quantity was eggplant.

Among the cereal products, milled enriched rice was consumed the most. Wheat intake was mainly in the form of french bread, but noodles and soda crackers were also eaten quite regularly. Other cereals eaten in small amounts were oatmeal, cornmeal, cookies, cake, and macaroni.

The visible fat consumed was 88 per cent of animal origin. Canned hog lard was the usual choice for cooking and frying. Margarine and vegetable oil were also used.

Refined sugar was the main sugar product consumed. Sugar cane and a variety of candy products such as chocolate, coconut, papaw, and marshmallows were also eaten in small amounts.

Coffee is reported in grams of ground coffee used in the preparation of the liquid extract. It was common in this area to find ground coffee mixed with varying amounts of chick-peas.

Daily intake of the various nutrients is detailed in tables 3 and 4. Mean caloric intake was low, in general. Infants, children up to 9 years of age, adolescent and young adult females were mostly deprived of an adequate intake. Under two years of age, the average caloric consumption was 43 calories per kilogram of body weight which was well below the recommended amount for that age group. In children 2-5 years old the mean consumption was 73 calories per kilogram of body weight, also under the desired amount of 90. Adult men showed satisfactory intakes, but females in late adolescence and young adulthood had remarkably low intakes of 25 and 24 calories per kilogram of body weight respectively.

The average consumption of protein was quite satisfactory in general, but small children and women received insufficient amounts. Animal protein amounted to 40.7 per cent of total protein.

Fat intake was low in general. In the whole population fat accounted for 27.4 per cent of the total calories.

The intake of calcium was low. The majority of the values

TABLE 3
AVERAGE DAILY NUTRIENT INTAKES BY AGE GROUP & SEX

Age Group	0-1	2-5	6-9	10-14		15-19		20-39		40-59		60 +		All Ages
	MF	MF	MF	M	F	M	F	M	F	M	F	M	F	MF
Number	7	11	6	3	6	2	7	7	6	7	6	3	3	74
Calcium, mg.	460	334	339	462	316	430	286	552	316	460	438	560	365	409
Iron, mg.	0.9	5.3	8.8	15.4	12.7	19.5	7.1	13.6	7.6	9.5	11.2	11.5	9.4	10.9
Vitamin A, I. U.	725	1450	773	1943	1174	653	1060	1142	1086	2108	1603	701	333	1134
Vitamin C, mg.	6	40	53	89	61	11	66	74	27	88	71	67	7	50
Thiamine, mg.	0.2	0.8	1.2	2.0	1.4	2.4	1.0	1.9	1.1	2.5	1.4	1.3	1.0	1.4
Riboflavin, mg.	0.7	0.6	0.7	0.8	0.7	0.8	0.5	1.0	0.6	1.3	0.9	1.2	0.9	0.8
Niacin, mg.	1.1	7.6	10.4	17.5	14.0	19.9	7.7	17.4	9.9	24.0	14.9	15.6	13.6	13.3

TABLE 4

AVERAGE DAILY NUTRIENT INTAKE PER KILOGRAM OF BODY WEIGHT

Age Group	0-1	2-5	6-9	10-14		15-19		20-39		40-59		> 60	
Sex	MF	MF	MF	M	F	M	F	M	F	M	F	M	F
Number	7	11	6	3	6	2	7	7	6	7	6	3	3
Mean, Weight, Kg.	7.9	14.5	23.6	34.3	36.9	56.5	52.6	54.2	56.8	58.5	65.6	54.0	47.6
Calories	43	73	65	69	50	54	25	41	24	53	31	32	32
Protein, g.	1.8	1.8	1.7	1.5	1.3	1.3	0.5	1.0	0.6	1.4	0.7	1.2	0.9
Animal Protein, g.	1.6	0.8	0.8	0.3	0.5	0.4	0.2	0.5	0.3	0.7	0.3	0.7	0.5
Fat, g.	1.6	2.1	1.9	1.9	1.4	1.8	0.8	1.3	0.9	1.8	0.9	0.8	1.0

fell under 500 mgs. daily. Iron consumption was particularly low in infants and young women. Pre-school children also had deficient intakes. Adolescent and adult men showed an adequate ingestion.

Vitamin A intake was low in all age groups. Vitamin C intakes were acceptable, in general, with the exception of infants, males 15 to 19 years, young and old females.

Thiamine was consumed in satisfactory amounts. Riboflavin intake was generally low, except in small children and old men. Niacin deficient diets were found in infants, children up to 9 years, and young women. The niacin derived from tryptophan is not included in the tables. In infancy a considerable additional amount of this vitamin was received in this manner.

N.R.C. recommended dietary allowances as revised in 1963 (6) were used in the evaluation of the dietary data.

B. Clinical Findings:

The per cent prevalence of the main clinical signs are given in table 5. There was an unusually low prevalence of dental caries in the age group 40 to 59 years. There was also a high occurrence (89 per cent) of caries among pregnant and lactating females.

Gingivitis was usually associated with pyorrhea and poor oral hygiene. There was only one 14 year old female with marked diffuse gingivitis. Angular lesions or scars were observed in about 4 per cent of the cases examined.

In addition to teeth malposition, other possible signs of vitamin D deficiency observed were costochondral beading and genu valgus. Mild beading was seen in an 8 months old baby who also had dry-brittle hair and enlarged parotids.

Skin seborrhea was much more prevalent in infants and mostly retroauricular. Skin xerosis was more prevalent in late adulthood and in females. Of the 22 cases with xerosis, 19 were females. Two of them also showed crackled skin. Follicular hyperkeratosis was shown by two girls 7 and 10 years old respectively.

Conjunctival injection was more frequent in adult males. Seven out of eight adults with this condition were men. There was a 7 years old girl with third degree undernutrition who

TABLE 5
CLINICAL SIGNS
% Prevalence

AGE GROUP	0-1	2-5	6-9	10-14	15-19	20-39	40-59	60 +	All Ages
NUMBER	16	70	62	86	51	77	60	39	461
Dental Caries	0	27	53	65	55	68	33	46	49
Gingivitis	0	1.4	1.6	4.7	2.0	13.0	23	13	7.8
Angular Stomatitis	0	4.3	9.7	0	3.9	2.6	6.7	2.6	3.9
Teeth Malposition	0	1.4	4.8	1.2	3.9	6.5	1.7	0	2.8
Skin Seborrhea	19	4.3	0	0	0	0	0	5.1	1.7
Xerosis of Skin	0	0	0	0	0	3.9	15	26	4.8
Conjunctival Injection	0	0	1.6	1.2	2.0	1.3	6.7	7.7	2.4
Dry-brittle hair	19	1.4	1.6	0	0	0	0	0	1.1
Hepatomegaly	13	7.1	0	0	0	5.2	6.7	2.6	3.5

had conjunctivitis, blepharitis, and angular stomatitis. Dry brittle hair was seen in 3 infants and 2 small children, but no edema was observed in them.

There was a rather considerable prevalence of palpable livers in infants and small children. Two infants also had splenomegaly. Eight of the nine adults with hepatomegaly were females.

Other signs appearing in very few subjects were: dental fluorosis, loss of knee and ankle jerks, and tongue papillary atrophy or hypertrophy.

Body height and weight results (table 6) showed again averages below United States (7) (8) and Puerto Rican standards (9). The mean per cent standard weights showed that moderate undernutrition, 10 to 17 per cent underweight, was the rule in infants, children, and adolescents. Adults, in general, had satisfactory weights. Children 6 to 9 yrs. of age showed the lowest per cent standard weight (83.2 per cent). The per cent standard weight was calculated in terms of weight for age up to 18 years, and weight for height above that age. The weights of children and adolescent for their attained heights were satisfactory. Mean height was below the standards since infancy, and persisted during childhood and adolescence. Adult height and weight means were also below United States averages (8).

Table 6 also shows that the population of the community was young, with 61 per cent of the people under 20 yrs. of age. There was also a tendency among young adults to grow taller than older people. This was more obvious among women.

In general, females had thicker skinfolds than males. This became very obvious in adolescence and adulthood. Skinfold was thicker in the arm than in the back until early adolescence. Above that age the opposite occurred.

Little correlation was established between per cent standard weight and skinfold thickness. Only children under 9 years of age showed some direct relation of the mean per cent standard weights and the mean arm skinfolds. The average weights showed some direct relation with the mean arm and back skinfolds in the ages 6 to 39, while the average heights showed the same direct relation with both skinfolds in all persons over 6 yrs.

TABLE 6

CLINICAL FINDINGS

Age Group	0-1			2-5			6-9			10-14			15-19			20-39			18-30			40-59			60 +		
	M	F	MF	M	F	MF	M	F	MF	M	F	MF	M	F	MF	M	F	MF	LF	PF	M	F	MF	M	F	MF	
Sex																											
Number	11	5	16	40	30	70	36	25	61	50	36	86	24	23	47	29	43	72	7	2	29	31	60	21	18	39	
Mean Age	13	8	10																								
Mean Height (inches)	28	26	27	39	38	39	46	46	46	55	56	56	64	60	62	65	60	62	59	61	64	60	62	64	58	61	
Mean Weight (lbs.)	17	16	17	32	30	31	49	46	48	73	80	76	111	107	109	129	124	126	128	112	133	130	131	127	108	119	
Mean % St. Wt.	87	86	87	92	86	89	83	84	83	84	89	86	86	92	89	94	106	101	—	95	99	111	105	94	96	95	
Mean Arm	6.4	6.2	6.3	6.2	6.7	6.4	6.3	5.9	6.1	6.5	9.1	7.5	5.9	14.3	10.0	5.9	17.0	12.5	16.3	13.0	6.8	17.5	12.6	7.6	13.4	10.2	
Skinfold mm.																											
Back	5.1	5.1	5.1	4.4	4.7	4.5	4.0	4.4	4.2	4.9	6.9	5.7	7.0	12.3	9.6	9.3	19.8	15.5	19.9	13.5	11.2	22.2	16.9	9.8	16.0	12.5	

pf = Pregnant female

lf = Lactating female

Blood pressure increased with age as expected (Table 6), but all average readings were within normal limits. Average systolic and diastolic readings were always under United States averages for children (7) and adults (10). Arterial hypertension was more prevalent among females. Seven adult women showed high blood pressure readings, while only 2 men did.

Mean pulse rates, in general, were higher than average, but always within normal limits except in pregnant and lactating females.

C. *Laboratory Findings:*

Low hemoglobin levels (Table 7) were particularly prevalent among infants, small children, pregnant and lactating women. In general, adolescents and adults showed satisfactory averages ranging from 12.1 to 14.4 g. per cent. The anemias observed were mostly of the hypochromic type as shown by the considerable number of low mean corpuscular hemoglobin concentrations. In early adolescence and adulthood hypochromia was quite frequent, in spite of the rather adequate average hemoglobin levels.

Total plasma proteins (Table 8) were lower than expected, particularly among children and adult men. A considerable number of values below 6 g. per cent were observed. Plasma albumin levels were adequate as a whole with very few values below 3 g. per cent.

Ascorbic acid values in plasma (Table 9) were all satisfactory. In regard to vitamin A plasma concentrations only 8 per cent, out of 393 determinations, showed low or deficient levels. Small children, 2 to 14 yrs., showed the higher prevalence of low values. Plasma carotene levels were also rather satisfactory with only 10 per cent showing low-deficient concentrations.

Urinary excretion rates of thiamine, riboflavin, and N-methylnicotinamide per gram of creatinine are summarized in Table 11. The excretion of thiamine was adequate with only 7 subjects in the low range and none deficient. Determinations of excretion rates of riboflavin showed considerable number of subjects with low-deficient levels. Of these, 25 per cent were deficient. Low values tended to prevail more among girls and young women. Fifty one subjects or 15 per cent

TABLE 7

HEMOGLOBIN AND HEMATOCRIT

AGE GROUP	0-1		2-5		6-9		10-14			15-19			20-39*					40-59			60 +		
SEX	MF		MF		MF		M	F	MF	M	F	MF	M	F	PF	LF	MF	M	F	MF	M	F	MF
HEMOGLOBIN																							
Grams %																							
Number	14	66	57				49	35	84	24	21	45	28	43	7	2	80	28	30	58	20	17	37
Mean	9.3	11.1	11.9				12.5	12.1	12.3	13.9	12.7	13.3	14.3	12.4	9.9	11.7	12.8	14.4	12.7	13.5	12.8	13.1	12.9
% < 10	79	29	14				8	3	6	0	5	2	4	12	43	50	13	0	13	7	15	0	8
HEMATOCRIT																							
Number	14	67	58				50	35	85	24	21	45	27	43	6	2	78	29	30	59	21	18	39
Mean	33	37	39				40	40	40	44	42	43	45	40	33	33	41	45	42	44	42	40	41
M. C. H. C.																							
Number	14	66	57				49	35	84	24	21	45	27	43	6	2	78	28	30	58	20	17	37
Mean	28	30	30				31	30	31	32	21	31	32	31	30	31	31	32	30	31	30	33	31
% < 28	36	11	14				14	9	13	0	5	2	11	16	33	50	17	7	20	14	30	0	16
% < 40	0	0	0				0	0	0	0	7	0	0	0	0	0	3	0	0	0	0	6	3

PF = Pregnant female subjects.

LF = Lactating female subjects.

* One pregnant female was 18 years old.

TABLE 8
PLASMA PROTEINS

AGE GROUP	0-1	2-5	6-9	10-14	15-19	20-39	40-59	60 +
TOTAL PROTEINS								
g. %								
Number	4	34	48	75	41	77	57	35
Mean	5.9	6.6	7.0	7.1	7.0	7.3	7.3	7.0
% < 6.0	50	26	13	15	10	9	5	14
PLASMA ALBUMIN								
g. %								
Number	3	48	52	76	37	75	55	33
Mean	3.9	4.7	4.7	4.8	5.1	4.9	4.8	4.7
% < 3.0	33	0	0	0	0	0	2	0

TABLE 9
PLASMA VITAMIN C
(mg. %)

AGE GROUP	0-1	2-5	6-9	10-14	15-19	20-39	40-59	60 +
NUMBER	8	47	25	35	18	32	24	15
MEAN	0.6	1.4	1.4	1.7	2.5	1.2	1.2	0.9

TABLE 10

PLASMA VITAMIN A and CAROTENE

AGE GROUP	0-1	2-5	6-9	10-14	15-19	20-39	40-59	60 +	All-Ages
PLASMA CAROTENE mcg. %									
Number	7	49	52	77	38	76	58	36	393
Mean	111	122	129	128	135	137	134	122	130
% < 40	29	12	8	9	0	12	7	25	10
% < 20	14	4	2	4	0	3	7	3	4
PLASMA VITAMIN A mcg. %									
Number	7	49	52	77	38	76	58	36	393
Mean	35	43	40	45	50	53	51	56	48
% < 20	29	12	15	8	3	7	5	6	8
% < 10	0	6	8	3	0	1	0	3	2

TABLE 11
URINARY EXCRETION OF THIAMINE, RIBOFLAVIN AND N-METHYLNICOTINAMIDE
PER GRAM OF CREATININE

AGE GROUP	2-5	6-9	10-14	15-19	20-39	40-59	60 +
Thiamine mcg./g. Number	20	47	73	37	68	51	25
Median	648	831	673	450	454	385	390
% < 66	0	0	1	0	1	8	4
Riboflavin mcg./g. Number	21	52	76	41	74	55	32
Median	733	310	95	80	62	222	313
% < 80	14	27	45	49	51	27	34
% < 27	0	19	17	34	41	22	25
N-Methylnicotinamide mg./g. Number	20	50	72	38	69	51	31
Median	4.0	4.1	3.2	3.1	4.5	3.6	3.5
% < 1.6	20	8	14	18	23	12	13

TABLE 12
INTESTINAL PARASITES
% Prevalence

AGE	SEX	No. SAMPLES	TRICHURIS	ASCARIS	HOOKWORM	E. HYST	E. COLI
0-1	M	9	0	0	0	0	0
	F	2	0	0	0	0	0
2-5	M	34	65	12	9	0	21
	F	24	33	0	8	0	8
6-9	M	33	79	6	52	6	21
	F	22	59	0	41	5	27
10-14	M	51	59	4	57	2	12
	F	31	52	10	58	3	23
15-19	M	20	55	0	60	5	15
	F	22	50	0	55	0	14
20-39	M	26	42	0	62	4	15
	F	43	28	0	21	5	23
40-59	M	27	26	0	37	15	26
	F	29	21	0	21	10	21
60 +	M	20	25	0	35	0	5
	F	16	19	0	50	0	6
All Ages	MF	409	44	3	39	4	17

showed excretion rates of N-methylnicotinamide under 1.6 mg. per gram of creatinine, but there was deficiency in only one of these subjects. The I.C.N.N.D. suggested guides were used in the interpretation of plasma vitamins and urine results (11).

The data obtained from the examination of feces for ova and parasites is presented in table 12. Trichuriasis was prevalent in all ages except under 2 years of age, but more prevalent among children, adolescents, and young adults. The infestation with *Ascaris* was very low. Hookworm was considerably prevalent in most age groups, but particularly so between 6 and 39 years.

Helminth infestation was, in general, higher in males than females. Moderate and severe infestations were rare. There were only 5, 2, and 8 cases of severe trichuriasis, ascariasis, and ancylostomiasis, respectively. There was definite tendency of severe cases to occur in particular family groups.

Intestinal protozoa, like *Endamoeba histolytica* which can cause amebic dysentery, were also found.

IV.—COMMENTS

A. Dietary Findings:

In terms of nutrients the diet was deficient in calories, calcium, vitamin A, and riboflavin. Mean caloric intake was low in infants and children. This finding is roughly in agreement with the observed weight and height measurements. The average heights of infants was very low, particularly among males, and the caloric intake was also very deficient. Children 6 to 9 years of age showed a low mean caloric intake of 65 calories per kilogram of body weight and also showed the lowest per cent standard weight.

The principal sources of iron in the diet were: rice 37 per cent, beans 23 per cent, and meat products 14 per cent. The low intake of iron in infants is explained by their diet which consisted almost exclusively of milk. In the 0-1 year group (which includes all children under 2 year of age) meat products, legumes, and vegetables were given only to children above one year. Infants were fed milk, sugar, oatmeal (pre-cooked), and coffee. A larger consumption of rice and beans, and perhaps meat products, by pre-school children and young women would have rendered an adequate consumption of iron.

Vitamin A intake was low. Twenty four per cent of the vitamin A consumed came from milk and cheese. Another good source were the tomatoes, particularly as tomato sauce, which provided 20 per cent of the vitamin. A larger consumption of green and yellow vegetables would have greatly improved the intake of this vitamin.

Vitamin C intakes were acceptable in general. The intake of this vitamin was closely related to the consumption of oranges, which provided 39.5 per cent of the total intake of this vitamin. Other significant sources were the starchy vegetables and tomatoes. White potatoes and green bananas provided 28 per cent of the vitamin.

In regard to the B vitamins, enriched rice was the main provider of thiamine and niacin. It provided 43 per cent and 36 per cent respectively of total intake of these vitamins. Coffee was responsible for 16 per cent of the total niacin.

The principal dietary source of riboflavin was milk. This was particularly so in children under two years. In adult men, the meat and cereal products made a considerable additional contribution.

B. Clinical Findings:

The prevalence of clinical signs that could be associated with specific deficiency diseases was very low. There were only a few subjects who showed combined signs of under-nutrition. The prevalence of lesions such as skin xerosis, conjunctival injection, and angular stomatitis was roughly in agreement with the dietary deficiencies of vitamin A and riboflavin. However, the higher prevalence of skin seborrhea in small children (0-1 years) and old men was in full contrast with the dietary findings. Riboflavin intake was adequate in these two groups. The observed seborrhea was mostly retro-auricular which is not considered as representative of ariboflavinosis as the nasolabial type.

The nutritional meaning of the observed cases of conjunctival injection must be weighed taking in consideration the existing weather conditions in the area at the time of the survey. Many cases of conjunctival injection could be attributed to the prevailing dry weather with strong winds carrying large amounts of dust.

The prevalence of dry brittle hair in small children was in agreement with their low protein intake. No edema was observed in these cases. All five cases of bilateral edema were adults, and the condition was always associated with pregnancy, obesity, hypertension and/or congestive heart failure. Past history of edema was always attributed to these same conditions or to the presence of varicose veins.

Height and weight data revealed moderate undernutrition, and retardation of growth in children and adolescents. The fact that young adults tended to grow taller than older people suggested that some recovery was being accomplished in regard to the existing growth retardation. Weight for attained height was satisfactory thus rendering a favorable prognosis upon the prevailing undernutrition.

In regard to the skinfold findings the direct relation described between the average per cent standard weights and arm skinfold thickness in children under 9 years of age; and between the average heights and weights and both skinfolds in persons over 6 years, supports the relative value of these skinfold measurements as indexes of nutritional status.

Blood pressure levels were very satisfactory. The fact that all average readings fell within normal limits and that the prevalence of high blood pressure was very low was particularly significant because they were taken under some degree of physical and emotional stress. During the survey many subjects were examined after long walks and considerable waiting, plus the excitement due to the examination itself.

C. Laboratory Findings:

In general, the low hemoglobin levels observed in infants, children and young women were in agreement with the low intakes of iron in the same groups. Although no definite correlation could be established between parasite load and the prevalence of anemia, it was possible that the relatively high prevalence of hookworm infestation had some bearing in the hypochromias observed. As mentioned before, low mean corpuscular hemoglobin concentrations were quite frequent in spite of the fairly adequate average hemoglobin levels.

The total plasma protein values were also in general agreement with the dietary and clinical findings. Among small children the intake of protein was low and dry brittle hair was

reported in 5 cases. The adequate plasma albumin levels observed render a satisfactory image regarding the existing protein nutritional status.

Satisfactory vitamin C plasma values were in accordance with the adequate intake of this vitamin and the absence of clinical signs.

Vitamin A plasma concentrations were higher than expected considering its low intake. However, it is well accepted that little correlation can be expected between blood and dietary data regarding this vitamin in view of its considerable body storage and the long time required for depletion.

The urinary excretion rates of the B vitamins were roughly in agreement with dietary intake. Thiamine intake and excretion values were satisfactory. Riboflavin intake was generally low and likewise were the excretion rates, which showed a considerable number of deficient values. The prevalence of low excretion of N-methylnicotinamide was also in accordance with the consumption of niacin.

RESUMEN

Estado nutricional de la población en áreas aisladas de Puerto Rico:
Encuesta del barrio Duey Alto, San Germán, Puerto Rico

Una encuesta nutricional fue llevada a cabo en una comunidad rural de Puerto Rico a principios de 1964. Se obtuvo información clínica, bioquímica y dietética. Cuatrocientos sesenta y una personas fueron examinadas clínicamente y al 99 por ciento de éstas se le hicieron estudios bioquímicos. La encuesta dietética comprendió el 13 por ciento de la población. Se usó el procedimiento de pesar y medir la ingesta individual de alimentos por un período de 24 horas en familias representativas. Estudios coprológicos fueron realizados en el 92 por ciento de los examinados.

La dieta fue deficiente en vitamina A, riboflavina, calcio y calorías. Niños y mujeres mostraron las ingestas más pobres. En cuanto a alimentos se observó un menor consumo de vegetales farináceos y de bacalao y una ingesta mayor de carnes y frutas frescas en comparación con otras áreas estudiadas por nosotros.

La prevalencia de signos clínicos asociados con desnutrición fue muy baja. Medidas de talla y peso mostraron subnutrición moderada además de retraso en el crecimiento de niños y adolescentes.

Los estudios hematológicos revelaron anemias moderadas de tipo hipocrómico. Las proteínas plasmáticas fueron satisfactorias en general. Los valores de ácido ascórbico en plasma fueron adecuados. En contraste con otras regiones del país la prevalencia de valores plasmáticos deficientes de vitamina A y caroteno fue baja.

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