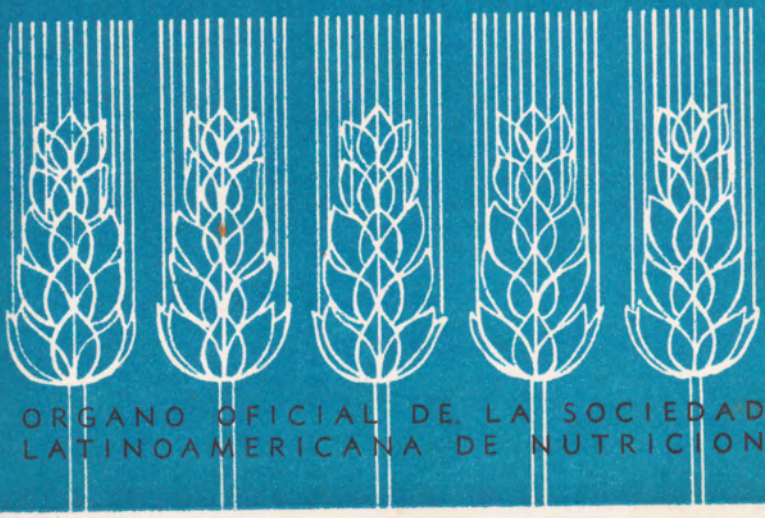
ARCHIVOS LATINOAMERICANOS DE NUTRICION



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EDITORIAL

Con el presente número de ARCHIVOS LATINOAMERICANOS DE NUTRICION se cumple el primer año de vida de esta publicación, creada por decisión de la Asamblea Constitutiva de la Sociedad Latinoamericana de Nutrición (SLAN), celebrada en Chicago en noviembre de 1965. Es propicia esta ocasión para hacer un recuento de lo que se ha logrado y, de acuerdo a los problemas que se nos han presentado, señalar las fallas y deficiencias con que nos hemos encontrado, con la finalidad de poder corregirlas en el futuro.

En las discusiones previas a su fundación quedó bien determinado el criterio por parte de los asistentes a la Asamblea de que los dos requisitos fundamentales en su edición deberían ser: la elevada calidad científica de los trabajos que se divulgarían y la regularidad periódica en su publicación.

Para lograr el primero de estos objetivos se ha nombrado un Comité de Redacción integrado por 30 miembros, con especialización en las diferentes ramas de la alimentación y nutrición. Las copias de cada manuscrito recibido en la sede de la Revista se remiten, de acuerdo al tema del artículo, a 2 ó 3 de dichos miembros en el respectivo campo, y en los casos en que no haya número suficiente de especialistas entre los editores, se solicita la colaboración de otros expertos en la materia, aunque no formen parte de dicho Comité. Las observaciones formuladas por los miembros del Comité se les transcriben a los autores respectivos, para que éstos hagan las modificaciones que sean necesarias. En esta forma se espera que los artículos aceptados definitivamente para la publicación correspondan al elevado nivel científico aspirado por los miembros de la SLAN.

En lo que se refiere a la segunda aspiración durante el primer año de publicación de la revista, no fue posible lograr la aparición con la regularidad anhelada, ya que no se contaba desde sus comienzos con la debida organización, además de que el número de manuscritos recibidos y aprobados fue insuficiente durante los primeros meses. Afortunadamente, esta

situación se ha ido superando gradualmente y esperamos que para el final del año en curso la Revista se publicará en las fechas que perviamente se han establecido.

Hasta el presente hemos recibido para su publicación cuarenta y cinco artículos, de los cuales se han rechazado cinco y a cuatro de los autores se les ha exigido una revisión fundamental de sus trabajos.

En los primeros cuatro números se ha publicado un total de 23 contribuciones originales.

Dichos trabajos han correspondido a los siguientes países: Brasil, 5; Bolivia, 1; Colombia, 2; Ecuador, 2; Francia, 1; Guatemala, 10; Haití, 3; Jamaica, 3; Estados Unidos de Norteamérica, 4; México, 4; Puerto Rico, 2; Uruguay, 1; Venezuela, 5, y su redacción correspondió: en español, 25; inglés, 15; portugués, 2, y francés, 2.

De estos datos es evidente que, hasta la fecha, la elaboración en trabajos origianles ha sido satisfactoria, pero, desafortunadamente, no así con respecto a otras contribuciones, tales como notas bibliográficas, noticias, etc.

ARCHIVOS LATINOAMERICANOS DE NUTRICION, como órgano de la SLAN, aspira a ser, según el deseo de sus fundadores, el enlace entre los colegas geográficamente tan dispersos, pero con las mismas inquietudes ante problemas comunes. Un intercambio de noticias sobre la actividad de sociedades e instituciones nacionales, congresos, visitas, cursos, nuevas publicaciones, etc., sería de gran valor para estrechar los lazos entre los miembros de la SLAN; por lo tanto, es de gran importancia para lograr este objetivo la colaboración de todos los colegas de Latinoamérica que nos suministren informaciones locales, elaboren notas bibliográficas sobre trabajos científicos publicados en revistas nacionales y extranjeras, comentarios sobre nuevos libros, etc. Esto nos permitirá la creación de una nueva Sección dedicada a la divulgación de dichas actividades.

El Comité de Redacción se permite, por lo tanto, hacer un cordial llamado a todos los colegas latinoamericanos para lograr el cumplimiento integral de los objetivos de ARCHIVOS LATINOAMERICANOS DE NUTRICION.

W. G. J. y M. R. D.

TRABAJOS DE INVESTIGACION

Vegetable protein mixtures for human consumption

The Development and Nutritive Value of INCAP Mixture 15, Based on Soybean and Cottonseed Protein Concentrates [1]

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SUMMARY

A series of studies were designed to develop and test vegetable protein mixtures based on soybean and cottonseed protein concentrates. The results obtained indicated that cottonseed and soybean protein complement each other when each provided the same concentration of protein in the diet. From this, INCAP vegetable Mixture 15 containing 25% crude protein, was formulated with 19% cottonseed flour, 19% soybean flour, 58% corn flour, 3% torula yeast, 1% calcium phosphate and 4500 I. U. vitamin A.

The mixture was tested in rats and dogs with good results. It has 80% of the nutritive value of casein. A significant improvement in protein quality was obtained when the mixture was supplemented with 0.2% methionine and 0.1% lysine or with 0.2% each of lysine, methionine and threonine. The corn can be replaced by other sources of calories such as cornstarch or banana flour, cornstarch and corn, processed in different ways. The studies also present information on mixtures based on cottonseed, soybean and skim milk.

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1 This investigation was supported by Grant AM-3811 from the National Institutes of Health, Bethesda, Md., U.S.A., and a grant from the W. K. Kellogg Foundation, Battle Creek, Mich., U.S.A. INCAP Publication I-429.

2 Chief, Division of Agriculture and Food Science, Institute of Nutrition of Central America and Panama (INCAP), Guatemala, C. A.
3 Member of the same Division.
4 Assistant Chief, same Division.
5 Same Division Veterinarian.

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INTRODUCTION

Several laboratories in different parts of the world are attempting to develop and introduce protein-rich foods or mixtures made of locally produced materials, as part of the programs to prevent protein-calorie malnutrition in areas affected by this problem (1-4).

Previous work in the Institute of Nutrition of Central America and Panama (INCAP) dealt with vegetable protein mixtures based on the combination of cereal grains with sesame flour as the main source of protein (5, 6). This was followed by the development of mixtures based on cereal grains and cottonseed flour (7, 8) or cereal grains and soybean flour (9), where the combination between the components was derived from the results of biological tests with experimental animals. The combination selected is the best in terms of protein value, which can be obtained between the ingredients. It is superior to the protein quality of mixtures where consideration is given only to final protein concentration, and the amino acid balance is left to follow by itself.

The above formulations have been extensively tested in experimental animals, and the results confirm their relatively high nutritional quality. In most cases, corn was the cereal grain used in combination with the vegetable protein concentrate, but other cereal grains proved as effective or slightly better (10, 11). This finding increases their applicability, since there are areas where other cereal grains are more economical than corn. More versatile formulations are necessary, however, with respect to the main protein source as well as to the use of foods richer than cereal grains in carbohydrate content, which would still be high in quantity and quality of protein.

This paper describes the development and testing of a vegetable protein mixture, numered INCAP 15, the basic protein of which consists of a combination between cottonseed and soybean protein concentrates. Different sources of additional calories were also tested.

MATERIALS AND METHODS

Description of ingredients.—The protein concentrates used for the development of the protein base of the mixture were

a pre-press hexane extracted cottonseed flour[6] and soybean flour[7]. The cereal used in most of the studies was white corn meal, or toasted corn, later ground to a flour. The other sources of calories tested as replacements for corn were cornstarch and banana flour. Torula yeast[8] served as a source of B-vitamins. All ingredients were analyzed for their nitrogen content by the Kjeldahl method.

BIOLOGICAL TESTS

a) *Development of basic mixtures.*—Six diets were prepared, of which Nos. 1 and 6 contained cottonseed or soybean flour, respectively, as the only source of protein, in a quantity to provide 10 or 20% protein in the diets. The rest of the diets consisted of mixtures in which soybean flour replaced cottonseed flour isoproteically in different proportions. The diets were supplemented with 3% torula yeast, 4% mineral mixture (12), 1% cod liver oil and 5% refined cottonseed oil. Cornstarch was used to adjust to 100%. All diets were supplemented with 5 ml of a complete vitamin solution (13) per 100 g and analyzed for their nitrogen content by the Kjeldahl method before feeding.

b) *Amino acid supplementation studies.*—From the previously described studies, Mixture 15 was formulated. This formula was then studied in order to determine its amino acid deficiencies. The tests were carried out at two levels of die tary protein. The basal diet providing 10 or 20% protein was supplemented with lysine, methionine and threonine added alone or in combinations.

c) *Nitrogen balance index in dogs.*—Four-month old dogs weighing 3.4, 3.7, 3.6 and 3.5 kg were used for the study. Two were fed casein and two were fed formula 15. The casein diet contained, in percentage: casein, 25; hydrogenated vegetable oil, 10; mineral mixture (12), 5; cod liver oil, 1; dextrin, 25; dextrose, 34. It was enriched with 5 ml of a complete vitamin solution (13) per 100 g of diet. Protein intake was decreased every 8 days from 6 g/kg body weight/day to zero, while the intake of calories remained constant at 130 cal/kg/day. After

6 Kindly supplied by Borgonovo Hnos., Zacatecoluca, El Salvador.
7 Kindly supplied by General Mills, Minneapolis, Minn., U. S. A.
8 Kindly supplied by Lake State Yeast Corp., Rhinelander, Wis.

allowing 15 days for protein repletion, the above was repeated. This time, however, the dogs fed casein were fed formula 15 and viceversa, so that all four animals had received the two protein sources.

The dogs were placed in individual metabolism cages and weighed daily. Each level of protein was fed for 8 days, obtaining 2 four-day balance periods. Food was provided every morning mixed with 600 cc of warm water. Urine was collected in dark bottles containing 1 cc of concentrated acetic acid. Feces were also collected daily. Upon completion of each 4-day balance period, samples of urine and the homogenized feces as well as of the diet were analyzed for total nitrogen by the Kjeldahl method. From these values, nitrogen retention and also the nitrogen balance index (14) of the two proteins were calculated.

d) *Biological tests with raw and toasted corn, cornstarch and banana flour.*—From the results of the study described under a), the best combination in terms of protein value between cottonseed and soybean protein concentrate was used to test variations of formula 15. In one experiment, raw corn in the formula was replaced by toasted corn, cornstarch or banana flour with and without sugar. In a second, the mixture with whole corn flour or with cornstarch was cooked, treated with amylolytic enzymes[9] and dried by freeze drying or by the use of hot air. Cooking was carried out by mixing one part of mixture 15 with 5 parts of water and heating to boiling. The enzyme treatment was carried out by adding to the above mixture 0.1% of the enzyme. The protein in the experimental diets was diluted to 10% for PER assay in one experiment, while in a second experiment the mixtures were tested with minimum dilution of their protein content.

e) *Testing of commercially produced mixtures and variations.*—In order to obtain information on the nutritive value of the commercially produced mixture as compared to the experimental one, as well as to learn whether or not protein quality could be increased, a study was carried out in which the commercial mixture, the experimental formula, a variation of same, and a milk supplemented formula with casein as control, were all tested at the 10% protein level in the diet. The composition of the commercial and experimental for-

9 Enzyme Rhozyme H-39, kindly donated by Rohm & Hass, Philadelphia, Pa.

mulas was the same, with the exception that soybean flour used in the commercial mixture was manufactured in Colombia. The variation tested was formulated to contain 30% soybean flour, 20% cottonseed flour, 3% torula yeast, 46% corn flour and 1% calcium carbonate. The skim milk supplemented formula consisted in 88 parts of the commercial formula and 12 parts of skim milk.

f) *Procedure usted with rats.*—Weanling white rats from the Wistar strain of the INCAP colony were used in all these experiments. Each diet was fed to groups of 8 rats. The animals were distributed among the experimental groups according to sex and weight so that all groups contained equal number of males and females and the average initial weight was the same. The rats were placed in individual all-wire screen cages with raised screened bottoms. Feed and water were provided *ad libitum*. Weekly records of food intake and weight changes were kept over a period of 28 days.

RESULTS

Table 1 presents the results of the study of different combinations between cottonseed and soybean flour. From PER and weight gain data at the 10% protein level in the diet, it appears that optimum complementation takes place when 60% of the dietary protein is derived from cottonseed flour and 40% from soybean flour. At the higher level of dietary protein, however, the differences in PER between the various combinations on the two protein sources tend to disappear. However, for practical purposes, and because the results suggested better protein quality with higher levels of soybean protein, formula 15 was formulated so that cottonseed and soybean protein would contribute equal amounts of protein to the final mixture 50% each.

For a 20% protein contribution to the mixture from the two components, the formula should contain 19% by weight of each. The amounts of the other components of the final mixture were formulated at 58% corn flour, 3% torula yeast and 1% calcium phosphate. In this mixture, 80% of the protein is derived from both cottonseed and soybean flour and 20% from the other components.

TABLE 1

EFFECT OF REPLACING COTTONSEED FLOUR WITH SOYBEAN FLOUR ON WEIGHT GAIN, AND PROTEIN EFFICIENCY RATIO IN RATS

Percentage distribution of protein from		Protein distribution in diet [1] g		Weight distribution in diet g		EXPERIMENT No. 1 [2]		EXPERIMENT No. 2 [3]	
CSF	SBF	CSF	SBF	CSF	SBF	Weight gain [4] g	PER	Weight gain [5] g	PER
100	0	19	0	38.0	0	67	1.91	154	1.74
80	20	15.2	3.8	30.4	7.6	86	2.31	153	1.82
60	40	11.4	7.6	22.8	15.2	101	2.50	156	1.84
40	60	7.6	11.4	15.2	22.8	102	2.46	153	1.92
20	80	3.8	15.2	7.6	30.4	109	2.60	162	1.93
0	100	0	19	0	38.0	101	2.65	154	1.93

1 All diets contained 3% torula yeast, 4% mineral mixture (12), 1% cod liver oil, 5% vegetable oil and 5 ml of a vitamin solution per 100 g (13).
2 Protein level in diet, 10%.
3 Protein level in diet, 20%.
4 Initial weight, 52 g.
5 Initial weight, 47 g.

TABLE 2

AMINO ACID SUPPLEMENTATION OF VEGETABLE MIXTURE 15

Amino acid supplement	Protein in diet [1] %	Weight gained [2] g	PER	Protein in diet [1] %	Weight gained [2] g	PER
None	10.1	101	2.52	17.3	157	2.07
L-lysine HCl (0.2%)	10.4	116	2.66	17.9	168	2.07
L-threonine (0.2%)	10.4	96	2.35	17.4	160	2.09
DL-methionine (0.2%)	10.2	109	2.43	17.5	159	2.04
L-lysine HCl (0.2%) + L-threonine (0.2%)	10.2	120	2.64	18.9	151	1.95
L-lysine HCl (0.2%) + DL-methionine (0.2%)	10.1	113	2.53	19.9	155	1.73
L-threonine (0.2%) + DL-methionine (0.2%)	10.0	114	2.64	18.6	151	1.91
L-lysine HCl (0.2%) + L-threonine (0.2%) + DL-methionine (0.2%)	10.7	144	2.86	19.3	167	1.91

[1] The protein 10% diet contained 40% of formula 15, while the higher protein diet contained 80%. Other supplements were 4% mineral mixture (12), 1% cod liver oil, 5% vegetable oil and 5 ml of a complete vitamin mixture (13) per 100 g.

TABLE 3

AMINO ACID SUPPLEMENTATION OF INCAP VEGETABLE MIXTURE 15

Treatment	Protein in diet %	Average weight [1] gain, g	PER
Vegetable Mixture 15	10.9	88	2.22
+ 0.1% L-lysine HCl	10.9	99	2.36
+ 0.2% L-lysine HCl	10.9	102	2.31
+ 0.1% DL-methionine	10.8	108	2.45
+ 0.1% L-lysine HCl + 0.1% DL-methionine	10.7	100	2.30
+ 0.1% L-lysine HCl + 0.2% DL-methionine	10.4	121	2.68
+ 0.2% L-lysine HCl + 0.1% DL-methionine	11.3	96	2.34
+ 0.1% L-lysine HCl + 0.1% DL-methionine + 0.1% L-threonine	10.8	123	2.72
+ 0.2% L-lysine HCl + 0.1% DL-methionine + 0.1% L-threonine	11.2	119	2.64
+ 0.2% L-lysine HCl + 0.2% DL-methionine + 0.2% L-threonine	10.9	140	2.95
Casein	11.7	121	2.87

[1] 28 days average initial weight 47 g/8 animals/group.

TABLE 4

THE EFFECT OF ADDING DIFFERENT SOURCES OF CALORIES TO THE BASIC MIXTURE OF SOYBEAN AND COTTON SEED PROTEIN CONCENTRATE OF MIXTURE 15

Calorie source added to basic soybean-cottonseed flour mixture [1]	Protein in diet %	Weight gain [2] g	PER	Protein in diet %	Weight gain [2] g	PER
Raw corn	12.0	113	2.24	24.4	157	1.51
Toasted corn	11.9	97	2.12	24.2	186	1.68
Cornstarch	12.6	108	2.14	24.0	184	1.67
Banana flour	12.4	109	2.00	23.9	111	1.21 [3]
Cornstarch + sugar	12.0	105	2.15	24.6	160	1.47
Banana flour + sugar	12.2	107	2.03	23.5	155	1.46

1 58% of each calorie source was used in experimental mixture in place of an equal weight of raw corn. The diets contained 19% cottonseed flour, 19% soybean flour and 3% torula yeast. The protein was diluted with cornstarch to 10 and 24% protein. Other ingredients added were as before (see Table 2).

2 Average initial weight, 44 g.

3 Two animals died of diarrhea.

TABLE 5

EFFECT OF COOKING AND DRYING WITH AND WITHOUT THE ADDITION OF AMYLOLYTIC ENZYME ON THE NUTRITIVE VALUE OF VARIATIONS OF VEGETABLE MIXTURE 15

Treatment	Calorie source	Protein in diet %	Weight gain [1] g	PER
Cooked-lyophilized	Cornstarch	12.6	121	2.22
Cooked-hot air drying	Cornstarch	12.5	132	2.25
Cooked-enzyme lyophilized	Cornstarch	13.2	118	2.07
None	Corn	12.1	131	2.23
Cooked-hot air drying	Corn	13.7	108	1.83
Cooked-enzyme lyophilized	Corn	12.3	116	2.30
Cooked-lyophilized	Corn	12.1	125	2.44

[1] Average initial weight, 51 g.

TABLE 6

PROTEIN COMPLEMENTATION BETWEEN VEGETABLE MIXTURE 15 AND SKIM MILK AT TWO LEVELS OF PROTEIN IN THE DIET

PROTEIN DISTRIBUTION IN DIET							
Vegetable Mixture 15	Skim milk	Protein in diet %	Weight gain [1] g	PER	Protein in diet %	Weight gain [1] g	PER
100	0	10.9	118	2.42	20.0	188	1.88
80	20	11.5	136	2.52	20.3	178	1.88
60	40	10.6	156	2.98	20.0	168	1.93
40	60	10.3	135	3.00	20.4	161	1.78
20	80	11.4	148	2.86	19.8	157	1.93
0	100	11.0	142	3.03	20.8	156	1.95

[1] Average initial weight, 48 g.

The mixture was then subjected to testing. Table 2 shows the results of amino acid supplementation. None of the three amino acid, lysine, methionine or threonine, added alone, produced a significant increase in PER. Threonine addition caused a slight decrease in protein quality. Likewise, none of the combinations of two amino acids caused an increase in PER. The addition of the three, however, produced at the 10% protein level a significant increase in weight gain and protein efficiency. The addition of the three amino acids alone or combined when the diet contained close to 20% protein, did not result in any improvement.

Table 3 shows the results of a second study in which mixture 15 was supplemented with two levels of lysine and methionine alone and in combination. It can be seen that 0.1 or 0.2% L-lysine HCl produces similar weight gain and PER. The combination of 0.1% L-lysine HCl and 0.2% DL-methionine caused a significant increase in weight gain and PER over the results obtained with the control group. The response obtained with this combination was similar to that obtained when mixture 15 was supplemented with 0.1% each of lysine, methionine and threonine. Best results were observed as before when mixture 15 was supplemented with 0.2% each of lysine, methionine, and threonine.

Table 4 presents a series of results in which corn was replaced by toasted corn or by starch, and by banana flour alone or with sugar added. None of the substitutions changed the nutritive value of the mixture when the protein in the diet was around 12%. However, at a higher level of dietary protein, the animals fed the mixture with banana flour showed lower gains owing to a decreased intake which resulted in a lower PER. The effect of cooking and drying on the protein quality of mixture 15 is shown in Table 5. None of the treatments applied changed the PER of the mixture. As an exception, the group of animals fed the mixture prepared with corn, cooked and dehydrated by hot air, gave a slightly lower weight gain and PER.

The results concerning the complementation between the proteins of mixture 15 and skim milk are shown in Table 6 at two levels of dietary protein. At the lower level, replacement of the protein from mixture 15 with milk resulted in an increase in PER up to the point where 60% of the protein

of the diet was derived from mixture 15 and 40% from skim milk. Replacement of higher amounts of mixture 15 protein by skim milk did not increase or decrease PER. Similar results can be observed at the higher level of dietary protein, although the differences in PER between diets are smaller than when the diets contained 10% protein.

Table 7 shows the results of the tests carried out with the commercial and experimental formulas and other variations. Protein efficiency ratios were very similar among all formulations tested and lower than the value found for casein. However, weight gain was significantly higher from the formula using 30% soybean flour and 20% cottonseed flour and from the skim milk supplemented formula than that found from the commercial and experimental formula.

Table 8 presents the average nitrogen balance values of the dogs fed casein, or vegetable mixture 15, at decreasing levels of protein intake. At all levels studied, better nitrogen

TABLE 7

PROTEIN QUALITY OF COMMERCIAL FORMULA 15 AND VARIATIONS

Formula	Protein in diet %	Average weight gain, g	PER
Experimental [1]	10.8	87	2.22
Commercial [2]	11.9	83	2.00
Variation No. 1 [3]	12.9	114	2.25
Skim milk supplemented [4]	12.3	103	2.19
Casein	11.9	116	2.52

1 Contained, in percent: soybean flour, 19; cottonseed flour, 19; corn flour, 58; torula yeast, 3, and calcium carbonate, 1.

2 Contained, in percent: same as above, except that the soybean flour was manufactured in Colombia.

3 Contained, in percent: soybean flour, 30; cottonseed flour, 20; torula yeast, 3; corn flour, 46, and calcium carbonate, 1.

4 Mixture of 88 parts of experimental formula and 12 parts skim milk.

TABLE 8

NITROGEN BALANCE DATA ON DOGS FED CASEIN AND VEGETABLE MIXTURE 15 AT DECREASING LEVELS OF NITROGEN INTAKE (Average 4 dogs)

CASEIN Nitrogen			MIXTURE 15 Nitrogen		
Intake	Absorbed mg/kg/day	Retained	Intake	Absorbed mg/kg/day	Retained
795	738	346	790	585	274
717	659	297	708	491	168
642	590	264	642	460	193
564	515	268	549	385	162
481	438	186	486	337	138
407	363	161	410	283	104
326	225	107	319	223	78
252	213	51	237	160	32
163	129	2	163	97	—14
91	59	—48	—	—	—
47	25	—61	67	28	—64
0	0	—105	0	—	—113

retention values were obtained with casein than with mixture 15, at comparable levels of nitrogen intake. The data likewise shows that nitrogen absorbed was also higher with casein. The same is true when nitrogen retention values are expressed on the basis of nitrogen intake. However, when nitrogen retention is expressed on the basis of the nitrogen absorbed, the values of casein and mixture 15 are similar.

The regression of nitrogen intake to nitrogen retention was NR = —104.95 + 0.60 NI for casein and NR = —93.17 + 0.47 NI for mixture 15, suggesting that mixture 15 has about 80% of the nutritional value of casein.

DISCUSSION

The results of the present investigation on the formulation of vegetable protein mixtures, using soybean and cottonseed protein concentrates as the main protein sources, indicate that

the amino acid pattern of these two proteins complement each other efficiently when each contributes an equal amount of protein to the mixtures. The type of complementation is one in which the nutritional quality improves to a certain point, when one protein is replaced by the other at isonitrogenous levels of dietary protein. Further changes in the ratio between cottonseed and soybean protein do not increase or decrease the protein value of the mixture. In other words, the protein value of soybean protein remains the same up to a certain point, when it is replaced by cottonseed protein and it decreases as cottonseed increases in the diet, at equal levels of protein intake. These results can be explained on the basis of the higher levels of lysine in soybean proteins as compared to the level for the same amino acid in cottonseed protein. On the other hand, cottonseed and soybean protein contain similar levels of sulphur containing amino acids. The decrease in the protein value of soybean, when it is replaced by cottonseed protein occurs when lysine and the methionine in the mixture balance each other. However, both amino acids are not present in sufficient amounts. This is indicated by the results of amino acid supplementation of the mixture, which indicated that the lysine addition alone caused a slight increase in protein quality, but in the presence of 0.2% methionine resulted in a significant increase in PER of the mixture.

It is of interest to note also that threonine is the third limiting amino acid after lysine and methionine, particularly when the higher levels of these two amino acids were added. This is a good example of the care which should be taken when proteins are suppleemnted with their limiting amino acids, as discussed by Rosenberg (15) and Harper (16). It should be pointed out that the cost of the mixture would not increase significantly if it were supplemented with 0.1% when proteins are supplemented with their limiting amino were added, not only would it be more expensive, but in this case threonine would also have to be added.

Formula 15 was developed to contain 19% cottonseed and 19% soybean protein, because 25% was the level of protein chosen for the final mixture using corn as calorie source. If the calorie sources are materials which do not provide protein, such as cornstarch, the desired levels can be obtained

by modifying the amounts of cottonseed and soybean protein in the mixture. Mixtures with any level of protein concentration can be prepared up to the limit provided by combinations of the protein sources which give the best protein value. For example, a protein concentrate containing 50% protein could be formulated with 50 g of cottonseed protein and 50 g of soybean, since each one of these two concentrates contains 50% protein. The protein efficiency will be maintained in all the mixtures; this indicates the advantage of formulating vegetable protein mixtures through the use of studies in rats, as indicated in this report.

The results also indicate that several foods can be used as calorie sources in mixture 15, without changes in the protein efficiency ratio as was reported before for other mixtures (6, 10, 11). Furthermore, treatment of the cereal grain with hydrolytic enzymes for carbohydrate does not change its quality.

When the tests were carried out at a 20% protein level in the diet, the PER values were lower than when the tests were performed at 10% protein in the diet. This is to be expected since it has been shown that lower PER values are obtained as the protein level in the diet increases (17-19).

The same type of complementation studies was performed between mixture 15 and skim milk as those carried out between cottonseed and soybean protein. The results obtained can be used to formulate mixtures of cottonseed, soybean and skim milk proteins. From the results obtained in this study, a mixture of high protein quality and with 29% protein can be formulated, consisting of: 40% corn flour, 14% soybean protein concentrate, 14% cottonseed protein concentrate and 32% skim milk. The PER value of such a mixture would be close to 3.0.

From the results obtained when the commercial and experimental formulas were tested, it can be concluded that the quality of the soybean flour produced in Colombia is similar to that employed in the experimental formula. The two modifications did not show a higher PER value although better weight gain was obtained probably due to a higher food intake.

The nitrogen balance results indicated that mixture 15 has 80% of the protein quality of casein, which is an adequate figure for human feeding. When the value is calculated on

the basis of the nitrogen absorbed, mixture 15 has the same quality as casein. This difference is due to the lower amounts of nitrogen absorbed when mixture 15 was fed as compared to casein. Similar results in animals and humans have been reported before for INCAP mixtures 9 and 14 (7, 9). These results can be interpreted to mean that the quality of the nitrogen absorbed is higher. In other words, the amino acid balance absorbed is as high as that from casein. There is no available information to explain this behavior of vegetable protein mixtures. The lower absorption from mixture 15 is probably due to indigestible protein resulting from the processing to which the protein sources were subjected. On the other hand, urinary nitrogen excretion was higher when casein was fed as compared to mixture 15. These results suggest that casein is catabolized faster than the protein from mixture 15. This problem is under investigation.

Finally, mixture 15 has been tested in children; the protein value of mixture 15 proved to be similar to that of skim milk when fed at levels of intake from 1 to 2 g protein/kg/day; such studies are to be reported elsewhere. Mixture 15 is already in commercial production with good acceptability in two Latin American countries.

RESUMEN

Mezclas de proteínas vegetales para consumo humano. Desarrollo y valor nutritivo de la mezcla INCAP 15 basada en concentrados de proteínas de soya y algodón.

Se diseñaron varios estudios conducentes al desarrollo de mezclas vegetales a base de concentrados proteicos de frijol de soya y de semilla de algodón. Los resultados obtenidos indican que las proteínas de ambas semillas se complementan entre sí cuando cada una aporta a la dieta la misma concentración proteica. Así, la Mezcla Vegetal INCAP 15, que contiene 25% de proteína cruda, se elaboró de acuerdo con la siguiente fórmula: 19% de harina de semilla de algodón, 19% de harina de frijol de soya, 58% de harina de maíz, 3% de levadura torula, 1% de fosfato de calcio y 4.500 U. I. de vitamina A.

Utilizando perros y ratas se llevaron a cabo pruebas del valor nutritivo de la mezcla, cuyo valor proteico asciende a 80% del de la caseína, con buenos resultados. Al suplementar la mezcla que proporcionaba niveles bajos de proteína con 0.2% de metionina y 0.1% de lisina, o con 0.2% de cada uno de los aminoácidos lisina, metionina y treonina, se logró una mejoría sgnificativa. Los estudios confirman que el maíz puede ser

reemplazado con otras fuentes de calorías, tales como harinas de almidón de maíz, de banano y de maíz procesado en diferentes formas. Asimismo, proporcionan datos referentes a mezclas elaboradas a base de semilla de algodón, frijol de soya y leche descremada.

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Metabolic studies with a corn and soya mixture for infant feeding

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SUMMARY

Nitrogen balance was used to study, in normal and malnourished children, the nutritive value of a vegetable protein mixture. Basically the mixture contained corn and soybean flour. The results were compared with those obtained with children fed cow's milk.

It was found that, when the undernourished children received this mixture as the only source of food, absorption and retention of nitrogen were 70.1 and 21.3% respectively. These values were inferior to those obtained with children fed cow's milk.

In the group or normal children this vegetable mixture increased the absorption and retention of nitrogen when substituted for part of their basic diet. This absorption and retention showed to be equal and even greater than when cow's milk substituted part of the basic diet. This is a very important finding considering that this mixture is intended as a supplement to the regional diets of low nutritive value.

It is well known that protein malnutrition is one of the most common causes of infant mortality in the tropics and subtropics (1). Since production and consumption of animal proteins are relatively negligible in these areas, attempts are currently being made to develop vegetable protein mixtures from locally available sources to obtain infant food of good nutritive value.

In Brazil, where the problem of infant malnutrition is as

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serious as in other developing countries, attemps of this nature are also being made. Thus, studies have been conducted by Nelson Chaves *et al.* (2), on the utilization of cashew nut and "macaçar" bean proteins for human consumption. In Ribeirâo Prêto, Dutra de Oliveira *et al.* have been concentrating their efforts on the development of supplementary proteins based on soya beans. Studies with soya milk produced in this country revealed that it's nutritive value is similar to that of cow's milk (3). Dutra de Oliveira *et al.* have also developed a mixture based on the soybean flour which proved to be an effective protein supplement to local infant feeding (4).

This paper describes the results of nitrogen balances on malnourished and normal children with another protein mixture where soya and corn are the principal components. This mixture was developed at the Institute of Nutrition of Central America and Panamá (INCAP) and their findings on animals and children are soon to be published (5). The replacement of part of a local diet with this protein mixture was the approach utilized in the study of this new infant food in normal children. The results obtained were compared with those found in a similar group of children fed cow's milk protein.

MATERIAL AND METHODS

Studies were carried out on a total of 13 children, in the 1 to 3 years age group. Eight were malnourished, according to our pre-estabished criteria (6). Five were considered clinically normal with their weights and heights corresponding to the standard Brazilian table developed by Ema de Azevedo (7).

Clinical data regarding these children is shown in Table I.

After admission to a metabolic ward, the malnourished children we divided at random into two groups —one to be fed cow's milk and the other the vegetable mixture under study. Both foods were given to the children in isocaloric and isoproteinic quantities.

The product under study includes 39.0% soya flour, 59.9% corn flour and 1.1% vitamin and mineral mixtures. Total protein content is 27%, as per INCAP's formula (5).

TABLE 1

CHILDREN'S CLINICAL DATA ON ADMISSION TO THE METABOLIC STUDIES

Child	Sex	Age (months)	Weight (kg.)	Height (cm.)	Remarks
M. F.	M	12	7.9	76.5	Malnourished
R. J.	F	26	9.9	82.0	Malnourished
R. F.	F	25	8.5	79.0	Malnourished
M. A.	M	14	5.2	66.0	Malnourished
S. D. S.	F	15	8.8	74.0	Malnourished
M. S. C.	F	15	6.1	68.0	Malnourished
N. M. F.	F	24	5.8	70.0	Malnourished
L. C. F.	M	12	8.4	73.0	Malnourished
M. R. R.	F	22	10.2	81.5	Normal
I. I. S.	F	34	12.8	87.5	Normal
M. A.	M	34	13.4	91.5	Normal
S. M. S.	F	29	13.3	86.5	Normal
W. C.	M	30	12.7	90.0	Normal

The soya flour utilized is a solvent extracted product manufactured in Southern Brazil (4).

During the first 24 hours after admission, all children received a hydrosaline solution. On the second day, the children were bottle fed cow's milk or the vegetable mixture in progressive quantities, up to a daily total of 1000 ml. This amount was reached after 3 to 4 days of treatment, providing a daily intake of approximately 630 calories and 15 grams of protein.

Two metabolic balances of 72 hours' duration were carried out on each malnourished child. These were started respectively on the 7th and 18th day of treatment. During the balance periods the children were placed in metabolic beds where feces and urine were collected separately. The beginning and the end of the feces collection were marked respectively by the appearance of carmine and carbon.

The nitrogen in the foods, feces and urine was determined by the Kjeldahl method.

All malnourished infants were kept in the ward for a pe-

TABLE 2

RANDOM SEQUENCE OF DIETS FED TO NORMAL CHILDREN

Children	PERIODS		
	1st	2nd	3rd
M. R. R.	B. D.	B. D. + C. M.	B. D. + C. M.
I. S. S.	B. D.	B. D. + C. M.	B. D. + V. M.
M. A.	B. D. + C. M.	B. D. + V. M.	B. D.
S. M. S.	B. D. + C. M.	B. D. + V. M.	B. D.
W. C.	B. D. + V. M.	B. D.	B. D. + C. M.

B. D.=Basic diet; C. M.=Cow's milk; V. M.=Vegetable mixture.

riod of 25 days and during this time received a commercial pediatric vitamin solution as well as penicilin and sulfaguanidine during the first ten days.

Studies were carried out on a group of five children, considered as normal, belonging to the same age group as the malnourished ones. Food given to them was according to the sequence shown on Table II. During this study, all the children had to pass through three different stages of feeding. At one, they received only the basic foods, at others, half of the basic diet protein was substituted by cow's milk or by the vegetable mixture under study. Cane sugar and/or corn starch were added to keep the diet isocaloric.

The quantity of proteins and calories given to the children was calculated to be constant, both during the period of basic diet as well as when part of it was substituted by cow's milk or the vegetable mixture under study. The basic diet included food usually eaten by the children of the region, which furnished a total of 26 grams of protein and 1100 calories daily (Table III). These foods were offered in the form of porridge; first cooked and then homogenized in a blender.

After five days on the same diet, the normal child was submitted to the 72 hour balance period and then the food

TABLE 3
DIET FED TO NORMAL CHILDREN

FOOD	Basic Diet g.	Basic Diet plus Vegetable Mixture g.	Basic Diet plus Cow's Milk g.
Rice	200	100	100
Beans	56	28	28
Potatoes	45	45	45
Tomatoes	28	28	28
Oil	15	15	15
Vegetable Mixture	—	53	—
Cow's Milk (skimmed)	—	—	44
Corn Starch	—	—	40
Sugar (Cane)	—	64	37

was changed. The time spent by a normal child at the hospital was approximately 30 days during which period each was submitted to three balances of 72 hours each. Techniques and methods utilized in this group were similar to those used with the malnourished children.

RESULTS

Tolerance and acceptance of the vegetable mixture were good. No refusals or gastrointestinal disturbances were observed which could have been attributed to the vegetable mixture.

Results of nitrogen balances showing individual values in each 3-day period appear in Tables IV and V.

Average nitrogen absorption and retention in malnourished children fed cow's milk were 79.7% and 34.2% respectively. In the group which received the vegetable mixture under study, these values were 70.1% and 21.3% respectively. In normal infants the average nitrogen absorption and retention with the basic diet were 56.4% and 13.9%. During the substitution of part of basic diet by cow's milk, average nitrogen

TABLE 4

NITROGEN BALANCES ON MALNOURISHED CHILDREN FED COW'S MILK OR THE VEGETABLE MIXTURE

COW'S MILK				VEGETABLE MIXTURE			
Name	Nitrogen Intake g/day	Absorpt. %	Retent. %	Name	Nitrogen Intake g/day	Absorpt. %	Retent. %
M. F.	2.4	82.7	44.4	S. D. S.	2.5	56.5	9.6
M. F.	2.7	84.8	43.6	S. D. S.	2.1	57.8	16.4
R. F.	2.6	76.9	35.4	M. S. C.	1.8	71.4	17.3
R. F.	2.8	77.3	20.0	M. S. C.	2.5	73.9	24.4
R. J.	2.4	81.6	45.3	N. M. F.	2.6	78.7	27.4
R. J.	2.4	82.2	29.0	N. M. F.	2.2	76.4	20.4
M. A.	2.5	80.5	28.1	L. C. F.	2.3	73.0	27.7
M. A.	2.4	71.4	27.6	L. C. F.	2.4	73.3	27.9

TABLE 5

NITROGEN BALANCES ON NORMAL CHILDREN

Name	BASIC DIET			BASIC DIET Plus VEGETABLE MIXTURE			BASIC DIET Plus COW'S MILK		
	Nitrog. Intake g/day	Absorp. %	Retent. %	Nitrog. Intake g/day	Absorp. %	Retent. %	Nitrog. Intake g/day	Absorp. %	Retent. %
M. R. R.	3.3	62.9	22.9	4.1	68.9	26.9	4.3	73.5	31.4
I. I. S.	4.2	58.5	17.6	4.5	63.4	19.6	4.4	70.6	17.6
M. A.	4.5	48.4	6.7	4.6	69.7	33.4	4.5	70.3	8.7
S. M. S.	3.8	54.5	11.2	4.7	67.7	24.1	4.8	64.3	23.8
W. C.	4.5	57.6	11.3	4.4	77.1	23.3	4.6	76.9	16.8

absorption and retention were 71.1% and 19.7%. When substituting part of basic diet by the vegetable mixture under study, average nitrogen absorption and retention were 69.4% and 25.5% respectively.

COMMENTS

The primary conclusion of these experiments is that the mixture under study was well accepted by malnourished children when it was offered as their only food as well as by the normal ones when it was ingested along with a diet of the common foods of the region.

Results of the nitrogen balances obtained with malnourished infants showed that absorption and retention of nitrogen, as percentage of intake, was smaller in the group fed with the vegetable mixture under study than in the group fed cow's milk. Retention of nitrogen reached by us with this mixture is similar to that reported by Scrimshaw *et al.* (8) with a vegetable mixture based on corn flour and cottonseed flour. The results found in the experiments made with normal children fed a basic diet which was replaced in part by the vegetable mixture under study, or by cow's milk, seem to us more vital than those obtained with the malnourished children. The general aim of a supplementary food is to use it in addition to local staple foods; we cannot expect that a supplementary food would be accepted as a sole food. It was verified in these normal children that absorption and retention of nitrogen as a percentage of intake is comparatively lowest when these infants are being fed only a basic diet, including foods normally eaten by them. When part of this basic diet is substituted by cow's milk or by the vegetable mixture under study, there is a substantial increase in the nitrogen absorption as well as in the nitrogen retention, independent of the order in which these supplementary foods are introduced in the study. It is also to be noted that the nitrogen retention in these cases was higher with the use of the vegetable mixture than with the use of cow's milk.

When the vegetable mixture or cow's milk were fed in substitution of part of the normal diet (but maintaining the same total nitrogen intake level as with the normal diet alone) there was improvement in nitrogen absorption and especially

in nitrogen retention, compared to that obtained with the normal diet. This improvement was probably due to the fact that substitution of part of the diet with cow's milk or with the vegetable mixture provided better amino acid balance of the body's nitrogen metabolism than was provided by the normal diet.

These results are quite important to us. They show that foods commonly eaten by low socio-economic groups in our country, which is mostly of vegetable origin, could be improved in their nutritive protein values via the introduction of well-balanced vegetable mixtures.

Finally we would like to call attention to the following points:

1. A basic infant diet may show great variation from one region of a country to another.
2. A particular infant food may be a good source of protein when fed alone to normal or malnourished children.
3. The use of a tested infant food as a supplement to a rice-based infant diet of a country may not show the same results with a corn —or a bean— infant-based diet of different regions or countries.
4. We would like to suggest that new infant foods always be tested in combination with local "daily-use" foods.

SUMÁRIO

Estudos metabolicos com uma mistura de milho e soja para alimentação infantil

Os autores estudaram através de balanços nitrogenados em crianças normais e desnutridas, o valor nutritivo de uma mistura de proteínas vegetais. Esta mistura consistia bàsicamente de milho e soja. Os resultados obtidos foram comparados com aquêles de crianças alimentadas com leite de vaca.

Foi encontrado que quando as crianças desnutridas recebiam esta mistura vegetal como sua única fonte de alimento, a absorção e retenção nitrogenada foi 70,1% e 21,3% respectivamente. Êstes resultados foram inferiores aquêles obtidos com crianças alimentadas com leite de vaca.

No grupo de crianças normais esta mistura vegetal aumentou a absorção e retenção nitrogenada, quando era oferecida em substituição à parte de sua dieta básica. Esta absorção e retenção mostrou ser igual ou mesmo superior aquêla obtida quando a substituição foi feita com leite

de vaca. Êste último resultado foi de grande importância em se considerando que a mistura em estudo tem por finalidades a suplementação das dietas regionais de baixo valor nutritivo.

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Application of a modified Riboflavin load test to a field study of Riboflavin nutritional status in Navajo indians

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SUMMARY

A modified riboflavin load test, consisting of collection of a single two hour urine sample following administration of 1 mg. riboflavin intramuscularly and a simplified fluorometric assay of riboflavin, was studied in 13 male and 51 female Navajo Indian vounteers at the Crown Point Public Health Service Indian Hospital, New Mexico. Average excretion values by this method correlated closely with values by a more complex assay procedure. Average ribofavin excretion values fell within an acceptable range (200 μg. or more) but a disproportionately large number of women under 30 and of post partum women excreted less than 100 μg. of riboflavin in 2 hours.

INTRODUCTION

In the course of a nutrition survey carried out among Navajo Indians of Arizona, Darby *et al.* (1) noted oral and conjunctival lesions suggestive of aribоflavinosis. Dietary data also pointed to a low intake of riboflavin, but no biochemical measurements were available to support these observations.

We have been interested in comparing nutrition status of rural Indian populations with that of Indians relocated in

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urban centers. In the summer of 1965, in order to evaluate laboratory procedures applicable to field studies of riboflavin status, we undertook a preliminary investigation of riboflavin nutritional status among Navajo Indians at the Crown Point Indian Reservation, New Mexico. A modified riboflavin load test with a simplified fluorometric riboflavin assay, suitable for field studies, was compared with results obtained with a more complex assay procedure. An attempt was made to relate urinary riboflavin excretion to riboflavin intake as estimated from dietary recall data.

METHODS

A. *Selection of Subjects*

Thirteen adult male and fifty-one female Navajo Indians were selected for the study, ranging in age from 16 to 77 years. The study group included 15 post partum women tested within two days of admission to the Crown Point Public Health Service Indian Hospital. The other subjects were Indian hospital employees and clinic patients.

B. *Dietary Data*

With the assistance of a Navajo interpreter, a one day recall diet history was obtained from 18 subjects and daily riboflavin intakes were calculated. A one week dietary recall history, limited to eggs, meat, and milk, was obtained from an addtitional 14 subjects. These three foods are the major sources of riboflavin in the Navajo diet. Riboflavin contents of foods were taken from Church and Church (3).

C. *Measurement of Riboflavin Status*

In a preliminary experiment, the oral administration of riboflavin was compared with intramuscular administration in, the same individual, with respect to the pattern of urinary excretion of riboflavin. Urine was collected at 30 minute intervals for 3 hours, and then at 4 hours, following oral intake of 5 mg. riboflavin*. The experiment was repeated, with urine collections at the same intervals, following intramuscular administration of 1 mg. riboflavin. The riboflavin

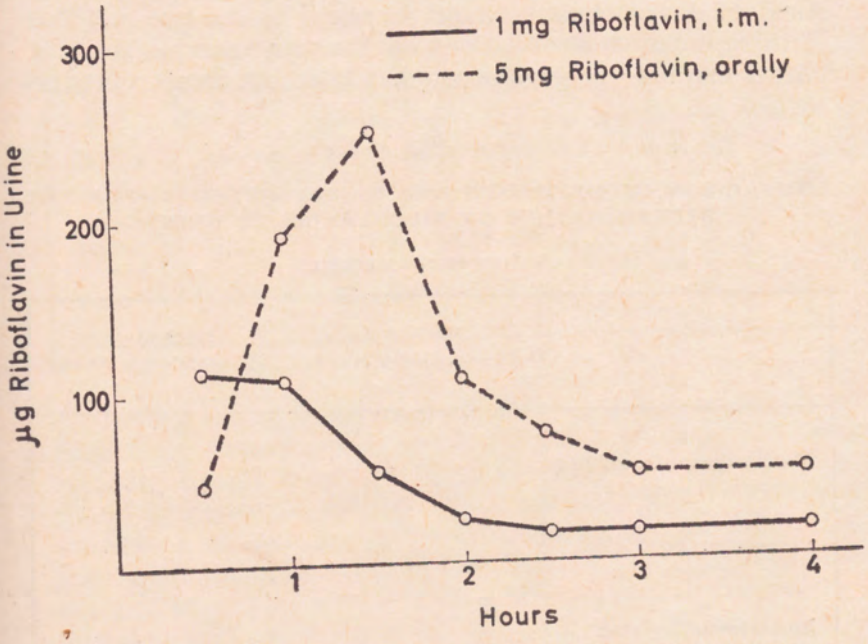
* Hyflavin, Endo Laboratories Inc., Richmond, Hill, California.

content of the urine was estimated by the simplified method, as described.

On the basis of the results of this experiment, a modified Test Dose Excretion Procedure (Lossy, *et al.* 4) was employed. Each subject was given 1 mg. riboflavin by intramuscular injection. A two hour urine sample was collected, following administration of the test dose, and assayed for riboflavin.

A simplified method (I) of urinary riboflavin analysis (5) was employed. The urine sample was diluted so that the riboflavin concentration was approximately 1 μg/ml. The fluorescence was measured in a Turner Fluorometer against a riboflavin standard, using 47-B and 2A-12 filters. Following this, 5 drops of concentrated HCl were added to three milliliters of the sample and the change fluorescence was related to riboflavin concentration, using a standard curve.

FIGURE 1



Riboflavin excretion, in micrograms, following intramuscular administration of 1 mg. riboflavin (————) and following oral administration of of 5 mg. riboflavin (- - - - - -).

Twenty-four urine samples were measured by this method and also by the butanol extraction method of Najjar (II), as modified by Varley (6).

RESULTS

Figure 1 shows riboflavin excretion, in micrograms, following a 5 mg. oral test dose and following a 1 mg. intramuscular test dose. It is seen that the major excretion of riboflavin is completed by 90 minutes after administration of the vitamin. For subsequent studies a 2 hour collection period was chosen for convenience. Use of an oral test dose would have required a longer collection period, but by 3 hours most of the riboflavin excretion had occurred and under conditions where intramuscular injection is not feasible oral administration would appear satisfactory.

Table 1 shows a comparison of the two riboflavin assay methods used. For the 24 individuals studied, the means and standard deviations are almost identical by the two methods. With repeated determinations on the same sample the simplified method (I) gave somewhat lowe but more reproduc-

TABLE 1

COMPARISON OF METHODS I AND II (SEE METHODS) FOR THE DETERMINATION OF RIBOFLAVINE IN URINE

Values in micrograms

	Method I (Simplified Method)	Method II (Extraction Method)
Mean value and standard error (24 samples)	211 ± 27	215 ± 26
Correlation coefficient for methods I and II	0.97	
Reproducibility (ten analyses of a single urine sample)	367 ± 23	413 ± 35

ible results than did th eextraction method (II). The correlation coefficient for the two methods was very high (0.97) and the simplified method was applied to a study of riboflavin status in a sample of the population.

Table 2 shows the average riboflavin excretion (in micrograms) of the 13 Navajo men ad 51 Navajo women. Extrapolating back from the data of Varley (6), an excretion of more than 200 μg. of riboflavin in two hours would be taken as "normal". It is seen that both men and women averaged more than 200 μg. However, although 35 of the 51 women either post partum or were under 30 years of age, these two groups accounted for 13 of the 16 individuals who excreted less than 100 μg. of riboflavin. On the other hand, only 1 of the 13 males excreted less than 100 μg. of riboflavin.

TABLE 2

URINARY RIBOFLAVIN EXCRETION OF NAVAJO INDIANS, FOLLOWING ADMINISTRATION OF 1 mg. RIBOFLAVIN INTRAMUSCULARLY. URINE COLLECTED FOR TWO HOURS. ALL VALUES IN MICROGRAMS. MEANS AND STANDARD DEVIATIONS ARE GIVEN.

Group	Number	Riboflavin Excretion	Range	Number excreting less than 100 mg.
Males	13	272±95	53-396	1
Females	51	221±140	35-516	16

Table 3 shows the average riboflavin intakes, as calculated from 1 day dietary recall records (18 subjects) and from 7 day records of milk, meat, and eggs (14 subjects) and the riboflavin excretion of each group of subjects. The intakes and excretions of each group were compared by calculating the Spearman Rank Correlation Coefficients (7). It is seen that there is an almost complete lack of correlation between dietary data and excretion data.

TABLE 3

CORRELATION OF DIETARY RIBOFLAVIN INTAKE, CALCULATED FROM DIET RECORDS, AND URINARY EXCRETION OF RIBOFLAVIN FOLLOWING INTAMUSCULAR ADMINISTRATION OF 1 mg. RIBOFLAVIN

	One-day diet record (all foods)	Seven-day diet records (milk, meat, eggs)
Number of subjets	18	14
Daily riboflavin intake (average)	545 μg.	450 μg.
Riboflavin excretion (average)	214	288
Correlation coefficient	—0.06	+0.04

DISCUSSION

The results indicate that the simplified procedure used, including collection of a single 2 hour urine sample following intramuscular administration of 1 mg. of riboflavin, and a simplified fluorometric assay for riboflavin, yields useful information on ribloflavin nutritional status and is applicable to field studies under a variety of conditions. Although it requires the use of a fluorometer, the method itself is not complicated or time consuming.

Although the number of subjects studied is small, the results do indicate that a considerable number of young women and post partum women in this population have urinary riboflavin excretions well below that which would be considered desirable. This is in keeping with the observations of Darby *et al* (1) that clinical and dietary signs suggestive of poor riboflavin nutrition occur among Navajo Indians of the Southwestern United States. The results also indicate the desirability of more detailed studies on young women and post partum women in these populations.

In a study of pregnant Guatemalan women of lower economic status, carried out by Arroyave *et al.* (8) a rather similar pattern of riboflavin excretion was found. Of 33 women, with an average 4 hour riboflavin excretion of 251 μg., 6 excreted less than 100 μg. of riboflavin. However, when the Spearman Rank Correlation Coefficient was calculated from their data. A coefficient of +0.87 was obtained, demonstrating a relationship between the dietary intake data and the excretion data.

We suspect that the marked lack of correlation between estimates of dietary riboflavin intake and excretion data in our study is due to our difficulty in obtaining accurate dietary information from this population, even with the assistance of an interpreter. It may be that where a language or communication barrier exist between the investigator and the population under study, biochemical studies offer a more reliable measure of nutritional status than do dietary data.

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RESUMEN

Aplicación de un método modificado de sobrecarga de riboflavina a un estudio de campo sobre el estado nutricional de indios Navajos con respecto a esta vitamina

Una prueba modificada para estudiar riboflavina desde un punto de vista nutricional fue llevada a cabo trabajando con voluntarios indios Navajos (13 varones y 51 hembras) en Crown Point Public Health Service Indian Hospital, New Mexico. Esta prueba consistió en la toma de una sola muestra de orina a las 2 horas después de la administracion intramuscular de 1 mg. de riboflavina. La riboflavina fue determinada fluorométricamente.

Los valores promedio de excreción por este método están muy íntimamente relacionados con los de un ensayo más complejo. Se encontró que los promedios de excreción de riboflavina estaban dentro de un límite aceptable (200 μg. o más), pero se vio que un gran número de mujeres menores de 30 años de edad y mujeres post partum excretaron menos de 100 μg de riboflavina en 2 horas.

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

The fruits consumed were oranges, bananas, custard apples, soursops, and peach nectar. Oranges were consumed regulary 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	40	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
VEGETALES & 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 cormeal.

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 creckers 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 chickpeas.

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
Sex	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 additonal 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 siigns 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 that 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 +		
Sex	M	F	MF	M	F	MF	M	F	MF	M	F	MF	M	F	MF	M	F	MF	PF	LF	M	F	MF	M	F	MF
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 mo	8 mo.	10 mo.	3.7	3.6	3.7	7.8	7.4	7.6	12	12	12	17	17	17	28	29	29	23	24	49	50	49	72	68	70
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 occurr 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 (precoked), 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 consumptionof 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 subjets who showed combined signs of undernutrition. 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 retroauricular which is not considered as representative of aribo-flavinosis 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 weigths 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 measurementes 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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La suplementación de la ración rural puertoriqueña con proteína de pescado*

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RESUMEN

El presente estudio trata sobre la suplementación de la ración rural puertorriqueña con tres diferentes concentrados de proteína de pescado, a saber: harina preparada a partir de bacalao seco y salado; harina de pescado (VioBin, deodorizado) y harina de pescado Tipo C (Nueva Escocia). La ración rural puertorriqueña, expresada en gramos por 100 gramos, consiste de arroz (pulido y enriquecido), 24.2; habichuelas coloradas, 6.3; batata blanca, 13.4; plátano verde, 6.7; guineo verde, 6.7; harina de maíz, 3.2; tubérculo de yautía (Xanthosoma sagittae (L) Schott), 6.7; azúcar, 13.4; manteca de cerdo, 6.4; aceite de ensalada, 4.7; salsa de tomate, 3.4; pimientos, 1.3; cebollas, 1.3; ajos, 0.2; vinagre, 1.1., y sal, 1.0. Todos estos ingredientes se cocinaron en agua corriente, luego se secaron a 65°-70°C y finalmente se molieron. El contenido de proteína de esta ración, determinado mediante análisis (Kjeldahl), fue de 5.67 a 5.88% (N × 6.25).

Las raciones suplementadas con harina de pescado o habichuelas coloradas se prepararon añadiendo, a la mezcla antes descrita, una cantidad suficente de los concentrados proteicos que aumentaban en 2.5 y 5.0% el nivel de proteína. Para la evaluación biológica de los concentrados proteicos, como única fuente de proteína, se prepararon raciones semi-sintéticas a un nivel de 10 y 12% de proteína.

Se emplearon dos métodos biológicos diferentes para la evaluación de las raciones, a saber: Razón de Eficiencia Proteica y Valor de Lactancia de la Proteína.

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Los resultados demostraron que:

1) El contenido de proteína de la ración rural puertorriqueña es muy bajo (5.67 - 5.88%) y de muy pobre calidad. REP: 0.71; Valor de Lactancia: —3.24.

2) Al suplementarse la ración rural puertorriqueña con proteína de habichuelas coloradas (2.5 y 5.0%) el efecto supletorio fue prácticamente nulo. Sin embargo, cuando esta misma cantidad de proteína se adicionó en forma de concentrados de pescado, el valor estimulante del crecimiento y el valor de lactancia de la proteína aumentaron significativamente.

3) Los tres concentrados de proteína de pescado, al evaluarse como única fuente de proteína, demostraron ser proteínas biológicamente completas y poseer índices nutricionales comparables a los de la proteínna de huevo. En contraste, la proteína de habichuela colorada demostró ser una proteína biológicamente incompleta, incapaz de mantener un crecimiento o una lactancia normal .(Véanse cuadros 1 y 2.)

En publicaciones anteriores (1, 2, 3) se ha demostrado que los factores nutricionales que más limitan el valor nutritivo de la ración rural puertorriqueña son los aminoácidos esenciales, especialmente aquellos que contienen azufre.

La acción supletoria sobre esta ración de varios productos alimenticios ricos en proteína, tales como las levaduras comestibles, la leche sin grasa (4, 5) y diferentes clases de leguminosas (6), ha sido estudiada por nosotros en el pasado. Hasta ahora, sin embargo, no se había realizado un estudio cuidadoso del efecto supletorio de las harinas de pescado, ya que hasta fecha relativamente reciente las harinas que se podían obtener eran, higiénica y organolépticamente hablando, de calidad inferior.

El presente estudio se efectuó al recibir nosotros dos tipos de harina de pescado de alta calidad, desde el punto de vista higiénico y organoléptico. Ambas eran de procedencia extranjera y diferían entre sí en el método usado en su preparación. También se estudió el efecto supletorio de una harina preparada por nosotros en la que se utilizó como materia prima bacalao seco y salado importado de Nueva Escocia, ya que este alimento ha sido usado desde tiempo inmemorial como aditamento regular a la ración básica del campesino puertorriqueño en la forma de varios platos, especialmente como la típica "serenata" (bacalao hervido condimentado con aceite, vinagre, ajo, cebollas y pimientos). Con fines de comparación se investigó además el efecto supletorio de cantidades adicio-

nales, a la que normalmente contiene la ración puertorriqueña, de habichuela colorada (*Phaseolus vulgaris*, var. Red-Kidney) cocidas y secas. Equivalían estos suplementos de habichuela colorada en contenido de proteína a los respectivos suplementos de harina de pescado indicados anteriormente.

MATERIALES Y METODOS

Se determinó el contenido de nitrógeno total en los ingredientes y en las raciones que se usaron en este trabajo por el método semicro de Kjeldahl (7). Por proteína se entiende N × 6.25.

Los concentrados de proteína de pescado que se estudiaron fueron los siguientes:

a) *Harina de bacalao salado y seco.*—Se obtuvo en el mercado local. Esta se importa principalmente de Nueva Escocia. Las pencas de bacalao se fragmentaron en pequeños pedazos y se lavaron con agua corriente repetidas veces hasta que se eliminó la mayor parte de la sal con que estaban impregnadas. Después se cocieron en agua hirviendo y se secaron en un horno que circula aire a una temperatura de 65°-70°. Se molieron los fragmentos secos hasta obtener un polvo que cernía por un tamiz número 60. Este polvo contiene 82.14% de proteína, 4.18% de humedad y 2.80% de grasa.

b) *Harina de pescado VioBin deodorizada.*—Esta harina se produce en escala comercial. La materia prima se compone de una variedad de pescados, los que son desecados, desgrasados y deodorizados por extracción con una mezcla azeotrópica. Esta harina contiene 77.10% de proteína, 10.80% de humedad y trazas de grasa.

c) *Harina comestible de pescado tipo C.*—La prepara la National Sea Products Ltd. de Halifax, Nueva Escocia. Usan desperdicios seleccionados de bacalao y de róbalo, incluyendo el esqueleto, pero no las vísceras. Contiene 68.29% de proteína y 8.89% de humedad. Su contenido de grasa, según las especificaciones de producción indicadas en "Fishery By-Products Technology55, Capítulo 18, por Julius Brody, no debería ser mayor de 10%.

Se usaron dos tipos de raciones experimentales:

(a) La ración rural puertorriqueña, la cual, expresada en

gramos por 100 graoms, consiste de arroz (pulido y enriquecido), 24.2; habichuelas coloradas, 6.3; batata blanca, 13.4; plátano verde, 6.7; guineo verde, 6.7; harina de maíz, 3.2; yautía (*Xanthosoma sagittae folium* (L) Schott), 6.7; azúcar, 13.4; manteca de cerdo, 6.4; aceite de ensalada, 4.7; salsa de tomate, 3.4; pimientos, 1.3; cebollas, 1.3; ajos, 0.2; vinagre, 1,1, y sal, 1.0.

Todos estos ingredientes se cocinaron hirviéndolos en agua corriente. La mezcla ya cocida se secó en el horno de aire caliente a una temperatura entre 65°-70°C. La ración pulverizada contiene 5.67 - 5.88% de proteína y 5.20% de humedad.

Para investigar el efecto supletorio de los tres concentrados de proteína de pescado y de la habichuela colorada se prepararon ocho raciones experimentales mezclando la ración rural con una cantidad de suplemento que aumentaba el contenido de proteína en aproximadamente 2.5 y 5.0 por ciento, respectivamente.

(b) Las raciones semi-sintéticas conteniendo separadamente cada uno de los tres concentrados de proteína de pescado o de las habichuelas coloradas como única fuente de proteína tenían la siguiente composición en gramos por 100 gramos: aceite de maíz, 10; celulosa en polvo (cellu flour), 4; mezcla de sales, U.S.P. XIV, 4; mezcla de vitaminas, 2.* A esta mezcla se el adicionó suficiente cantidad de los suplementos proteicos para que proveyera aproximadamente de 10 ó 12 gramos de proteína, completándose hasta 100 gramos con almidón de maíz. De este tipo de ración se prepararon ocho raciones diferentes.

Los experimentos con animales se efectuaron usando ratas de la cepa Wistar - Escuela de Medicina Tropical. Se usaron dos métodos biológicos para evaluar los concentrados proteicos:

(1) *Razón de eficiencia proteica.*—En esta técnica se observa el aumento en peso y el consumo de proteína durante un período de cuatro semanas. En cada ensayo se usaron 12 ratas machos de 28 días de edad. El aumento en peso por gramo de proteína ingerida es el parámetro que se determinó.

* Mezcla de vitaminas para fortificación de dieta de "Nutritional Biochemicals Corporation, Cleveland, Ohio". Dos gramos de esta mezcla en 100 gramos de dieta suplen cantidades adecuadas de: vit. A, vit. D, vit. E, vit. C, inositol, colina, menadión, ácido p-amino benzoico, niacina, riboflavina, piridoxina, tiamina, pantotenato de calcio, biotina, ácido fólico y vit. B_{12}.

(2) *Valor de lactancia de la proteína.*—En este método, el cual fue desarrollado en este laboratorio (6), se usa un mínimo de diez camadas de ratitas acabadas de nacer, con su madre respectiva. El número de ratitas en cada complejo madre-cría se hace uniforme reduciendo éstas a seis (camada standard). La ración que se le ofrece a la madre contiene aproximadamente 12% de proteína.* Se mide el cambio en peso de la madre y de las ratitas durante los primeros catorce días de la lactancia. Durante este mismo período de tiempo se determina también la cantidad de proteína consumida por la madre. El cambio en peso, en gramos, del complejo madre e hijos, dividido por los gramos de proteína ingerida por la madre, nos da el valor de lactancia de la proteína.

RESULTADOS Y DISCUSION

Razón de eficiencia proteica

En el Cuadro Nº 1 se da a conocer el contenido de proteína de las diferentes raciones expresadas en gramos por ciento. También en dicho cuadro se informa la ganancia en peso corporal de los animales durante el experimento, la cantidad de proteína consumida y finalmente la razón de eficiencia proteica.

Los resultados obtenidos demuestran claramente que los tres concentrados de proteína de pescado estudiados por nosotros suplementan muy significativamente, aun a un nivel de 2.5% de proteína, la ración rural puertorriqueña. El aumento en peso que se registró a este nivel fue entre 3 y 5 veces mayor que el que se obtuvo con la ración rural sin suplemento alguno, mientras que el aumento en consumo de proteína sólo

* Cuando se intentó ensayar, por el método de lactancia, la ración rural puertorriqueña y las correspondientes mezclas de ésta con las diferentes harinas de pescado y habichuelas coloradas, no se pudo satisfacer la recomendación de un 12% de proteínas por contener todas estas mezclas menos de esa cantidad de proteínas. Sin embargo, como lo que interesábamos era establecer una comparación entre las raciones suplementadas con harina de pescado y con cantidades equivalentes en término de proteína de habichuela colorada, los resultados que se obtuvieron fueran comparables entre sí, ya que todas las mezclas contenían aproximadamente el mismo contenido de proteína.

Por el contrario, en el experimento en que se evaluaron las tres harinas de pescado y habichuelas coloradas como única fuente de proteína en la ración semi-sintética, sí se pudo satisfacer el requisito del 12% de proteína. Por lo tanto, los valores que se obtuvieron en este caso no sólo son comparables entre sí, sino que tienen valor absoluto con relación al método de lactancia propuesto por nosotros.

CUADRO Nº 1

RAZON DE EFICIENCIA PROTEICA DE LAS DISTINTAS RACIONES EXPERIMENTALES

(Los valores son el promedio de 12 animales)

SUPLEMENTO PROTEICO	Ganancia en peso corporal g.	Proteína en ración %	Total de proteína consumida g.	Razón de eficiencia proteica
RACION RURAL PUERTORRIQUEÑA (RRP):				
NINGUNO	8.7	5.67	12.2	0.71 ± 0.13*
RRP MAS APROXIMADAMENTE 2.5% PROTEINA EN FORMA DE:				
HABICHUELA COLORADA	11.6	8.32	14.5	0.80 ± 0.05
HARINA DE BACALAO	42.5	9.17	24.0	1.77 ± 0.11
HARINA DE PESCADO "VIOBIN"	32.8	8.58	17.3	1.89 ± 0.04
HARINA DE PESCADO "TIPO C"	37.5	8.22	21.3	1.76 ± 0.06
RRP MAS APROXIMADAMENTE 5.0% PROTEINA EN FORMA DE:				
HABICHUELA COLORADA	20.8	10.82	21.6	0.96 ± 0.07
HARINA DE BACALAO	59.8	10.74	32.6	1.83 ± 0.14
HARINA DE PESCADO "VIOBIN"	62.8	10.81	28.1	2.23 ± 0.07
HARINA DE PESCADO "TIPO C"	64.0	10.57	32.2	1.99 ± 0.07
RACION SEMI-SINTETICA CON 10% PROTEINA EN FORMA DE:				
HABICHUELA COLORADA	10.7	10.32	19.2	0.56 ± 0.06
HARINA DE BACALAO	117.3	9.88	31.8	3.69 ± 0.08
HARINA DE PESCADO "VIOBIN"	90.7	9.35	28.3	3.20 ± 0.09
HARINA DE PESCADO "TIPO C"	73.3	9.85	28.5	2.57 ± 0.11

* Error standard del promedio.

se llegó a doblar, demostrando esto una mejor utilización de la proteína presente en la ración.

Esta acción supletoria se observó aun en forma más intensa al aumentarse el suplemento de proteína de pescado de 2.5% a 5%. A este último nivel la ganancia en peso corporal, lo mismo, que el consumo de proteínas, aumentaron mucho más; sin embargo, los índices de razón de eficiencia proteica, aunque aumentaron, no llegaron a doblar los obtenidos al nivel de 2.5%.

De estos tres concentrados de pescado, el que demostró poseer una mayor eficiencia proteica, al añadirse a la dieta rural puertorriqueña, a cualquiera de los dos niveles usados, fue el preparado por la VioBin Co. Es bueno aclarar, sin embargo, que la diferencia que se observó entre éste y los otros dos concentrados no fue muy significativo; en otras palabras, las tres harinas de pescado estudiadas suplementaron prácticamente con igual eficiencia la ración rural puertorriqueña.

También suplementamos la ración rural puertorriqueña con una cantidad adicional de 2.5% y 5% de proteína de habichuela colorada. Los resultados obtenidos demostraron, sin lugar a dudas, que la adición de dicha proteína, a los niveles indicados, aunque incrementaba la ganancia en peso lo mismo que el consumo de proteína por parte de los animales experimentales, mejoró muy levemente la utilización de la proteína presente en dicha ración. En otras palabras, el efecto supletorio de esta cantidad adicional de proteína de habichuela colorada sobre la ración rural puertorriqueña resultó ser prácticamente nulo.

En el Cuadro Nº 1 también se informan los resultados obtenidos cuando se ensayaron estos tres concentrados de pescado y la habichuela colorada como única fuente de proteína en una ración semi-sintética. Los índices obtenidos en el caso de las harinas de pescado, en general, demostraron que son proteínas biológicamente completas y de gran valor nutricional. La habichuela colorada, por el contrario, demostró poseer una razón de eficiencia proteica muy baja, lo que indica que la proteína que contiene es de muy pobre calidad.

Valor de lactancia de la proteína.—Como se puede ver en los Cuadros 1 y 2, el contenido de proteína de la ración rural puertorriqueña varió, según preparada en nuestro laboratorio, entre 5.67 y 5.88%. El bajo nivel de proteína en dicha ración

hace sospechar que ésta sea la causa del valor de lactancia extremadamente negativo (—3.24) que se obtiene al ofrecérsela como dieta exclusiva al complejo madre-cría. Sin embargo, al suplementar dicha ración con una cantidad adicional de 2.5 y 5% de proteínas de habichuela colorada y aumentar el contenido de proteína en la ración a 8.32% y 10.82%, respectivamente, se produjo un incremento en el índice de lactancia, pero persistieron a ambos niveles de suplementación valores extremadamente negativos. Esto aparentemente indica que el factor responsable por los índices negativos de lactancia observados fue la calidad y no la cantidad de proteína en la ración. Esta conclusión se hizo aún más evidente al suplementar, a los mismos niveles, la ración rural puertorriqueña con las harinas de pescado bajo estudio. Al añadir éstas a un nivel de 2.5% y aumentar la proteína total en la ración a concentraciones entre 8.26% a 9.17%, los valores del índice de lactancia aumentaron a niveles muy cerca a cero*; al suplementar con 5% de proteína de pescado y aumentar el contenido total de proteína a niveles entre 10.57% a 10.81%, los índices de lactancia se convirtieron en valores definitivamente positivos, como se puede ver en el Cuadro 2.

En el Cuadro 2 se informan también los índices de lactancia obtenidos para los tres concentrados de proteína de pescado y la habichuela colorada cuando éstos constituyen la única fuente de proteína en la ración.

El índice de lactancia para las harinas de pescado no sólo es positivo, sino también de alta magnitud y comparable al obtenido en nuestro laboratorio al usar este mismo ensayo con la proteína de huevo, 3.06 (6). Por el contrario, el valor obtenido para la proteína de la habichuela colorada es altamente negativo, confirmando de nuevo su baja calidad nutricional.

Los resultados obtenidos en ambas pruebas biológicas demuestran, sin lugar a dudas, el alto valor nutricional de los concentrados de pescado, lo que en parte explica los efectos beneficiosos que se obtienen cuando se adicionan a la ración rural puertorriqueña tanto durante el período de crecimiento como durante la lactancia.

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* Los índices de lactancia son números positivos o negativos siendo cero el punto intermedio de la escala.

CUADRO Nº 2

VALOR DE LACTANCIA DE LA PROTEINA EN LAS DISTINTAS RACIONES EXPERIMENTALES

(Los valores son el promedio de 10 camadas)

SUPLEMENTO PROTEICO	Ganancia en peso de ratitas g.	Pérdida en peso de madre g.	Proteína en ración %	Total de proteína consumida g.	Valor de lactancia de la proteína
RACION RURAL PUERTORRIQUEÑA (RRP):					
NINGUNO	57.3	82.5	5.88	8.73	—3.24 ± 0.90*
RRP MAS APROXIMADAMENTE 2.5% PROTEINA EN FORMA DE:					
HABICHUELA COLORADA	45.8	77.8	8.32	13.88	—1.96 ± 0.35
HARINA DE BACALAO	74.6	76.1	9.17	16.80	—0.17 ± 0.09
HARINA DE PESCADO "VIOBIN"	71.2	88.9	8.58	17.82	—1.13 ± 0.05
HARINA DE PESCADO "TIPO C"	67.7	66.7	8.26	15.69	+0.08 ± 0.28
RRP MAS APROXIMADAMENTE 5.0% PROTEICA EN FORMA DE:					
HABICHUELA COLORADA	52.5	77.3	10.82	20.48	—1.14 ± 0.19
HARINA DE BACALAO	97.4	64.2	10.74	24.03	+1.31 ± 0.06
HARINA DE PESCADO "VIOBIN"	87.3	72.6	10.81	23.58	+0.60 ± 0.05
HARINA DE PESCADO "TIPO C"	83.6	56.9	10.57	24.24	+0.90 ± 0.32
RACION SEMI-SINTETICA CON APROXIMADAMENTE 12% PROTEINA EN FORMA DE:					
HABICHUELA COLORADA	60.9	80.0	11.83	15.73	—1.20 ± 0.31
HARINA DE BACALAO	151.6	20.0	11.67	42.88	+3.03 ± 0.43
HARINA DE PESCADO "VIOBIN"	135.2	21.8	11.61	41.51	+2.71 ± 0.07
HARINA DE PESCADO "TIPO C"	121.8	35.3	11.89	40.12	+2.16 ± 0.13

* Error standard del promedio.

SUMMARY

The supplementation of the Puerto Rican rural ration with fish protein

Previous publications have demonstrated that one of the main nutritional deficiencies in the Puerto Rican Rural Diet (PRRD) is its low content of the sulfur containing amino acid, methionine, in its protein. The present study deals with the supplementation of the PRRD with three different fish protein concentrates, namely: (1) dried-salted cod fish, (2) whole fish flour (VioBin, deodorized), (3) fish meal (Type C, from Nova Scotia). The compositiion of the basal ration representing the PRRD was (in grams per 100 grams): rice (polished, enriched), 24.2; red-kidney beans, 6.3; white sweet-potato, 13.4; plantain (green), 6.7; banana (green), 6.7; corn meal, 3.2; tanier (yautia), 6.7; sugar, 13.4; lard, 6.4; salad oil, 4.7; tomato sauce, 3.4 sweet-pepper, 1.3 onion, 1.3; garlic, 0.2; vinegar, 1.1, and salt, 1.0. All these ingredients were cooked by boiling in tap water, dried at 65°-70°C and grounded. The protein content of the basal ration was found to be, 5.67 to 5.88% (N $\times$ 6.25).

The fish protein and red-kidney bean supplemented rations were prepared by adding, to the above described ration, an amount of the fish protein concentrates or the red-kidney bean meal that represented an increase of approximately 2.5 and 5.0% protein. Beside, for the biological evaluation of the fish protein concentrates and the red kidney bean meal as the only source of protein a semi synthetic basal ration was prepared having 10 or 12% protein level.

Two different biological procedures were employed, namely: The Protein-efficiency ratio and the Lactation Value of the Protein.

From the results obtained by both experimental procedures it is evident that:

(1) The protein content of the PRRD is very low (5.67 - 5.88%). By both biological procedures its protein was found to be of a very low nutritional value. Growth promoting value: 0.71, Lactation value: —3.24.

(2) When the protein of the PRRD was increased to 8.32 and 10.82% by the addition of red-kidney bean, the supplementary effect of this extra amount of red-kidney bean was practically nil. However, when this additional protein was in the form of fish meal the supplementary action of all three fish concentrates was very significant. Both the growth promoting value and the lactation value of the protein were dramatically increased.

(3) The three fish protein concentrates, when evaluated as the only source or protein in the diet, were found to be biologically complete proteins demonstrating protein efficiency ratios and lactation values comparable to those of whole egg protein. On the other hand, the red-kidney bean protein was found to be an incomplete protein unable to support neither normal growth or lactation. (See Tables 1 and 2.)

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NUTRICION APLICADA

Recomendación diaria de calorías y nutrientes para la población colombiana

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Se ha hecho un cuidadoso estudio y revisión de las recomendaciones existentes en diferentes países (1, 5, 8, 13, 14, 31), de los estudios de grupos de expertos de la O.M.S. y F.A.O. (2, 3, 15, 29, 39), así como estudios realizados por diferentes expertos tanto en calorías como proteínas, vitaminas y minerales (2, 3, 9, 11, 14, 15, 17, 20, 22, 23, 25, 26, 28, 29, 30, 32), que permiten formular la Recomendación diaria de calorías y nutrientes para la población colombiana, teniendo en cuenta principalmente la temperatura ambiente, el "peso deseable" (1, 4, 6, 10, 21), de los diferentes grupos de población, y la actividad física desarrollada.

El propósito fundamental de estas recomendaciones es el tener una guía que permita formular la recomendación diaria de calorías y nutrientes para grupos de población, evaluar los resultados de las investigaciones alimentarias que se realicen en Colombia y fijar metas de consumo de alimentos. Se considera que las cifras recomendadas son adecuadas para asegurar el buen estado nutricional de la mayoría de la población que se encuentre en "buen estado de salud".

Prácticamente, para los nutrientes considerados las recomendaciones son superiores en más del 60% a los requerimientos mínimos teóricos probables considerados para los distintos grupos, lo cual permite cubrir ampliamente las variaciones individuales que se pueden presentar.

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Las recomendaciones son dadas teniendo en cuenta el punto medio de edad en los diferentes grupos.

Calorías

Para el cálculo tanto de calorías como de los demás nutrientes se ha tomado el denominado "Hombre de Referencia" recomendado por la F.A.O. (29), de 25 años de edad, 65 kg. de peso, pero se le ha asignado una recomendación de 3.000 calorías diarias; desarrolla una actividad moderada y puede ser agricultor, obrero, chofer.

Como se ha modificado el valor calórico total, la fórmula simplificada para obtener el valor calórico total queda en la siguiente forma: $E = 650 + 36.1\ P$.

La "Mujer Referencia" (29), de 25 años de edad, 55 kg. de peso, con una recomendación diaria de 2.000 calorías, desarrolla igualmente una actividad moderada como la realizada en trabajos domésticos, fábricas, oficinas, cuidado de niños. Ambos, viviendo en una temperatura anual media de 10°C. Al igual que en el caso del hombre referencia, la fórmula simplificada queda modificada en la siguiente forma: $E = 500 + 27.2\ P$.

Ajustes por clima:

Se presentan las recomendaciones ajustadas para 10, 20 y 30 centígrados de temperatura, cubriendo en esta forma los diversos climas en que vive la mayoría de nuestra población. Se ha tenido en cuenta el siguiente criterio para realizar estos cálculos:

A partir de 10°C, las recomendaciones deben ser disminuidas en 2.5% por cada 5°C de aumento en la temperatura externa hasta 20°C (29). Teniendo en cuenta la información disponible (1, 2, 10, 20, 22, 23, 29), entre los 20 y 30°C parece adecuada una reducción del 2% y así se ha hecho en las recomendaciones que se presentan. Para cálculos de las necesidades calóricas de poblaciones viviendo en climas con temperatura entre 30 y 40°C debe aumentarse un 1% por cada 2°C de temperatura, cuando se mantienen las condiciones de actividad antes mencionadas (22, 23, 28). Las necesidades calóricas de poblaciones en climas por debajo de 10°C no necesitan ser modificadas salvo cuando el uso de ropa "muy pesada" como medio de protección determina un mayor trabajo (1, 22, 23, 28).

INSTITUTO NACIONAL DE NUTRICION

RECOMENDACIONES DIARIAS DE CALORIAS Y NUTRIENTES PARA LA POBLACION COLOMBIANA - 1965

Temperatura Media Anual de 10° C.

Grupos de Edad Años	Calorías	Proteínas g.	Calcio mg.	Hierro mg.	Vit. A U. I.	Tiamina mg.	Riboflavina mg.	Niacina mg.	Vit. C mg.	Vit. D U. I.
Niños										
0 - 1 ambos sexos	945	27	600	7	1500	0.4	0.6	6.6	40	400
1 - 3 " "	1365	31	700	8	2000	0.6	0.8	9.0	40	400
4 - 6 " "	1680	36	700	10	2500	0.7	1.0	11.0	40	400
7 - 9 " "	2205	43	800	12	3500	0.9	1.3	14.5	40	400
10 - 12 Hombres	2520	61	800	15	4500	1.0	1.5	16.6	40	400
10 - 12 Mujeres	2415	60	800	15	4500	1.0	1.4	16.0	40	400
Adolescentes										
13 - 15 Hombres	3255	78	800	15	5000	1.3	1.9	21.5	40	400
16 - 19 "	3465	78	800	15	5000	1.4	2.1	23.0	40	400
13 - 15 Mujeres	2835	73	800	15	5000	1.1	1.7	18.7	40	400
16 - 19 "	2520	65	800	15	5000	1.0	1.5	16.6	40	400
Adultos										
20 - 29 Hombres	3000	68	500	10	5000	1.2	1.8	18.8	50	400
30 - 39 "	2910	68	500	10	5000	1.2	1.8	19.4	50	
40 - 49 "	2760	68	500	10	5000	1.1	1.6	18.0	50	
50 - 59 "	2610	68	500	10	4500	1.0	1.6	17.3	50	
60 - 69 "	2370	68	500	10	4500	0.9	1.4	15.6	50	
20 - 29 Mujeres	2000	60	500	15	5000	0.8	1.2	13.2	50	400
30 - 39 "	1940	60	500	15	5000	0.8	1.2	12.4	50	
40 - 49 "	1840	60	500	15	5000	0.8	1.1	12.1	50	
50 - 59 "	1740	60	500	12	4500	0.8	1.0	11.4	50	
60 - 69 "	1580	60	500	12	4500	0.8	0.9	10.3	50	
Embarazo 2ª mitad	+200 día	+12 día	+400 día	+3 día	+1000 día	+0.2 día	+0.3 día	+2 día	+15 día	+400
Lactancia	+800 día	+18 día	+500 día	+3 día	+2000 día	+0.4 día	+0.5 día	+6 día	+15 día	+400

INSTITUTO NACIONAL DE NUTRICION

RECOMENDACIONES DIARIAS DE CALORIAS Y NUTRIENTES PARA LA POBLACION COLOMBIANA - 1965

Temperatura Media Anual de 20° C.

Grupos de Edad Años	Calorías	Proteínas g.	Calcio mg.	Hierro mg.	Vit. A U. I.	Tiamina mg.	Riboflavina mg.	Niacina mg.	Vit. C mg.	Vit. D U. I.
Niños										
0 - 1 ambos sexos	900	27	600	7	1500	0.4	0.5	6.0	40	400
1 - 3 " "	1300	31	700	8	2000	0.5	0.8	8.5	40	400
4 - 6 " "	1600	36	700	10	2500	0.6	0.9	10.5	40	400
7 - 9 " "	2100	43	800	12	3500	0.8	1.2	14.0	40	400
10 - 12 Hombres	2400	61	800	15	4500	1.0	1.4	16.0	40	400
10 - 12 Mujeres	2300	60	800	15	4500	0.9	1.3	15.0	40	400
Adolescentes										
13 - 15 Hombres	3100	78	800	15	5000	1.2	1.8	20.4	40	400
16 - 19 "	3300	78	800	15	5000	1.3	2.0	22.0	40	400
13 - 15 Mujeres	2700	73	800	15	5000	1.1	1.6	17.8	40	400
16 - 19 "	2400	65	800	15	5000	1.0	1.4	16.0	40	400
Adultos										
20 - 29 Hombres	2850	68	500	10	5000	1.1	1.7	18.8	50	400
30 - 39 "	2800	68	500	10	5000	1.1	1.7	18.4	50	
40 - 49 "	2600	68	500	10	5000	1.0	1.5	17.0	50	
50 - 59 "	2500	68	500	10	4500	1.0	1.5	16.5	50	
60 - 69 "	2250	68	500	10	4500	0.9	1.3	14.8	50	
20 - 29 Mujeres	1900	60	500	15	5000	0.8	1.1	12.5	50	400
30 - 39 "	1800	60	500	15	5000	0.8	1.1	11.8	50	
40 - 49 "	1750	60	500	15	5000	0.8	1.0	11.5	50	
50 - 59 "	1650	60	500	12	4500	0.8	1.0	10.8	50	
60 - 69 "	1500	60	500	12	4500	0.8	0.9	9.9	50	
Embarazo 2ª mitad	+200 día	+12 día	+400 día	+3 día	+1000 día	+0.2 día	+0.3 día	+2 día	+15 día	+400
Lactancia	+800 día	+18 día	+500 día	+3 día	+2000 día	+0.4 día	+0.4 día	+6 día	+15 día	+400

INSTITUTO NACIONAL DE NUTRICION

RECOMENDACIONES DIARIAS DE CALORIAS Y NUTRIENTES PARA LA POBLACION COLOMBIANA - 1965

Temperatura Media Anual de 30° C.

Grupos de Edad Años	Calorías	Proteínas g.	Calcio mg.	Hierro mg.	Vit. A U. I.	Tiamina mg.	Riboflavina mg.	Niacina mg.	Vit. C mg.	Vit. D U. I.
Niños										
0 - 1 ambos sexos	880	27	600	7	1500	0.4	0.5	5.8	40	400
1 - 3 " "	1270	31	700	8	2000	0.5	0.7	8.3	40	400
4 - 6 " "	1570	36	700	10	2500	0.6	0.9	10.3	40	400
7 - 9 " "	2050	43	800	12	3500	0.8	1.2	13.5	40	400
10 - 12 Hombres	2345	61	800	15	4500	0.9	1.4	15.4	40	400
10 - 12 Mujeres	2250	60	800	15	4500	0.9	1.3	15.0	40	400
Adolescentes										
13 - 15 Hombres	3030	78	800	15	5000	1.2	1.8	19.9	40	400
16 - 19 "	3220	78	800	15	5000	1.3	1.9	21.2	40	400
13 - 15 Mujeres	2640	73	800	15	5000	1.1	1.6	17.4	40	400
16 - 19 "	2340	65	800	15	5000	0.9	1.4	15.4	40	400
Adultos										
20 - 29 Hombres	2790	68	500	10	5000	1.1	1.7	18.4	50	400
30 - 39 "	2700	68	500	10	5000	1.1	1.6	17.8	50	
40 - 49 "	2570	68	500	10	5000	1.0	1.5	16.9	50	
50 - 59 "	2420	68	500	10	4500	1.0	1.4	15.9	50	
60 - 69 "	2200	68	500	10	4500	1.9	1.3	14.5	50	
20 - 29 Mujeres	1860	60	500	15	5000	0.8	1.1	12.2	50	400
30 - 39 "	1800	60	500	15	5000	0.8	1.0	11.8	50	400
40 - 49 "	1710	60	500	15	5000	0.8	1.0	11.2	50	
50 - 59 "	1620	60	500	12	4500	0.8	1.0	10.6	50	
60 - 69 "	1480	60	500	12	4500	0.8	0.9	9.8	50	
Embarazo 2ª mitad	+200 día	+12 día	+400 día	+3 día	+1000 día	+0.2 día	+0.3 día	+2 día	+15 día	+400
Lactancia	+800 día	+18 día	+500 día	+3 día	+2000 día	+0.4 día	+0.5 día	+6 día	+15 día	+400

Ajustes por edad y peso:

Se considera que el "peso deseable" de 65 y 55 kg. del Hombre y Mujer Referencia se mantiene con muy pocas variaciones después de los 25 años. Teniendo en cuenta que las necesidades calóricas disminuyen progresivamente después de alcanzar la vida adulta, entre otros factores, por la disminución tanto en el metabolismo basal como de la actividad física, los siguientes ajustes deben ser hechos a medida que aumenta la edad (1, 23, 29).

—Reducir un 3% entre 30 y 39 años de edad.
—Reducir un 5% más entre 40 y 49 años de edad.
—Reducir un 5% más entre 50 y 59 años de edad.
—Reducir un 8% más entre 60 y 69 años de edad.
—Reducir un 8% más entre 70 y 79 años de edad.
—Reducir un 10% más después de los 79 años de edad.

Los ajustes por variaciones del patrón de "peso deseable" se han hecho sabiendo que del total de calorías recomendadas el 75% de ellas depende directament del peso y el 25% es independiente de él (1, 2, 29).

El aumento de 200 y 800 calorías para la segunda mitad del embarazo y la lactancia, respectivamente, se considera suficiente para cubrir las necesidades aumentadas de estos grupos (1, 2, 29).

Proteínas

Teniendo en cuenta el papel fundamental de las proteínas en la formación, reparación y reemplazo de tejidos, el cálculo de las necesidades se ha hecho usando los valores de cantidad mínima de proteínas que necesitan niños "normales" en rápido proceso de crecimiento (1, 3, 9, 25, 26) y aplicando los valores de "peso deseable" en los distintos grupos considerados, para lo cual ha servido de base el estudio seccional de crecimiento y desarrollo, realizado por el Instituto Nacional de Nutrición (4).

Estos valores toman en cuenta la proteína necesaria para compensar las pérdidas urinarias de nitrógeno endógeno (estimadas en 2 mg N por cal. basal), la proteína necesaria para crecimiento (asumiendo que del peso ganado el 18% es proteína) y las pérdidas fecales y por la piel (aproximadamente un 8 a 10%) (26).

Este requerimiento mínimo total así obtenido se aumentó en aproximadamente un 80% para cubrir variaciones tanto individuales como de aprovechamiento que se puedan presentar, estableciendo así un relativo amplio margen de seguridad (1). Para el cálculo de las necesidades en adultos se tuvo en cuenta la cantidad mínima de proteínas necesarias para compensar las pérdidas urinarias, fecales y por la piel y, al igual que en los grupos de 0 a 25 años, se dio un margen de seguridad de aproximadamente el 80% por encima de los requerimientos mínimos. Los valores presentados en la tabla han sido calculados asumiendo que las proteínas suministradas en una dieta mixta tienen un valor biológico de ochenta (V. B. 80). Las cifras recomendadas son dadas considerando una eficiencia de conversión y utilización de acuerdo con el valor biológico.

Calcio

Son muy diversos los criterios existentes para fijar las recomendaciones de este mineral (1, 5, 8, 10, 11, 14, 15, 16, 21). Sin embargo, para nuestro medio, de acuerdo a los estudios realizados (12), parecen ser adecuadas las recomendaciones dadas por el grupo de expertos FAO/OMS (15), por lo cual se han adoptado, con algunas modificaciones, las cifras por ellos recomendadas.

Hierro

Se han tomado como base las recomendaciones dadas por N.R.C. La diferencia existente en menores de un año es debida a la diferencia de pesos (1, 17).

Vitamina A

Se han tomado como base las recomendaciones dadas por N.R.C. (1) y los estudios realizados en nuestro medio (12).

Tiamina

Las recomendaciones de tiamina se basan en 0.4 mg por cada 1.000 calorías (1).

Riboflavina

Las recomendaciones de riboflavina se basan en 0.6 mg por cada 1.000 calorías (1).

Niacina

Las recomendaciones de niacina son dadas en equivalentes y se basan en 6.6 mg por cada 1.000 calorías (1).

Vitamina C

A pesar de que estas cifras, comparadas con recomendaciones anteriores, son un poco más bajas, parecen suficientes para llenar las necesidades de los distintos grupos según el criterio de distintos autores (32) y de acuerdo a los estudios realizados en nuestro medio (12).

Vitamina D

Se considera que las cantidades dadas son suficientes para llenar las necesidades en los distintos grupos (1).

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BIBLIOGRAFIA LATINOAMERICANA

ARGENTINA

La deshidratación y desalinización por motivos laborales.—Dalma, J. **Rev. Fac. Med. de Tucumán** (Argentina), 7:215, 1964-1965.

Se analiza el efecto del alcohol en los factores laborales. La apetencia alcohólica tiene su motivo principal en el trabajo muscular pesado en el ambiente caluroso. En estas circunstancias se producen grandes pérdidas de agua y sales debido principalmente a la sudoración excesiva. Se estudia el problema de las carencias más importantes en estas condiciones. 11 referencias.

Incidencia del bocio en el nivel mental de escolares.—Zuecon, M. Y., H. de. **Rev. Fac. Med. de Tucumán** (Argentina), 7:273, 1964-1965.

En estudio comparativo entre niños bociosos y normales de escuelas rurales se encontró un nivel de inteligencia inferior al cociente medio. En los niños bociosos se encontró un cociente intelectual inferior con una diferencia estadísticamente significativa respecto a los normales. 5 referencias.

BRASIL

Considerations on the hematological picture of malnourished children.—J. E. Dutra de Oliveira, N. de Oliveira Netto & L. Scatene (Facultad de Medicina, Ribeirao Preto (S. P.), Brasil). **J. Trop. Pediat.**, 10: 105-110, 1965.

Los niños estudiados presentaron una anemia moderada. Cuando fueron sometidos a ensayos terapéuticos que incluían administración de proteína de buena calidad, hierro, ácido fólico y vitamina B_{12}, los resultados no fueron tan satisfactorios en lo que se refiere a la curación de la anemia.

A incidencia de anemia e poliglobulina na esquitossome-mensoni.—Guerra Alvariz, F. e Nunes de Freitas, O.—**O Hosp.**, 70:1279, 1966.

En 215 pacientes con esquitosomiasis mansoni residentes en Río de Janeiro se encontró una incidencia extremadamente baja de anemia, en oposición a la mayoría de las observaciones previas en diferentes regiones. La poliglobulia fue vista frecuentemente en pacientes de ambos sexos, tanto en la forma hepato-intestinal como hepato-esplénica. Tales hechos no habían sido señalados anteriormente en la literatura. 8 referencias.

119 basal metabolism experiments in Manaus, Amazonas.—Aguiar, S. **O Hosp.** 70:1319, 1966.

En determinaciones de metabolismo basal realizadas en 86 varones y en 33 hembras en edades entre 18 y 25 años, en Manaus, con una temperatura media de 27.7°C y humedad relativa media de 84.4%, los resultados obtenidos en relación a los patrones de Boothby y DuBois revelan una desviación de —6.0% y 2.4% para los hombres y —5.0% y 8.1% para las hembras. 12 referencias.

Protein's shortage in brazilian northeast. — N. Chaves. **Arquiv. Brasileiros Nutr.** 20:53, 1964.

El autor revisa la deficiencia proteica, la cual es altamente descrita en el problema nutricional de hoy día. Esta importancia incrementa en virtud de las condiciones sociales y económicas de los países y sectores en vías de desarrollo. Se describen las causas y consecuencias

del síndrome, las cuales son analizadas en mayor detalla como concernientes al kwashiorkor y al síndrome pluricarencial. También se discute la incidencia de la deficiencia proteica a nivel nacional e internacional y llama la atención sobre la seriedad del problema.

Food's Industry in Brazil.—P. Borges. **Arquiv. Brasileiros Nutr.** 20: 7, 1964.

Se hace una revisión de la industria brasileira de alimentos desde su comienzo hasta el presente. Debido al valor de producción, número de empleados, nivel técnico, consumo de energía eléstrica, etc., este sector provee ser de capital importancia en el desarrollo.

Alimentary situation in Latin America. — H. Vecchio Mauricio. **Arquiv. Brasileiros Nutr.** 20:45, 1964.

El autor revisa la situación alimentaria en América Latina. Llama la atención a la disminución de la producción agrícola durante los pasados 25 años en relación a la explosión demográfica. Se considera imperativo llevar a cabo una reforma y expansión de la agricultura en el continente latinoamericano, de tal manera de provocar un incremento de tres o cuatro veces la producción actual.

ECUADOR

Efecto de la alimentación adicional en escolares pobres (1958-1961).—R. Enderica Vélez (Instituto Nacional de Higiene, Guayaquil, Ecuador). **Rev. Ecuat. Hig. Med. Trop.**, 22: 77-83, 1965.

En un grupo de más o menos 300 escolares que recibieron ayuda alimentaria en la escuela se llevaron a cabo observaciones de actividad física e intelectual, controlándose peso y talla durante 4 años (1958-1961). Se encontró inmediato progreso en cuanto a la actividad física y mental, asimismo después de tres años de control se notó aumento significativo en los promedios de peso y talla, para las edades de 12 y 13 años.

Estadística y Salud Pública. — R. Enderica Vélez. **Rev. Ecuatoriana Hig. y Med. Trop.** 24:19, 1967.

Se expone la importancia de conocer las estadísticas de los otros sectores de la economía del país para poder desarrollar en mejor forma los planes de Salud Pública. Se verifica una revisión y análisis de los datos estadísticos de otros sectores, recomendándose que a nivel de un organismo superior se recopilen y presenten datos periódicamente, en forma de una publicación sencilla, pero completa, capaz de ser comprendida por todas las personas interesadas en los problemas del desarrollo económico del país.

Glucoproteínas en diabetes mellitus: estudio electroforético.—Paredes S., M. **Rev. Ecuatoriana Med.** 4: 157-161, 1966.

Se investigó electroforéticamente el contenido de proteínas totales y glicoproteínas del suero sanguíneo en 30 pacientes normales y 30 diabéticos. En estos últimos se encontró disminución de las albúminas totales, con aumento de las globulinas totales, alfa 1, beta y gamma. Se encontró además un aumento de las glicoalbúminas, ligero aumento de la glicoglobulina alfa 1 y disminución de las otras glicoglobulinas.

GUATEMALA

Utilización del calcio del maíz tratado con cal.—J. E. Braham y R. Bressani. **Nut. Bromatol. Toxicol.** 5: 14-19, 1966.

Se determinó la absorción y retención del calcio en ratas alimentadas con maíz adicionado de calcio y con maíz tratado con hidróxido de salcio. El calcio tratado es mejor absorbido y retenido. La adición de lisina aumenta la absorción y retención de calcio en ambos tipos de maíz. 16 referencias.

La erradicación del bocio endémico en Guatemala. Informe final. J. Romeo de León y O. G. Re-

tama. **Nut. Bromatol. Toxicol.** 5: 43-54, 1966.

El bocio endémico mostraba una incidencia del 38.5% en Guatemala en el año 1952. Mediante el uso de la sal iodada (iodato) y un adecuado control de iodo en la sal consumida por la población, ha sido posible reducir esta alta incidencia a cifras de 15% en 1962 y de 5% en 1965. La última tasa indica que, de acuerdo con el criterio de la OMS, el bocio endémico dejó de ser un problema de salud pública en este país. Guatemala es el primer país de América y el segundo en el mundo que erradica esta enfermedad como problema sanitario. 21 referencias.

PERU

Hierro sérico en el recién nacido de la altura.—L. Palacios, C. Reynafarje, J. Ramos y D. Villavicencio. **Arch. Inst. Biol. Andina** (Perú) 2:40, 1967.

Se determinó el hierro sérico en 29 niños recién nacidos a una altura de 3.730 metros y a los tres días de nacidos. Igualmente se determinó en las madres. Al nacer se encontraro ncifras de 190.6 microgramos y a los tres días de 102.71. Los valores maternos fuero nmenores. Los autores postulan que la hipoxia de la altura no tiene influencia significativa en el metabolismo del hierro.

Peso corporal, talla, pulso y tensión arterial del niño en la altura.—J. Macedo Dianderas. **Arch. Inst. Biol. Andina** (Perú) 2:35, 1967.

En 300 niños sanos se determinó peso, talla, frecuencia del pulso y presión sanguínea, encontrándose que el peso y la talla son menores que el standard para niños que viven a nivel del mar. La frecuencia del pulso muestra tendencia a menores valores, especialmente en los mayores; la presión sanguínea es menor. Se discuten los datos desde el punto de vista de aclimatación a la hipoxía crónica ambiental.

Acidos grasos no esterificados plasmáticos en pacientes carenciales. Ramírez Velasco, C. A. **Revista del Cuerpo Médico** (Perú) 5:507, 1966.

En 30 pacientes carenciales se encontró una cifra promedio de 792 μMol/Lt de ácidos grasos no esterificados, lo cual representa un incremento del 25% con variación del 4-5% sobre el valor normal. Se hacen consideraciones sobre este hallazgo. 7 referencias.

Estudio sobre la toxicidad de una muestra de nuez de Brasil con alto contenido de selenio.—Chávez, J. F. (Inst. Nac. de Nutr., Venezuela). **Bol. Soc. Química del Perú** 32: 195-203, 1966.

Se describe el efecto tóxico estudiado en ratas alimentadas con harina de nuez de Brasil (Bertholletia excelsa). De acuerdo a los síntomas observados y al elevado contenido de selenio en la harina usada (51.2 $\pm$ 2.4 p.p.m.), se asocia la toxicidad de la harina con la presencia de este elemento. En otras muestras de nuez compradas al azar el contenido de selenio era menor que 3 ppm. Se ignora la procedencia de las muestras. 18 referencias.

PUERTO RICO

A dietary study of men desiding in urban and rural areas of Puerto Rico.—J. H. Blanton, Maresa Rodríguez, R. Costas, Jr., A. A. Colón, M. Feliberti, H. Benson, R. Aixala & M. R. García-Palmieri (School of Medicine, University of Puerto Rico, San Juan, Puerto Rico). **Am. J. Clin. Nutrition**, 18: 169-175, 1966.

Los hallazgos indicaron que aquellos que vivían en áreas suburbanas consumían más calorías y grasas que los le áreas rurales. El porcentaje de calorías provenientes de proteínas era similar, pero existía diferencia en las fuentes de carbohidratos.

Nutritional status of people in isolated areas of Puerto Rico. Survey of Barrio Mavilla, Vega Alta, Puerto Rico.—N. A. Fernán-

dez, J. C. Burgos, I. C. Plough, Lydia J. Roberts & C. F. Asenjo (División de Nutrición, Departamento de Salud Pública, San Juan, Puerto Rico). **Am. J. Clin. Nutrition**, 17: 305-316, 1965.

Descripción de hallazgos similares a otros países en vía de desarrollo, tales como hiperqueratosis folicular, retardo en crecimiento, infestación parasitaria, etc.

VENEZUELA

El tratamiento de la anemia anquilostomiásica severa y simple. ¿Transfusiones? ¿Sangre?—M. A. Römer. **Acta Med. Ven.** 13: 273-276, 1966.

Se analizan las ventajas del uso del hierro bajo la forma de protoxalato de hierro, sobre las transfusiones sanguíneas en el tratamiento de la anemia anquilostomiásica. Se comentan los riesgos de las transfusiones. 14 referencias.

Efectos depilatorio y citotóxico del coco de mono (Lecythis ollaria). F. Kerdel-Vegas. **Acta Med. Ven.** 13: 277-279, 1966.

Se estudia el efecto depilatorio del coco de mono mediante observaciones clínicas y de experimentación; el efecto citotóxico es estudiano en cultivos de fibroblastos de ratón. Se logró identificar la fracción tóxica, responsable de este efecto, la cual resultó ser un aminoácido selenífero. Se establece la importancia de este hallazgo por sus implicaciones en salud pública. 2 referencias.

La lactancia general. — E. Vizcarrondo, G. Degwitz, R. Delgado Rovati y H. Ceballos. **Rev. Venezolana San. Asist. Soc.** 30: 285-303, 1965.

Se analizan los diferentes tipos de leches usados en la alimentación de los niños, su composición, características y uso. Se enfocan aspectos de la política lechera en Venezuela y se hace un análisis de la legislación sobre leches modificadas.

Clínica de la desnutrición.—F. Castellanos. **Rev. Venezolana San. Asist. Soc.** 30: 495-498, 1965.

Se hace una revisión de las manifestaciones clínicas que se presentan en el síndrome pluricarencial o kwashiorkor, en las formas intermedias, en el marasmo y en el nanismo nutricional.

El problema de nutrición en la madre y el niño. Crecimiento demográfico mundial y abastecimientos alimentarios. — H. Méndez Castellanos. **Rev. Venezolana San. Asist. Soc.** 30: 313-317, 1965.

Se analiza la producción de alimentos en relación a la población mundial, espacios útiles aprovechables de la tierra y en relación a las formas de productibilidad.

La lactancia materna.—N. P. Masse. **Rev. Venezolana San. Asist. Soc.** 30: 361-369, 1965.

Se hace un enfoque de la lactancia materna según que las condiciones socio-económico nutricionales y sanitarias son favorables o desfavorables, comparando en ambos grupos la lactancia materna con la artificial. 51 referencias.

LIBROS NUEVOS

Aumento de la producción y el consumo de proteínas comestibles. Alimento para una población mundial en crecimiento: recomendaciones para una acción internacional encaminada a evitar la inminente crisis de proteínas.—Informe del Comité Asesor sobre la Aplicación de la Ciencia y la Tecnología al Desarrollo. Naciones Unidas, Consejo Económico y Social, 43º período de sesiones, No. E-4343, mayo 1967.

Este importante documento de más de 100 páginas fue preparado por el Comité Asesor sobre la Aplicación de la Ciencia y Tecnología al Desarrollo, basado sobre un documento de trabajo elaborado por el Dr. N. Scrimshaw. Se someten 14 proposiciones específicas que comprenden el estímulo de la producción de fuentes tradicionales de proteínas, reducción de pérdidas, uso de harinas de oleaginosas y de pescado, investigación de fuentes de proteínas de organismos unicelulares, suplementación con aminoácidos y estimular la investigación y enseñanza en el campo de la nutrición.

Cada proposición se explica y discute ampliamente en un anexo que ocupa la mayor parte de la publicación.

Es de esperar que este importante documento encuentre una amplia distribución en los organismos gubernamentales relacionados con la elaboración de planes de producción, fomento e investigación y que ayude a despertar la conciencia mundial para enfrentarse a un problema de suma gravedad mientras que no sea tarde.

W. G. Jaffé

Análisis industrial en la fabricación de alimentos.—N. Czyhrinciw Konradi, M. de Mosqueda y M. Garcés Medina. 182 páginas, Caracas, Litografía y Tipografía Vargas, 1966, Bs. 35.

Distribuido en 17 capítulos, el presente volumen constituye, sin duda, un magnífico esfuerzo del personal del Departamento

de Tecnología de Alimentos de la Facultad de Ciencias de la Universidad Central de Venezuela. Los 6 primeros temas se refieren a las diversas características químicas y físicas de la materia prima vegetal, a algunas constantes químicas y frescura del pescado y carne y a las determinaciones comunes a los productos envasados. En esta forma se prologan eficazmente los capítulos siguientes, destinados a renglones específicos, como Pan, Encurtidos, Salsas, Jugos y Néctares enlatados, Mermeladas, Bebidas alcohólicas, Vinagre y enlatados de Productos de mar y de Productos de carne. En cada uno de estos temas se incluyen las determinaciones analíticas y constantes más importantes y la descripción de los procedimientos y equipo utilizados. De particular interés son las numerosas tablas donde se presentan, en muchas de ellas, resultados obtenidos en el propio Departamento, algunos no publicados hasta ahora. También dignas de mención son las fotografías bien logradas y los excelentes esquemas y diagramas que ilustran las explicaciones. Sin embargo, al lado de la figura 9, la cual muestra el tamaño del kumquat y que carece de comentario alguno en el texto, hallamos en el Capítulo 14 una descripción detallada del salómetro automático CDM-21 y de su funcionamiento, pero sin foto que lo ilustre.

Con objeto de ahorrar espacio y a la vez centralizar la información, hubiera sido mejor incluir entre los apéndices finales, en forma de tabla, la composición porcentual y el contenido de vitaminas y minerales tanto de la materia prima como de los productos terminados, datos que aparecen diseminados en los capítulos respectivos. Creemos que se hubiera ganado más con una mejor castellanización de ciertos términos técnicos, tales como "pH metro" y "osterizer", a la vez que con algunas modificaciones de estilo. Puede concluirse que se trata de una obra de gran utilidad práctica; en ella se encuentra vertida la experiencia y vastos conocimientos del Profesor Czyhrinciw, por lo cual la estimamos como altamente recomendable no sólo para el estudiante, sino también para el técnico especializado de la industria de alimentos.

J. F. Chávez

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