This survey was undertaken to measure the public health significance of malnutrition in early childhood in Haiti. Protein-calorie malnutrition was found to be widespread in this age group, and the authors estimate that one out of 14 children were likely to have been suffering from kwashiorkor at the time of the survey.

PREVALENCE OF PROTEIN-CALORIE MALNUTRITION IN HAITIAN PRESCHOOL CHILDREN

D. B. Jelliffe, M.D., F.A.P.H.A., and E. P. Patricia Jelliffe, S.R.N.

IT IS GENERALLY recognized that malnutrition represents one of the most important health problems in the Republic of Haiti, and that this is particularly so in young children is suggested by the commonness of cases of kwashiorkor in the larger towns.

The main purpose of the present survey was to attempt to measure the public health significance of malnutrition in early childhood in Haiti by estimating its prevalence on a country-wide basis. With this in mind, a small mobile team spent a two-month period visiting a total of 24 rural villages distributed throughout all five of the country's Departements, as well as two groups of children in the slum areas of the capital, Port-au-Prince (Figure 1). In all, 1,322 children were examined in the vulnerable one-three-age group.

Methods

Owing to very poor rural communications, scattered houses in mountainous regions, movement of villagers on the very frequent market-days and other factors, day-to-day selection of suitable circumscribed population samples presented difficulties; while all practical procedures employed had to be simple, rapid, and requiring very little indestructible equipment capable of being transported for long journeys by jeep on mountain tracks.

Basically, in each village the complete child population aged between one and three years was weighed and examined clinically according to a nutritional schedule described elsewhere.[1] All the children were of predominantly African descent and of the lower socio-economic group.

Protein and Calorie Deficiency

While clinical cases of classical pediatric deficiency disease, such as rickets and scurvy, were very uncommon, it was found that malnutrition probably due to various combinations of protein and calorie deficiency was widespread.

Methods of Assessment

Three main simple modes of clinical assessment appeared to be available for use in the field in order to measure the prevalence of malnutrition due to pro-

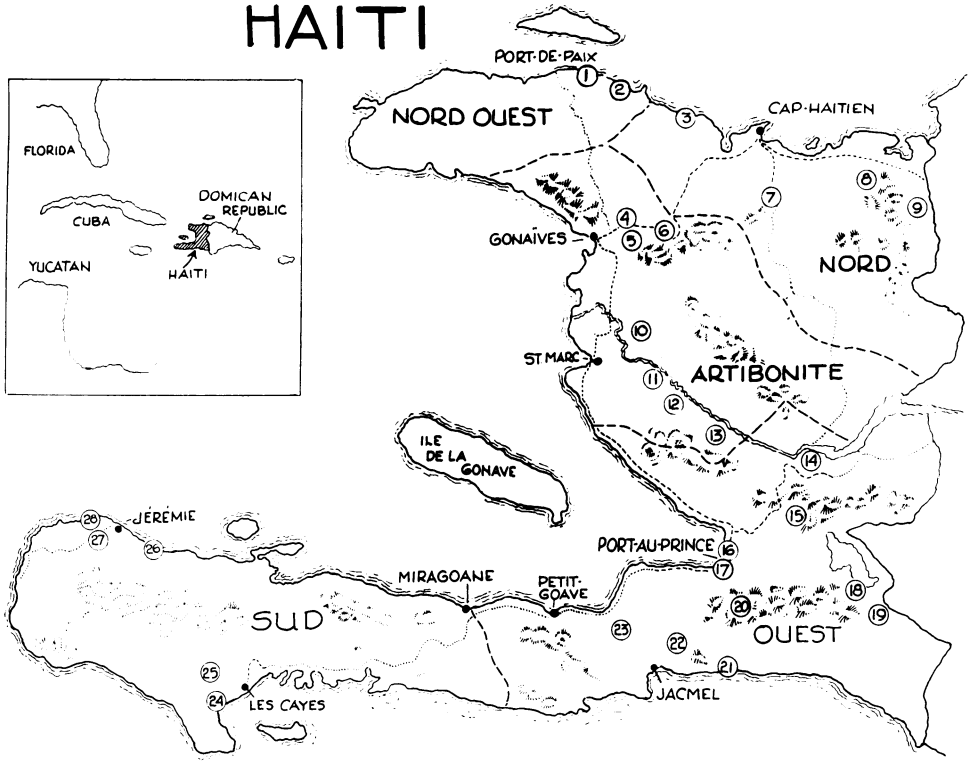

Figure 1—Haiti, Showing 24 Villages and Two Slum Areas Surveyed. (Villages No. 3 and 23 not included in analyses owing to incomplete examination of child population.)

tein-calorie deficiency in this age-group. All had certain errors and limitations, and they best can be regarded as giving mutually complementary information.

1. Assessment by Syndrome

An attempt was made during the survey to record the number of children whose general condition fitted into such recognizable clinical pictures as could be termed syndromes. The difficulty here, as appreciated by all working in this field in tropical pediatrics, is that—presumably as a result of such variable factors as types of weaning foods, length of breast feeding, presence and burden of intestinal parasites, associated infections and inherent genetic difference—a kaleidoscopic variety of clinical pictures can, and does, occur, often being difficult or impossible to classify with certainty.

Nevertheless, the following four syndromes were looked for in each village, diagnosis being made on the spot by clinical inspection.

(a) Kwashiorkor—This well recognized syndrome, probably due to severe protein lack in rapidly growing children, with some adequate or even a high intake of calories in the form of starchy largely carbohydrate foods, was the most objectively identifiable. Criteria for diagnosis were pitting edema (at least in the pre-tibial region), an obviously low body weight, wasted muscles, with at least relatively "normal" overlying subcutaneous fat, and apathy, as evidenced by silent listless inertness, even during the minor trauma of finger-pricking. Some degree of "moon-face" was usually present. One or more of the following

"variable" signs were often found, but were not regarded as necessary for diagnosis: hair changes (hypochromotrichia, sparseness, silkiness, straightness, pluckability), hepatomegaly, classical "flaky-paint" dermatosis, and signs of associated vitamin lack, especially ariboflavinosis.

(b) Incomplete Kwashiorkor—It has long been appreciated that, if classical cases of kwashiorkor are to be seen, then, equally, other less completely affected children must also occur. Apart from uncertainty in establishing criteria for diagnosis, it is also difficult to know what to term these cases. "Pre-kwashiorkor" has been suggested, but can be rejected, as many of these children may never go on to develop the complete picture. It would seem better temporarily to call these cases "mild" or "incomplete" kwashiorkor.

The criteria for diagnosis are the same as listed for kwashiorkor, save that edema is not present. It will then be appreciated that the diagnosis of this condition in the field was based largely on inherently inaccurate clinical judgment of low body weight, wasted muscles with relatively normal subcutaneous fat, and apathy.

(c) Nutritional Marasmus — Diagnosis of this syndrome, probably due to an extremely low intake of all nutrients, including protein, was based on the clinical picture of a very low weight. with marked wasting of both muscle and subcutaneous fat, without edema, or significant apathy. Associated signs of avitaminoses and hair changes were sometimes present.[2]

(d) Nutritional Dwarfing — Children with what is here called "nutritional dwarfing" presented clinically as being obviously considerably underweight and undersized, while, at the same time, having relatively normal body proportions, including muscle and subcutaneous fat relatively proportional to their body size. Apathy was not present and there were usually no other physical stigmata. These undersized, stunted children may be considered as due to severe growth retardation as a result of an inadequate, but relatively balanced, diet.

Results

The prevalence of kwashiorkor in the five Departements and the one slum group varied from 3 to 16 per cent, with an average for the whole country of 7 per cent. (Because of the diagnostic significance of edema, these results are identical with those for the "edema index.") (Table 1.)

As expected the prevalence of "incomplete kwashiorkor" was higher than classical edematous kwashiorkor, being 10 per cent for the whole group. Nutritional marasmus was found in only 2 per cent and nutritional dwarfing in 7 per cent of the combined Departements (Table 1).

2. Assessment by Nutritional Indexes

Alternatively, attempts to assess the nutritional status of preschool children

Table 1—Prevalence of Certain Nutritional Syndromes in Haitian Preschool Children in Different Regions of the Country

Departement	Number of Villages or Groups	Number of Children	Kwashiorkor No.	Kwashiorkor %	Incomplete Kwashiorkor No.	Incomplete Kwashiorkor %	Nutritional Marasmus No.	Nutritional Marasmus %	Nutritional Dwarfing No.	Nutritional Dwarfing %
Nord-Ouest	2	86	8	9	6	7	2	2	5	6
Nord	3	171	28	16	19	11	3	2	13	8
Artibonite	7	300	13	4	34	11	1	0	16	5
Ouest	7	416	22	5	40	10	16	4	36	9
Sud	5	217	13	6	20	9	2	1	18	18
Combined Departements	24	1,190	82	7	119	10	24	2	88	7
Urban slum	2	132	4	3	14	11	–	–	–	–
Total combined	26	1,322	86	7	133	10	–	–	–	–

in a tropical country, such as Haiti, can be made from data obtained in the following three ways:*

(a) Vital statistics (i.e., one-four-year-old mortality rate).

(b) Laboratory tests (i.e., plasma proteins, liver histology, and chemistry).

(c) Clinical nutritional indexes.

In the present type of field study, the collection of suitable vital statistics was impossible. The principal laboratory examination, which might have yielded useful results, would have been an assessment of the total and differential plasma protein levels, although interpretation might have been difficult in view of such possible variable influencing factors as liver damage, intestinal helminths, and malarial infection. However, it was not possible to carry out this test, principally because of problems with relation to taking blood from the external jugular or femoral veins of these small children in the remote villages visited and the effect of this procedure on the unsophisticated peasant mothers concerned. A further problem would have been transport, not only refrigeration, but, more difficult to overcome, the mechanical hemolysis of the blood samples resulting from several hours journey by jeep over very poor roads. Liver biopsies were also plainly impossible to carry out under field conditions.

Reliance had, therefore, to be placed on the use of certain stigmata or measurable physical signs which were felt might be used as public health indexes of nutritional status, in the same approximate way that the splenic index is employed in malarial surveys. Of the numerous physical signs recorded during the present survey, only three were considered as sufficiently constant as to be potentially useful as nutritional public health indexes[3]: (1) edema, (2) arm muscle and fat measurements, and (3) hair changes. (Deviation of body weight could also be added here as a fourth index, but, in view of its special significance, it can be best considered separately later.)

(1) Edema — According to most authorities, the two principle objectives, easily measurable and constant physical signs in the syndrome of kwashiorkor are the low body weight and edema, beginning in the feet, ankles, and lower legs.

Edema was tested for in the pre-tibial region. Initially, moderate pressure was used with one finger for a period of twenty seconds, but this was soon shortened to three seconds in view of the confusion arising from the slight pitting produced in normal children by prolonged pressure, especially in the hot weather found in Haiti during the summer months. In addition, the rule was adopted that if there was any doubt as to the validity of the pitting test, then edema was not recorded.

Results

The one to three-year-old edema index varied from 0 per cent to 23 per cent in different villages in Haiti (Table 2); while the figure among the slum children was 3 per cent. The over-all prevalence of edema in this age group in all the villages and two slum areas was 7 per cent. (A detailed consideration of possible reason for this variation will be given elsewhere.)

Theoretically, other possible causes of edema in this group required differentiation, especially the nephrotic syndrome, severe hookworm anemia, and quartan malaria. In actual fact, all children with edema in this age group were found to be suffering from kwashiorkor, although field tests of the stools and blood film had to be carried out with a portable McArthur microscope in some cases.[4]

(2) Arm Muscle and Fat Measure-

* Dr. J. Bengoa. Personal communication.

Table 2—Prevalence of Edema in One to Three-Year-Old Children in 24 Rural Villages in All Departements of Haiti

Departement	Nord-Ouest		Nord			Artibonite						
Village	Berger	Carenage	Grand Bassin	Dosmond	Carrefour Menard	Castra	Drouet	Poterie	Hautes Feuilles	Passerelle	Bassin	Miguette
Number examined	70	16	53	43	75	49	37	28	49	47	70	20
Number positive	6	2	7	10	11	2	2	3	1	3	1	1
Per cent positive	9	13	13	23	15	4	5	11	2	6	2	5

Departement	Ouest							Sud				
Village	Petit Mouillage	Poste Pierre	Trou Caiman	Furcy	Dosmond	Les Roches	Fond Parisien	La Corrier	La Borde	La Ferme	Trou Bonbon	Gaumier
Number examined	63	43	67	29	66	26	122	41	30	55	45	46
Number positive	2	0	1	2	4	4	9	2	3	4	2	2
Per cent positive	3	0	2	7	6	2	7	5	10	7	4	4

ments—It would seem possible that a useful, rough gauge of depletion of protein and calories may be obtained by directly measuring the body's principal stores—that is of subcutaneous fat as an index of calorie adequacy, and of voluntary muscle for evidence of protein depletion.

Simple measurements of this sort were carried out on most of the groups of children studied. The middle of the right upper arm, overlying the center of the belly of the biceps, was chosen because of its easy accessibility while the child was sitting on his mother's knee, the relatively circular nature of the limb at this point, the minimal involvement with edema, and the fact that other investigators have also used this site. Two measurements were made: (a) the arm circumference, and (b) the biceps skinfold (measured with standard pressure calipers over the anterior surface of the middle of the belly of the biceps muscle).

Calculations—A cross-section through the middle of the upper arm shows that, excluding vessels and nerves, the limb can be visualized there as made up of two concentric circles—a smaller inner one formed by the humerus together with surrounding muscle, and also an outer circle formed by the actual arm circumference, containing humerus, muscle, and a thin peripheral ring of subcutaneous fat and skin (Figure 2).

Measurements of either the diameter or the circumference of the humerus are not possible without radiological assistance and, in the present calculations, it is assumed that this bone does not vary as markedly in diameter in malnutrition as does the overlying fat and especially the muscle tissue, and its variations are ignored.

Of the two measurements already referred to, the arm circumference (C_1) is in fact the circumference of what may be termed the muscle and subcutaneous fat compartments; while the skinfold (s)

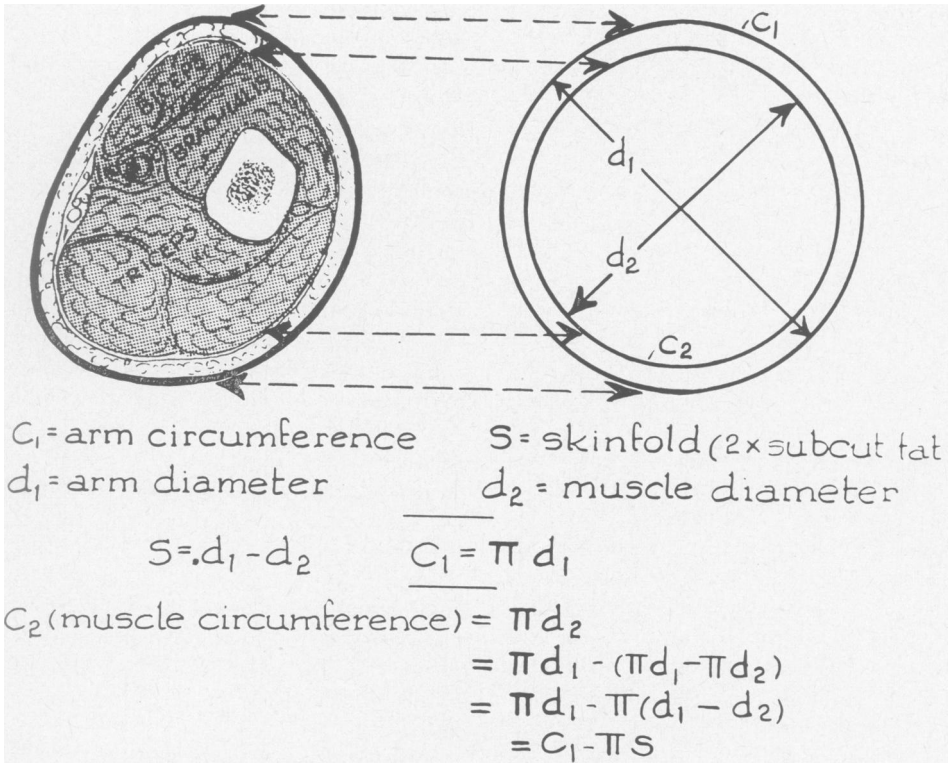

Figure 2—Calculation of Muscle Circumference.

represents twice the actual thickness of the subcutaneous fat. (As noted by Hammond, the skinfold measured is in fact a parallel-sided fold composed of two thicknesses of subcutaneous fat and skin.[5])

Using these two measurements, it is possible to calculate the circumference of the "inner" circle composed principally of muscle (C_2):

C_1 = measured outer or arm circumference
s = skinfold thickness (i.e., twice the subcutaneous fat)
d_1 = diameter of arm; d_2 = diameter of muscle compartment
$s = d_1 - d_2$
$C_1 = \pi d_1$
$C_2 = \pi d_2 = \pi d_1 - (\pi d_1 - \pi d_2)$
$= \pi d_1 - \pi (d_1 - d_2)$
$= C_1 - \pi s$

Results

Two problems require consideration. First, the question of age (which will be considered later) and second, the absence of standards. The latter deficit was kindly made good by Dr. Verity Wills of the Medical Research Council Tropical Metabolism Research Unit, University College of the West Indies, Jamaica, who made available results of a large series of measurements of both biceps skinfolds and of arm circumferences in mainly "normal" Jamaican children of similar ethnic type—that is of mainly West African descent—to those examined in Haiti.

Based on these Jamaican figures, together with personal observation of the range of results between apparently nor-

mal Haitian preschool children and those with kwashiorkor, arbitrary levels were selected for "low arm circumferences." For children from 12 to 24 months, this was taken as 14.25 cm, and for the older children, 25-36 months, 14.5 cm. Both levels represent about 80 per cent of the Jamaican average figures.

In the 19 groups examined in this way between 60 and 88 per cent were found to have a low arm circumference with an over-all average of 69 per cent.

Calculation of the muscle circumference was undertaken in the seven villages and two slum groups where skinfold measurements had been taken. Again arbitrary levels were selected based both on personal experience in Haiti and on calculations from the Jamaican figures. A low muscle circumference was recorded with results of 12.5 cm or below 12-24-month-old children, and with 13 cm or lower for 25-36-month-olds. (Again these levels represented about 80 per cent of the average for Jamaican children.) In the seven villages of children so examined, 67 per cent showed a low muscle incumference.

(3) Hair Changes—Four hair changes were recorded in all the children examined — sparseness, straightness, silkiness, and lightening of color. Details of the standards used and results obtained are to be given elsewhere. In brief, it may be noted that the possibility of employing a "hypochromotrichia index" as a gauge of protein malnutrition, as suggested by an earlier investigation in Jamaica did not, in fact, appear to be straight-forward, owing to the lack of a clear-cut association of hypochromotrichia with nutrition alone.[6]

An additional sign was looked for in the last 14 villages and in the two slum groups. This followed a suggestion by Dr. J. Bengoa, who advised us of attempts by Central American workers to use abnormally easily pluckable or detachable hair (pelo facilmente desprendible) as a nutritional index of protein malnutrition. The test is carried out by grasping a small clump of hair between the index finger and thumb over the crown of the head and pulling firmly for a second or two. Normally just a few hairs are pulled out, whereas in kwashiorkor a large number (i.e., 20-40) are removed both easily and painlessly.

Results

In the 14 villages so examined, easily pluckable hair was present in from 10 to 65 per cent, with an average of 52 per cent.

3. Assessment by Weight Deviation

For some years the Mexican school of nutritionists, under the direction of Dr. F. Gómez, have advocated the classifying of malnutrition in early childhood into categories or degrees depending upon the percentage deviation of the weight below the average or mean for the group (i.e., first degree malnutrition from 75 per cent to 90 per cent of the average weight, second degree from 60 per cent to 75 per cent, and third degree below 60 per cent).[7]

As no Haitian standards are available, the average weights drawn up from mainly "normal" Jamaican children by Dr. Verity Wills were employed.* As usual with this type of survey in a rural tropical peasant group, difficulties were encountered with regard to the children's ages. In a very few cases, birth certificates (extraits de naissance) were easily available, while, in a surprisingly high percentage, mothers did not know the child's exact age, but could recite the day, month, and year (and even the hour and day of the week) of the child's birth.

In the rest of the mothers, it was possible to arrive at least at the year of age, which could then be checked by refer-

* These figures are themselves 20 per cent below average American figures.

Table 3—Comparison of Nutritional Status of One to Three-Year-Old Haitian Children in All Five Departements and Two Slum Regions as Assessed by Edema, Low Arm Circumference, and Degree of Malnutrition by Weight Deviation

Departement	Number of Villages or Groups	Number of Children	Edema		Low Arm Circumference		Deviation of Weight							
							1st Degree		2nd Degree		3rd Degree		Combined	
			No. Positive	% Positive	No. Positive	% Positive	No. Positive	% Positive	No. Positive	% Positive	No. Positive	% Positive	No. Positive	% Positive
Nord-Ouest	2	16	6	9	58/74	78	35	41	29	34	1	1	55	64
Nord	3	171	28	16	108/121	88	63	37	65	38	13	8	141	83
Artibonite	7	300	13	4	–	–	102	34	44	15	6	2	158	59
Ouest	7	416	22	5	257/376	68	156	38	59	14	8	2	223	54
Sud	5	217	13	6	136/226	60	79	36	47	22	7	3	133	61
Combined	24	1,190	82	7	557/797	70	435	37	244	21	35	3	710	60
Slums	2	132	4	3	58/92	63	40/94	43	22/94	23	2/94	2	64/94	68
Combined Slums and Departements	26	1,322	86	7	369/968	69	475/1,284	37	266/1,284	21	37/1,284	3	774/1,284	60

ence to the date of local events, both political and natural. It may be noted that in this relatively young age group (one-three years), peasant mothers usually know how old their children are, but become less certain as the years pass and the particular child increases in age and is succeeded by younger siblings.

In the present survey, if the age was known with reasonable certainty, the weight recorded was compared with the Jamaican average for this exact age group. If, however, only the year of age was known, the Jamaican standard used was that of half-way through this year. Thus all children noted as being two years of age were compared with the Jamaican average for two and a half years.

Results

Classification of children seen in the five Departements and slum group into the three degrees of malnutrition showed: first degree from 34 to 43 per cent; second degree from 14 to 38 per cent, third degree from 1 to 8 per cent. The over-all average in the three degrees was respectively 37 per cent, 21 per cent, and 3 per cent (Table 3).

Discussion

Limitation of Methods

All the methods of assessment employed were found to have various limitations, disadvantages, and inaccuracies.

(1) Assessment by Syndrome—With exception of the kwashiorkor group, the lack of objectivity of this method meant that it was of relatively slight value for comparative statistical purposes. Many malnourished children could not be pigeon-holed in any of the four syndromes listed — the different clinical types of malnutrition in this age group make up a continuous spectrum with many intermediate and indeterminate forms.

This method, although it will always remain mainly based on clinical inspection, plainly needs to be refined by correlating the results with measurements of the weight, height, arm muscle, and subcutaneous fat. In turn, this might enable a more precise definition of the various major syndromes by attempting to formulate certain diagnostic levels of weight, height, and proportion of muscle to fat.

However, even if this refining of syndromal assessment were possible, it would still remain an incomplete measure and too uncertain and time-consuming for routine public health work in the field.

(2) Assessment by Nutritional Indexes—Of the possible clinical indicators, the presence of pre-tibial edema is the most clear-cut, provided other uncommon nonnutritional causes of edema are kept in mind and excluded. However, the one to three years edema index has the obvious disadvantage that it only measures the prevalence of one severe form of protein-calorie syndrome, that is kwashiorkor, and gives no assistance in estimating the commonness of incomplete cases or of other syndromes.

Muscle and fat measurements have as yet been used insufficiently in the field of tropical pediatrics, and, as with all anthropometric data, the lack of standards remains a limiting factor.

Moreover, in the arm measurements described and in the calculations made from them, certain approximations must be recognized. First, the arm circumference and the underlying muscle do not in fact form exact circles. The subcutaneous fat varies at different parts of the normal child's arm circumference, being thicker over the triceps than the biceps; while alterations in fat deposits or of muscle thickness in malnutrition in this age group may not be uniform all over the body, so that the biceps

skinfold and the mid-upper arm measurements may not be representative. In addition, the measurements made are entirely linear, whereas the tissues to be measured—subcutaneous fat and muscle—ideally require assessment by volume or by weight.

Apart from its value as an actual measure of subcutaneous fat, the biceps skinfold (or possibly an average value obtained from the skinfolds over the biceps, triceps, and medial and lateral aspects of the upper arm) is needed to calculate the muscle circumference, and, although the calculation already outlined (based on the formula $C_2 = C_1 - \pi s$) is a simple one, it is necessary to consider if this is necessary, not from an anthropometric point of view, but when attempting to use muscle wasting as a nutritional public health index.

In all protein-calorie syndromes in this age group, with the exception of certain cases of kwashiorkor (especially the so-called "sugar-babies"), deficient muscle appears to be accompanied by a slight or marked lowering of thickness of subcutaneous fat, so that a "positive" low muscle circumference is always accompanied by a low arm circumference. Conversely, any severe decrease of the much smaller "compartment" formed by the subcutaneous fat appears to be always accompanied by marked muscle deficit, as, for example, in both nutritional marasmus and nutritional dwarfing.

However, certain more fatty cases of kwashiorkor, especially in the occasional child with "sugar-baby" kwashiorkor, which is seen in Haiti as in Jamaica,[8] there exists the possibility that increased subcutaneous fat may sometimes "compensate" in thickness for underlying wasted muscle. That this can very occasionally occur in the extreme sugar-baby type of kwashiorkor was confirmed in the present survey.

It is then suggested that, for practical public health purposes, the "positive" low arm circumference can tentatively be equated with a low muscle circumference and hence considered as an index of wasting or poor development of muscle. This appears to be confirmed by the close similarity of these two indexes—low arm circumference (73 per cent) and low muscle circumference (67 per cent)—in the seven Haitian villages where both measurements were made.

With regard to the presence of easily pluckable hair, certain problems and ambiguities have to be considered. First, it is a difficult test to define precisely, with such variables as how hard the observer pulls and how many hairs so plucked constitute a positive result. In addition, local scalp conditions, such as extensive infected seborrhoea, are common in this age group in Haitian village children and appear also to be associated with easily pluckable hair. Also, a practical point deserving consideration is that children in this age group, especially boys in the third year of life, frequently have their hair either shaved or cut very close so that testing for this sign becomes impossible.

More importantly, it has not yet been established that easily pluckable hair is either a relatively constant feature of protein-calorie malnutrition (with the exception of kwashiorkor), or, conversely, that it cannot occur with other diseases, such as anemia.

However, despite these criticisms, and despite the obvious need for further standardization of the test and for investigation of its correlation with malnutrition, it certainly deserves further trial as a simple field index.

(3) Assessment by Weight Deviation—The Gómez system of classification by weight deviation has certain limitations. Obviously, unless carefully excluded, wasted children with infective disease, such as tuberculosis or with dehydration, may be included and, indeed, in some cases it may be an academic consideration as to whether or not they should be

included as examples of secondary or conditioned malnutrition.

Second, the Gómez classification plainly does not differentiate between the different forms of malnutrition, that is between the various syndromes, although, and of as much importance, it does permit an approximate grading as to prognosis. Thus, although children with third degree malnutrition in a village will usually comprise both cases of kwashiorkor and nutritional marasmus, all will be seriously ill children with a poor prognosis. In fact, in some situations, the classification by weight may aid in formulating public health policy as to the disposal of malnourished children detected in the health clinics.

This classification is undoubtedly one of the most important devices for measuring the public health significance of protein-calorie deficiency disease in this age group, as in each syndrome a low body weight is a constant finding. Differentiation into the three degrees permits a grading of the nutritional status of a preschool child population which cannot be achieved in any other way.

It is therefore suggested that the simplest and most reliable field method of assessing the prevalence of protein-calorie deficiency in preschool tropical children is by a combination of (a) the edema index, (b) the Gómez weight classification, and (c) the low arm circumference index. The apparatus required for these tests is very simple and junior staff can easily be trained to perform them. The main difficulty will be in setting up standards for the last two methods.

Other possible parameters—based on syndrome, subcutaneous fat, calculated muscle circumference, and easily pluckable hair—may give valuable ancillary information, but either require more elaborate methods and much greater expenditure of time, or are based on standards which are, at least at present, even more difficult to define.

Situation in Haiti

The actual situation in Haitian preschool children in the lower socioeconomic group can then be considered in light of figures obtained during the survey for the three main nutritional indicators mentioned above in the country's five Departements and the combined urban slum group (Table 3).

As can be seen, there is a considerable, but not complete, parallelism between findings in the three categories, particularly marked, for example, in the uniformly low results in the Departement du Nord. Possible reasons for the differences in both villages and Departements will not be discussed in the present short account, but will be dealt with in full elsewhere.

In broad terms, however, the survey has demonstrated that, in contrast with the uncommonly seen classical textbook nutritional syndromes, protein-calorie deficiency is widespread in this age group and forms a huge public health problem. Thus, of the whole 1,322 children examined the edema (or kwashiorkor) index was 7 per cent, suggesting that, in this age group at this socioeconomic level and in the country as a whole, approximately one out of 14 children were likely to have been suffering from kwashiorkor in the summer of 1958 at the time of the survey.

That other severe forms of malnutrition due to protein-calorie lack are common is suggested by the classification of the children by weight deviation, which shows 37 per cent with first degree malnutrition, 21 per cent with second degree, and 3 per cent with third degree, giving an all-embracing figure of 60 per cent for children seen in the survey with first, second, and third degrees of malnutrition.

Lastly, confirmatory evidence of widespread protein-calorie deficiency is indicated by the fact that 69 per cent of all the children examined showed what

was considered to be an abnormally low arm circumference, probably principally related to wasting or poor development of muscle tissue.

All in all, the survey results suggest that, whereas the prevalence of kwashiorkor is 7 per cent, some degree of malnutrition due to deficiency of protein and calories is much commoner and affects about two-thirds of the present-day Haitian one to three-year-old children in the lower socioeconomic group.

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Occupational Importance of Ionizing Radiation

Even if one considers only the occupational aspect of radiological health, its scope and predictable growth are truly formidable: It is estimated that 175,000 persons are currently employed in atomic energy industry. Thousands of other workers are engaged in operations involving the use of x-rays and radioactive substances. Two thousand hospitals and other institutions are licensed to use radioisotopes for medical purposes. . . . The rapid growth in the past few years in the number of workers dealing with radioactive materials is as nothing compared with the growth we shall see in the immediate years ahead.

(David E. Price, M.D. Is Man Becoming Obsolete? Public Health Reports, August, 1959.)