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Comparison of Haitian children in a nutrition intervention programme with children in the Haitian national nutrition survey*

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Weight-for-height and height-for-age data were compared for preschool-age Haitian children enrolled in a community health and nutrition intervention programme and children measured in the Haiti national nutrition survey of 1978. Cross-sections of the longitudinal data of the intervention programme corresponding to the season when the national survey was conducted (May to September) were chosen for the three years of available programme data (1969, 1970, 1971). Significantly less stunting was found in children in the 1970 and 1971 intervention group than in the children covered by the national survey. Tests of trend also showed that the height (or length) status of the children in the intervention programme improved from 1969 to 1971. Wasting, or low weight status, was in general not significantly different in any of the comparisons. Nevertheless, the data were more favourable to children in the intervention groups, even in 1970, a year of food shortages. The results of the comparison are consistent with a positive programme effect.

In many parts of the world, health and nutrition monitoring programmes are carried out to measure the weights and often the heights[a] of children over a period of time. Growth charts plotted using these data will indicate any irregularities in a child's growth performance, and aggregated data may also be used by local health personnel to interpret the impact of a nutrition or health programme on children. The data from these monitoring programmes may also be compared with data from nutrition surveys, like those conducted by the Centers for Disease Control (*1*). Such comparisons are, however, problematic since the monitoring programmes are longitudinal, whereas the surveys are cross-sectional in nature. Here, we compare data collected from a health and nutrition monitoring and intervention programme carried out in rural Haiti with data obtained from the Haiti nutrition status survey (*2*). For this purpose, we developed a method for comparing the two data bases that permits the extraction of cross-sectional information from a longitudinal study. The differences in growth between the two groups facilitate evaluation of the effectiveness of the nutrition monitoring and intervention programme. Another indicator of the programme's effectiveness, reduced childhood mortality rates in the study population, has been described elsewhere (*3*).

BACKGROUND

Malnutrition in Haiti has been reported since the 1920s, when a "mysterious swelling disease" was described (*4*). More recently the efforts of the Haitian Bureau of Nutrition to reduce protein-energy malnutrition by educating mothers on how to prepare weaning foods from locally available ingredients has met with partial success (*5, 6*); protein-energy deficiency resulting in oedema (kwashiorkor) is therefore disappearing, despite a worsening economic situation. In 1961 the frequency of nutritional oedema in Haitian children was 7% (*7*), but by 1978 this prevalence was found by the Haiti National Nutrition Survey to have been halved (*3*). Nevertheless, 27% of Haitian preschool-age children continue

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[a] Height is used here to mean either the standing height of a child or the recumbent length of a child.

to suffer from moderate to severe malnutrition by Waterlow standards, and frequent infections, especially diarrhoea, contribute to this problem.

Rural Haitian children are normally breast-fed until approximately 21 months of age (*8*). The relatively high mortality rate among children aged 12–24 months (*6, 7*) coincides with the period when most children are weaned. The special vulnerability of Haitian 1–4-year olds to malnutrition and death is determined partly by certain feeding practices common to rural Haiti. The averge daily per capita energy intake in Haiti, measured by several dietary surveys, is about 6.3 MJ. Most of this energy is supplied by rice or corn, and in some regions sweet potatoes, yams, as well as cassava are important items of diet. Children suffering from diarrhoea and its after-effects may not be offered these foods because of cultural beliefs held by their parents.

In rural Haiti, one principal meal is prepared and consumed per day. However, in the Artibonite Valley area, where the nutrition programme discussed in this study was conducted, very small meals, in addition to the major meal, are eaten at different times of the day. Since young children are less able than adults to absorb their total energy intake from one large meal, they tend to be more deleteriously affected by these eating practices than adults (*9*). Although Haitian bean and cereal mixtures are complementary with respect to amino acid composition, and traditional practices dictate the mixing of grains and legumes, mothers of malnourished children in the rural areas pay little attention to the proportion of beans and cereals they use to prepare their meals. Diets of such children may therefore be lacking in certain essential amino acids. Furthermore, cooking oil is expensive in Haiti and the small amounts added to foods do not contribute much energy.

Several major nutrition surveys have been performed in Haiti over the past quarter of a century and these have provided useful information in estimating the prevalence of malnutrition among children (*1, 7, 10*). Here, we compare the distribution of anthropometric measurements in a rural population undergoing an aggressive, community-based, nutrition monitoring and intervention programme with measurements obtained from Haiti's most recent and comprehensive national health and nutrition survey (*2*), which was conducted by the Bureau of Nutrition, Department of Public Health and Population of the Republic of Haiti, and the Centers for Disease Control between May and September 1978 (*11*). The monitoring and intervention programme was carried out by community health staff from the Albert Schweitzer Hospital in Deschapelles, from 1968 to 1974. During the summer of 1970, there was a shortage of food in the rural areas, and people had to depend for their diets more on irrigated crops, such as rice, and less on corn and millet.

The study area, encompassing 23 rural villages in a 26 km^2 area surrounding the hospital, was located in the Artibonite region of the country, which is one of the five rural sampling regions covered by the Haiti national health and nutrition survey. The study area is largely agricultural with both non-irrigated upland farms and low-lying irrigated plains. Because of extensive community health services provided by the hospital, the mortality rates in the area are much lower than those for the rest of the country (*3*). During the term of the project, infant mortality dropped from 86 to 33 deaths per thousand live births, and age-specific mortality rates among 1–4-year olds were approximately one third the national average.

MATERIALS AND METHODS

Field methods

National Health and Nutrition Survey. For the purposes of this survey, Haiti was divided into six sampling regions; five were rural and the sixth was the urban area of Port-au-Prince. Sampling was performed using a two-stage population proportional method, the details of which have been published previously (*12*). Each child is represented by a single set of height and weight measurements taken on one occasion between May and September 1978.

Intervention Programme and Growth Survey. The families of the children studied in the intervention and growth survey programme were poor, with small landholdings of a few hectares, a few chickens or pigs, and occasionally a vegetable garden. Most families had planted some corn and/or millet along with yams in upland areas, and some families grew rice in the lowland areas.

The programme examined 2700 children aged 0–6 years and measured their weights and heights as a means of detecting those in need of nutritional rehabilitation. The children were brought by their parents to monthly health rallies held in the rural villages from the summer of 1968 until December 1970. Measurements were made quarterly beginning in January 1971. In order to ensure that no child was inadvertently excluded from the programme, voluntary collaborators at the Albert Schweitzer Hospital helped to register every family living within the 26 km^2 area surrounding the hospital. All children under 5 years of age were enrolled in a special programme of health maintenance and were followed up until their sixth birthdays.

In addition to routine measurements, the children were immunized, underwent oral rehydration treatment, received anthelmintics, and were treated for serious illnesses. Children weighing less than 80% of the Harvard weight-for-age "standard" or having oedema were enrolled, together with their mothers, in a nutrition education and rehabilitation unit which treated the children over a 3-month period, while their mothers were being taught. During the course of the study, 650 of the 2700 children received special rehabilitative care.

If no place in the unit was immediately available, children with third-degree malnutrition (Gomez classification) or who showed no net weight gain in the previous 6 months were given a ration of dry skimmed milk with sugar and oil added[b] every 2 weeks for at least 3 months, and the mothers were instructed in how to mix the milk properly. Home visitors monitored the use of the milk, which was always prescribed as "medicine" for the sick child. While they could not always guarantee that the milk was not shared with siblings, it appeared that in most cases it was administered to the child for whom it was prescribed.

During the summer of 1970, when near-famine conditions prevailed in Haiti, the voluntary collaborators in the villages reported increasing numbers of migrants, many of whom were malnourished children, in the intervention region.

Some children were lost to follow-up studies, while others were added to the measurement protocol after the study had begun. The number of measurements associated with a particular child ranged from 3 to 37, with the interval between consecutive measurements for a given child varying from 2 weeks to 6 months.

Determination of the ages was straightforward for the 40% of children with birth certificates and for those who were born during the study. The dates of birth of most of the remaining children in the survey were obtained by inspection of hospital records. If a child had moved into the neighbourhood and had no birth certificate or if the birth was not certified in some other way, the mothers were questioned carefully in order to determine the child's birth date.

Children were weighed using spring balances[c] of 30-kg capacity. These could be easily operated by the mothers and were easily transported. Balances were calibrated periodically to an accuracy of 50 g and were zeroed daily.

Measurement of length was carried out by two health workers using measuring boards constructed locally. These consisted of a fixed foot-piece, a movable head-piece, and a steel measuring tape attached to the side of the board. All measurements of length were made with the children supine. The calculations were adjusted to the percentage NCHS/CDC reference values for children over the length tabulations, developed by the US National Center for Health Statistics (NCHS), and the Centers for Disease Control (CDC), Atlanta, GA, USA.

The persons weighing or measuring the children were literate farmers who had been recruited locally and received constant supervision; a nurse or physician was always present while the measurements were being made.

[b] The supplementary food consisted of 1.2 kg of powdered skimmed milk fortified with vegetable oil and sugar in the ratio 4:1:1 by weight. The daily ration contained approximately 1.5 MJ of energy and 20 g of protein.

[c] Detecto Co., New York, USA.

Analytical methods

Since height is much less labile than weight, it is a more reliable indicator of chronic levels of malnutrition; and because an effective nutrition intervention would be expected to increase height-for-age among the participants, we have concentrated on differences in height. However, weight-for-height should also be considered since it is important to detect levels of acute malnutrition.

Variations in the heights of each child monitored in the intervention programme that were due to measurement errors were largely removed using a cubic spline-smoothing technique (*13*). This produced a smooth curve that closely follows the original data of height measurements (*14*). Distributions of the spline-smoothed data were calculated and averaged for the entire population of children in the intervention study. Any percentile values of these smoothed data could therefore be plotted for the entire ranges of ages in the study. To compare the cross-sectional data of the national survey, the percentile values of height at monthly ages were calculated. These percentile values from the national survey were then subjected to cubic spline smoothing as was done for the NCHS/CDC reference values (*15*). Plots of the same percentile values for the two data-bases facilitate comparison of the heights as an indicator of long-term nutritional status.

Comparison between the national survey and the intervention programme. Most of the comparisons between the cross-sectional data of the national survey and the longitudinal data of the intervention programme were performed for children less than 5 years of age since this age range was associated with the greatest risk of disease related to poor nutritional status.

The measurements in the national survey were taken only between May and September 1978. This period coincides with Haiti's diarrhoea season, and it is well known (*16, 17*) that this has an effect on nutritional indices. Measurements of weight during this period would therefore be expected to be lower than those taken at a different time of year on children of the same age or height. Height, being less labile than weight, should be less prone to this sort of seasonal variability. However, during growth spurts, seasonal diarrhoea might also affect height.

Comparisons were made using data for the entire Haitian rural sample rather than for the Artibonite Valley alone because matching of data for the sampling period of the latter would have decreased the size of both the supplementation and the national survey groups substantially. Also, there were no significant differences between the rural Artibonite group and the overall rural sample in the national survey (*2*).

In order to control seasonal bias in measurements when comparing data from the two surveys, two subsets of data from the longitudinal study were created. The first subset included only children measured from May to September 1971. The year 1971 was the third year of the project and ended the period when monthly measurements were taken. From this subset of 1262 children, height and weight measurements were randomly selected for each child measured during the period. The second subset included only children measured from May to September 1970, a year in which there was a food-shortage. It therefore represents a test of the short-term effectiveness of the intervention programme during a crisis. From this subset of 1521 children, height and weight measurements were again randomly selected for each child measured during the period. In addition to the two subsets, a third subset covering the period May to September of 1969 was also chosen. Since at this time the programme had functioned for less than 1 year, these data represented the best available approximation to a baseline.

For each of the three time periods we randomly selected a single set of measurements for each child. This removed the bias that would otherwise have been introduced by multiple inclusion of some children in the analysis. The use of a single value, rather than a mean or a weighted mean value, ensured that approximately the same emphasis was given to each child in both the nutrition intervention programme and the national survey.

In order not to distort the results of the study by including migrant children, especially those who moved into the study area during the summer of 1970, only data for children who were present for six continuous months in the intervention programme were included. Children under 3 months of age could not be compared directly since very few were covered in the national survey. For some comparisons between the two sets of data, the age-category-specific percentage ratings of the 50th percentile weight-for-height and height-for-age as well as the categories for the Waterlow classification were taken from the published report (*2*). For the intervention study, the percentage of the reference value for each index and the ratings according to the Waterlow system were calculated for the following six age categories: 3–5 months, 6–11 months, 12–23 months, 24–35 months, 36–47 months, and 48–59 months inclusive. Values of height-for-age that were between 85% and 90% of the reference median value are defined as moderate stunting. Values less than 85% are defined as severe stunting. Moderate wasting is defined as values between 80% and 90% of the reference median weight-for-height value, and severe wasting is defined as values less than 80% of the reference value.

RESULTS

Fig. 1 shows the spline-smoothed 10th percentile heights for boys over the entire intervention period together with similar data for boys in the Haiti national survey. The NCHS/CDC 10th percentile heights for boys are also shown. Fig. 2 shows the corresponding data for girls. Data for children under 3 months in the national survey were extremely sparse and were therefore not included. These plots show that though 10th percentile heights for children in the national survey appear to commence at higher values than their intervention counterparts, the latter children compensate during the critical post-weaning period, and 10th percentile values in this group remain higher for children past 2 years of age. These

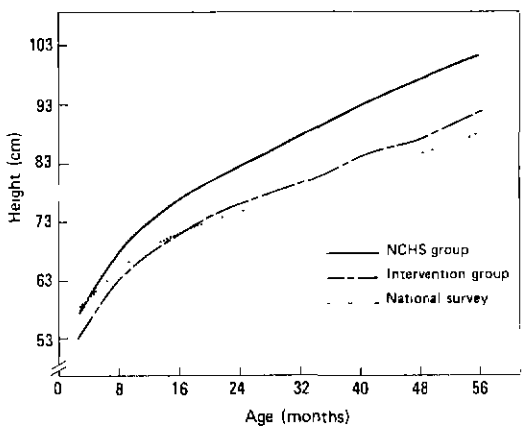

Fig. 1. Plots of 10th percentile heights of boys from the intervention group and those from the Haitian national survey. The 10th percentile heights from the NCHS/CDC survey are shown for reference purposes.

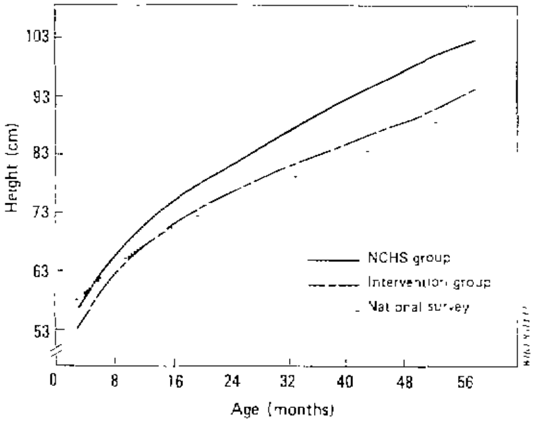

Fig. 2. Plots of 10th percentile heights of girls from the intervention group and those from the Haitian national survey. The 10th percentile heights from the NHCS/CDC survey are shown for reference purposes.

plots also show how much smaller the extreme of the height distribution is in Haitian children relative to the situation in the USA. There is also a smaller difference in this respect between the sexes in Haitian children compared to their counterparts in the USA.

Tables 1, 2, and 3 show, respectively, the age-specific prevalence rates for stunting, wasting, and stunting plus wasting for children of 1–5 years of age. The Tables contain the number of children at risk in each age category, the number falling into the particular malnutrition category, the proportion afflicted, and the Z-statistic for the test of differences in proportions, which is calculated by comparing the appropriate subgroup rate with the age-specific rate found in the national survey.

Children under 12 months of age were not included in these Tables because they were not direct beneficiaries of the programme; there were also insufficient data for children of 0–3 months old in the national survey, the data of which appear to be age-biased and/or accompanied by a large random measurement error (see Fig. 1 and 2 and the discussion section). Despite these difficulties, data for such children were included in the analyses to provide a reference baseline.

Table 1 shows the comparative prevalence rates for stunting in children of 12–59 months. Comparison of the four age groups shown indicate that the intervention groups were less stunted. In children of 12–23 months the difference in prevalence rates is not statistically significant. However, after 2 years of age the differences are consistently significant ($P = 0.001$). In general, the 1971 group had higher values of height-for-age than their 1970 counterparts. Although for all three groups in Table 1 the rates of stunting increased with age, the rate of increase was much lower in the intervention groups. The initial rate of stunting among 3–5-month old children in the 1970–71 intervention groups was 4–5 times that of children of this age in the national survey (see Table 4); however, the rate of stunting among 4–5-year olds in the intervention groups was only 74% of that of children of this age in the national survey.

Table 2 shows the rates of wasting for children of 12–59 months in the 1970–71 intervention groups and in the national survey. There were few significant differences between the groups. All differences except one favour the intervention groups, and the prevalence of wasting in all age groups covered was

Table 1. Comparison of stunting in children aged 12–59 months in random samples of the intervention group (1968–72) and the Haiti national survey (1978)

Age (months)	National survey (May–September 1978)		Intervention group (May–September 1971)			Intervention group (May–September 1970)		
	Stunted (%)[a]	r/n[b]	Stunted (%)[a]	r/n[b]	Z[c]	Stunted (%)[a]	r/n[b]	Z[c]
12–23	19.2	241/1255	15.8	44/278	+1.39 (0.16)[d]	17.6	50/284	+0.63 (0.34)[d]
24–35	35.2	390/1107	24.1	55/228	+3.50 (<0.001)	24.4	77/315	+3.83 (<0.001)
36–47	37.1	389/1049	21.6	62/287	+5.43 (<0.001)	28.2	80/284	+2.91 (0.005)
48–59	42.0	365/869	30.4	73/240	−3.40 (<0.001)	31.8	100/315	+3.29 (0.001)

[a] Stunting indicates values less than 90% of the NCHS/CDC median value.

[b] r is the number of children who were stunted at the time of measurement, n is the number of children who were measured at least once in the interval

[c] Value of the statistic for testing the difference in rates of stunting in the national and intervention samples, positive values indicate a lower rate of stunting in the intervention sample

[d] Figures in parentheses indicate the P value.

Table 2. Comparison of wasting in children aged 12–59 months in random samples of the intervention group (1968–72) and the Haiti national survey (1978)

Age (months)	National survey (May–September 1978)		Intervention group (May–September 1971)			Intervention group (May–September 1970)		
	Wasted (%)[a]	r/n[b]	Wasted (%)[a]	r/n[b]	Z[c]	Wasted (%)[a]	r/n[b]	Z[c]
12–23	9 8	123/1255	9 4	26/278	+0 23 (0 83)[d]	7 0	20/284	+1 59 (1 59)[d]
24–35	7 4	82/1107	4 4	10/228	+1.93 (0.05)	5 1	16/315	+1.59 (0.11)
36–47	3 7	39/1049	5 2	15/287	−1 05 (0 29)	1.8	5/284	+2.01 (<0 05)
48–59	3.8	33/869	2 5	6/240	+1.08 (0 28)	3 2	10/315	+0 53 (0.60)

[a] Wasting indicates values less than 80% of the NCHS/CDC median value.

[b] r is the number of children who were wasted at the time of measurement, n is the number of children who were measured at least once in the interval.

[c] Value of the statistic for testing the difference in rates of wasting in the national and intervention samples; positive values indicate a lower rate of wasting in the intervention sample.

[d] Figures in parentheses indicate the P value.

Table 3. Comparison of stunting plus wasting in children aged 12–59 months in random samples of the intervention group (1968–72) and the Haiti national survey (1978)

Age (months)	National survey (May–September 1978)		Intervention group (May–September 1971)			Intervention group (May–September 1970)		
	Stunted and wasted (%)[a]	r/n[b]	Stunted and wasted (%)[a]	r/n[b]	Z[c]	Stunted and wasted (%)[a]	r/n[b]	Z[c]
12–23	3.4	43/1255	3 2	9/278	+0.16 (0 87)[d]	3 9	11/284	−0 35 (0 73)[d]
24–35	5.6	62/1107	3 1	7/228	+1 89 (0.06)	2 5	8/315	+2.72 (<0 01)
36–47	2.9	30/1049	3.1	9/287	−0.24 (0 81)	1.8	5/284	+1 18 (0.24)
48–59	3 0	26/869	1 7	4/240	+1 31 (0 19)	2.2	7/315	+0.76 (0 45)

[a] Stunting indicates values less than 90% of the NCHS/CDC median value; wasting means less than 80% of the NCHS/CDC median

[b] r is the number of children who were stunted and wasted at the time of measurement, n is the number of children who were measured at least once in the interval.

[c] Value of the statistic for testing the difference in rates of stunting and wasting in the national and intervention samples, positive values indicate a lower rate in the intervention sample

[d] Figures in parentheses indicate the P value.

Table 4. Prevalence of stunting in the random samples of the intervention group and the Haiti national survey

Age (months)	National survey (May–September 1978)		Intervention group (May–September 1971)		Intervention group (May–September 1970)		Intervention group (May–September 1969)	
	Stunted (%)[a]	r/n[b]	Stunted (%)[a]	r/n[b]	Stunted (%)[a]	r/n[b]	Stunted (%)[a]	r/n[b]
0–2	—	—	18 0	7/39	19 2	14/73	12 8	11/86
3–5	2.0	7/349	3.6	2/55	14 9	13/87	8 0	4/50
6–11	5.7	41/724	5.2	7/135	10.4	17/163	11 3	18/159
12–23	19.2	241/1255	15 8	44/278	17 6	50/284	14 2	46/323
24–35	35.2	390/1107	24.1	55/228	24.4	77/315	29.2	84/288
36–47	37.1	389/1049	21 6	62/287	28.2	80/284	34.5	101/293
48–59	42.0	365/869	30 4	73/240	31.8	100/315	34.4	100/291

[a] Stunting indicates values less than 90% of the NCHS/CDC median value

[b] r is the number of children who were stunted at the time of measurement; n is the number of children who were measured at least once in the interval

significantly lower in the near-famine year of 1970 ($Z=3.19$; $P<0.001$) than in the national survey of 1978.

Table 3 shows data for children who were both stunted and wasted. There is a consistent though statistically insignificant difference between the intervention groups and the national survey children in all age categories. As in the case when wasting alone was considered, there were in general fewer stunted and wasted children in the intervention samples in the higher age groups.

Table 4 shows stunting over the 3 years of the intervention programme for which full enrolment data were available. It also includes infants of below 12 months of age since they provide a reference baseline with which to compare the older children. Here we see that children of 2 years or older experienced a general improvement over the study period. For children of 24–59 months the χ^2 test for the years 1969 to 1971 is significant ($\chi^2=3.25$; $P=0.10$). In the 36–47-month age group the χ^2 test is significant ($\chi^2=11.30$; $P=0.001$) (*20*).

Our findings indicate more stunting in 3–5-month old children in the May to September 1971 intervention group, compared with the national survey children (3.6% versus 2.0%, respectively). For infants of 6–11 months of age, there was slightly less stunting (5.2% vs 5.7%). In the May to September 1970 group, there was very much more stunting in both these age groups as compared with the national survey children (14.9% for the 3–5-month olds and 10.4% for the 6–11-month olds). As mentioned earlier, stunting is not considered to be an acute effect of malnutrition except at the youngest ages, and 1970 was a year of food shortage.

The distributions of height-for-age and weight-for-height as a percentage of the NCHS/CDC median values for various age categories are shown in Fig. 3 and 4 (*18*). The horizontal reference lines across the plots correspond to cut-off points for wasting and stunting as described by Waterlow (*19*).

For each age category two distributions are shown side-by-side. The boxes with the open circles represent an age-specific distribution of height-for-age (Fig. 3) or weight-for-height values (Fig. 4), derived by comparing the May to September 1971 randomly selected measurements with the NCHS/CDC reference median values. The boxes with solid circles represent the age-specific distribution of height-for-age (Fig. 3) or weight-for-height values (Fig. 4), by comparing the national survey measurements with the NCHS/CDC reference median values.

Fig. 3 shows that, while the two distributions have similar means and medians in the lower age groups, the national survey distribution (solid circles) are more variable for children of less than 1 year of age. For children older than 1 year, the lower extreme distribution of national survey data is below that of the intervention subsample; however, the mean values of the two groups do not differ significantly at any age. As we demonstrated using the Waterlow cut-off for stunting, there were significantly more severely stunted children in the national survey group over 1 year of age.

Fig. 4 shows that wasting is essentially equivalent in the intervention and national survey groups. In general, however, children in the intervention programme exhibited proportionally fewer negative, as well as positive, deviants.

DISCUSSION

Nutrition monitoring, counselling, and diet supplementation have been shown to have positive effects on children in Haiti (*6*). The children in the Deschapelles intervention group benefited not only

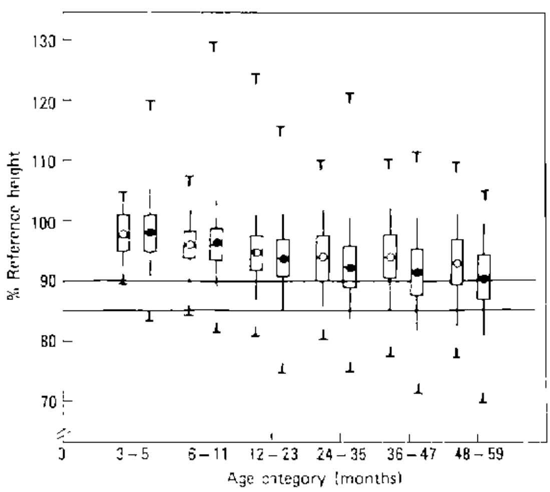

Fig. 3. Distribution of height-for-age for both sexes in the intervention group and in the Haitian national survey. Heights are shown as a percentage of a reference median value. The horizontal line drawn at 85% of the reference height corresponds to the cut-off for severe stunting and that at 90% to the cut-off for moderate stunting, as defined by Waterlow (*19*)

o = Mean heights for the May–September 1971 intervention group.

• = Mean heights from the Haitian national survey

T = 95th percentile value.

⊥ = 5th percentile value.

Upper and lower limits of the boxes correspond to 75th and 25th percentile values, respectively

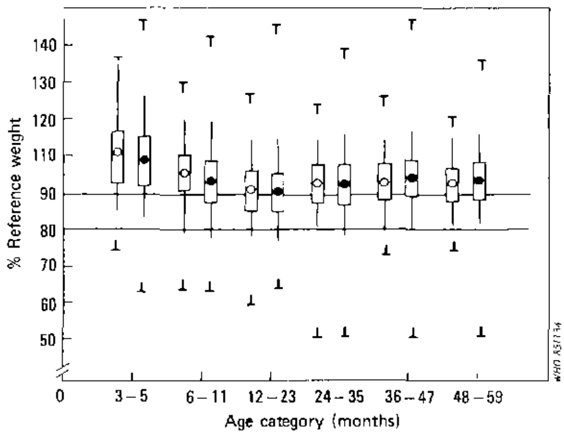

Fig 4. Distribution of weight-for-height for both sexes in the 1971 intervention group and in the Haitian national survey. Weights are shown as a percentage of a reference median value. The horizontal line at 80% corresponds to the cut-off for severe wasting and that at 90% to the cut-off for moderate wasting.
o = Mean weights for the May–September 1971 intervention group.
• = Mean weights from the Haitian national survey.
T = 95th percentile value.
⊥ = 5th percentile value.
Upper and lower limits of the boxes correspond to 75th and 25th percentile values, respectively.

from the nutrition-education aspect of the programme but also from immunization and early intervention for a range of infectious diseases. As mentioned previously, mortality rates were drastically reduced (*3*). There did, however, remain the question of the possible effect of the overall programme on growth.

In any nutrition intervention that does not involve in-centre feeding of children, the important matter of allocation of food within the family arises, since it is virtually impossible to effectively monitor the flow of food once it leaves the centre. If an association between the programme and a positive health or nutritional effect does exist, it may be due directly to increased intake of dietary energy or indirectly to effects related to income supplementation or other factors that change with time. Here, the last possibility appears to be ruled out on the basis of available evidence (*21*). However, either of the other two explanations could be operative. The answer to this question is important because such information may be used either to provide evidence against "dry-feeding" interventions or to modify existing practices governing child feeding.

Ideally, the effects of the programme could have been shown by comparing the programme children with a control group. This was, however, not feasible for ethical reasons. Hence, when the results of Haiti's national nutrition survey were published in 1978, we were at least able to compare the results of the nutritional status of children in the intervention programme with that of children surveyed 9–11 years later.

Stunting appears to be significantly less prevalent in the 12–59-month old children in the intervention groups (see Table 1) compared with that of the children covered by the Haiti national survey. The intervention groups also seem to have been protected to some degree from wasting, especially during the 1970 food shortage period (see Table 2).

As shown in Fig. 1 and 2, the 10th percentile values for children in the national survey are higher than those of the NCHS/CDC values at the age of 3 months, but this was reversed in children of 4–5 months old. The 10th percentile values in the national survey intersect those of the intervention group at 14–18 months for both boys and girls. The relatively high 10th percentile height-for-age values of the national survey infants indicate that either age misreporting may have been a problem or that measurement errors have increased the frequency of children in both extremes of the distribution. Alternatively, since more infants with low birth weights survived in the intervention group, the resulting 10th percentile value would be lower, had the low-weight, and presumably low-height, infants been excluded. However, since the height values in the intervention group were higher than even the NCHS 10th percentile values, the first two of these explanations, rather than the third, are more likely.

The relatively slow rates of increase in height in children up to 18 months of age in the national survey correspond to a period that is characterized by good progess in both the NCHS/CDC and the intervention groups. Indeed, the plots of the 10th percentiles of those populations are practically parallel to one another over those ages (Fig. 3 and 4). If ages were consistently underestimated, then the real national survey 10th percentile curve would be displaced, and its slope would be closer to that of the two other distributions. However, the entire distribution would be lower relative to that of the intervention group.

It is interesting to note in Fig. 1 and 2 that the curves for boys and girls are essentially the same. The sex specificity accounted for by using the NCHS/CDC reference values made it unnecessary to stratify by sex in the analyses.

Although it is unfortunate that there are no baseline data (i.e., pre-1969) for comparison, children of 2 years or more exhibited a decreased tendency to stunting, over the course of the study. This is consistent with a positive programme effect, even if this could also be explained by a general trend towards improved nutritional status. It is unlikely that the differences between the intervention group and the national survey children are attributable to an overall decline of the nutritional status of Haitian children between 1971 and 1978. There do appear to be indications that, despite worsening economic conditions, the prevalence of nutritional oedema in Haiti decreased through the 1960s and 1970s (*2, 7*). It is also known from other countries that economic indicators do not always correlate well with health or nutritional effects (*22*).

Despite indications that nutritional status was improving in Haiti during the 1970s the data from both the 1970 and the 1971 intervention samples showed that there was less stunting than in the national survey of 1978. The data from 1970 and 1971 not only compare well over the course of nearly a decade of improving nutritional status nationally, but also the programme appears to have protected the children during the famine-like conditions of 1970. The χ^2 test for stunting over the three years of the intervention (Table 4) was significant only in children of 2 years or older. This is not surprising since height responds slowly to environmental effects, and children tend to be protected by breast-feeding through most of their second year of life.

Another possible explanation for the relatively better status of the children in the intervention programme is that they are representative of a population that is healthier than the national average. However, this is unlikely since the study area surrounding the Albert Schweitzer Hospital is poor, and the children were as chronically malnourished as those in the rest of Haiti (*3*). In the national survey, the prevalences of both wasting and stunting in children in this area were found to be about average for the country (*2*). Although economic data are not disaggregated to the extent necessary to establish indices for the area around the Albert Schweitzer Hospital, the available data from this and neighbouring areas indicate that the study area is about as poor as the country as a whole (*21*). This explanation can therefore be discounted.

RÉSUMÉ

COMPARAISON D'ENFANTS HAÏTIENS INCLUS DANS UN PROGRAMME D'INTERVENTION NUTRITIONNELLE AVEC LES ENFANTS INCLUS DANS L'ENQUÊTE NATIONALE HAÏTIENNE SUR LA NUTRITION

De 1968 à 1971, 2700 enfants de villages entourant l'hôpital Albert Schweitzer à Deschapelles, Haïti, ont été inclus dans un programme de surveillance nutritionnelle et d'intervention sanitaire.

En l'absence de données de base et d'informations provenant d'un groupe témoin, qui n'ont pu être recueillies pour des raisons éthiques, il a été impossible d'évaluer précisément les effets du programme sur la santé. Cependant, avec la publication en 1980 de l'enquête sur l'état nutritionnel en Haïti, et le fait que les données de cette enquête ont été mises à disposition par les Centers for Disease Control, il a été possible de comparer les progrès de la croissance des enfants des régions rurales pauvres entourant l'hôpital inclus dans le programme de surveillance nutritionnelle d'intervention et ceux des enfants couverts par l'enquête nationale. A cet effet, nous avons mis au point une technique permettant de comparer les données transversales de l'enquête nationale et les données longitudinales du programme de surveillance nutritionnelle. Ceci a permis le premier examen rigoureux des effets du programme, en l'absence de données de base ou de données témoins.

En tenant compte de la saison, de l'inégalité de poids des enfants de l'étude longitudinale, des migrations et de l'année civile, nous avons pu montrer que le programme faisait baisser la prévalence de la chétivité (petite taille par rapport à l'âge) à la fois au cours de son application et par comparaison avec les données provenant de l'enquête nationale. L'importance de la maigreur (faible poids par rapport à la taille) dans le groupe d'intervention était à peu près la même, ou un peu moins marquée, que dans l'ensemble du pays. Ceci s'est vérifié pendant toute la durée du programme, y compris l'année 1970, une année de disette.

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