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Secular Trends in Height and Weight as Indicators of the Evolution of Nutritional Status

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Mortality data and vital statistics contribute indirect information for evaluating the problem of malnutrition; but in many cases, and particularly at the level of small communities, vital statistics are not only difficult to obtain but, in general, also have a poor reliability. On the other hand, anthropometric measures are related to the nutritional status of the living population, and are relatively easy to obtain with adequate reliability. For this reason, the secular trends in height and weight established in different population groups may constitute a low-cost practical instrument for the continuous evaluation of the nutritional status of a population.

The relatively small size of the adult in the developing countries seems to be the end result of continuous exposure to an adverse environment in which malnutrition plays a leading role. Previously presented data [3] are summarized and illustrated in figure 1, in terms of height growth in populations of different ethnic extraction from sociocultural extremes. The graph indicates that the environmental effect (VA) is established early in life and is larger than the racial effect (VR). This is generally accepted and recognized when the sociocultural extremes are far apart. However, the data presented in table I illustrate that differences in height also occur when the sociocultural extremes are much closer together, and established within racially homogeneous populations. In this case, the data presented were obtained in the rural population of Central America, segregated into sociocultural extremes using the index developed by MÉNDEZ [5].

In the case of weight, and using the definitions of GÓMEZ *et al.* [2], sociocultural differences are reflected in a greater prevalence of second and third degree malnutrition in children under 5 years of age. Of 375 children examined in the lower sociocultural groups, 98 (26%) were suffering second

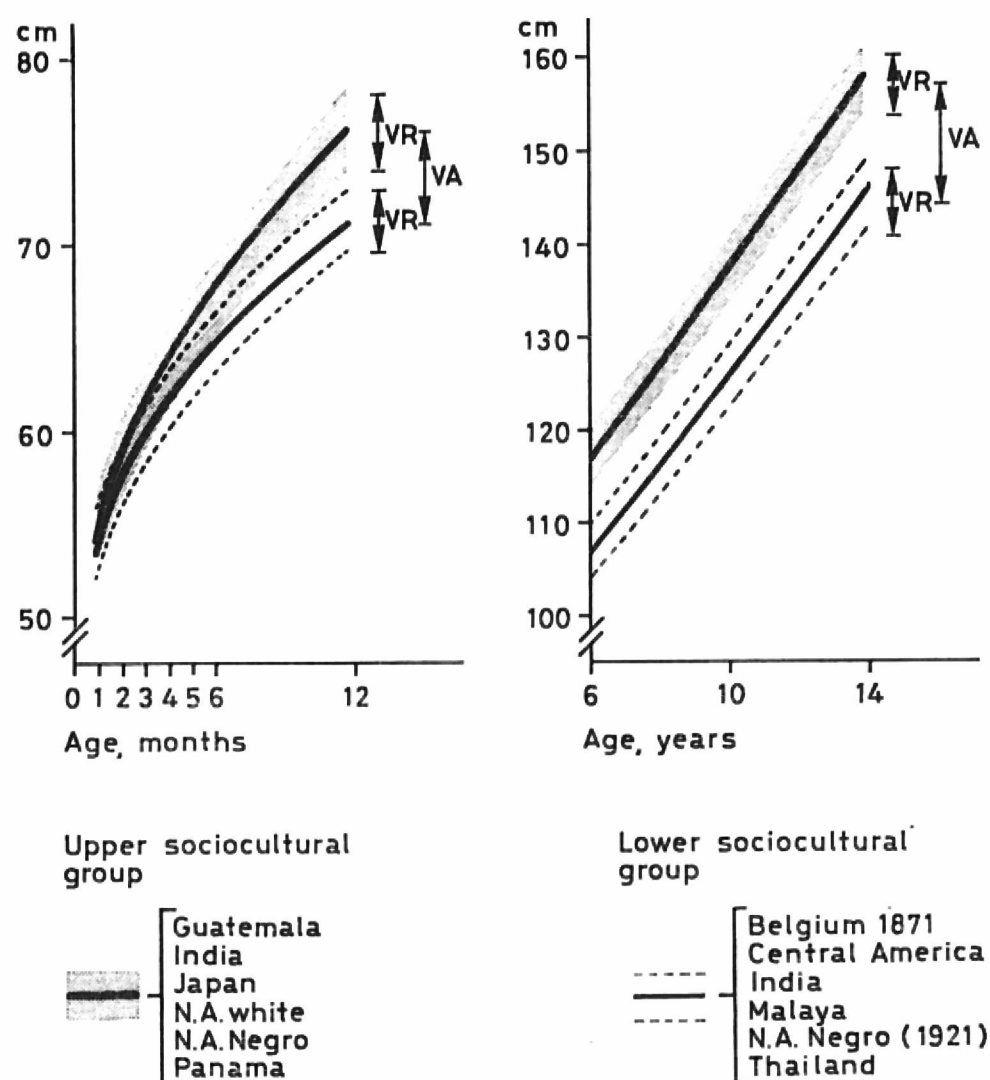


Fig. 1. Growth in height for population groups from sociocultural extremes. VR = Variability due primarily to racial factors. VA = Variability due primarily to environmental factors.

and third degree malnutrition, while 24 (10%) of 228 children in the upper sociocultural groups were classified as second degree malnutrition; there was no third degree malnutrition in this group. The differences described in terms of height and weight are also apparent in terms of other anthropometric characteristics [3, 8].

It is not easy to demonstrate the effect of diet supplements on the growth of children. Studies of INCAP, however, suggest that children receiving protein supplements during their preschool years, gained in height at the rate of 0.61 cm/month, while corresponding controls gained 0.55 cm/month [3, 4]. This estimate of a differential growth rate indicates that it should be possible, with improved diets during the preschool years, to add

Table I. Average height (cm) of Central American children at selected ages, by sociocultural group

Country	Age, years					
	6		10		14	
	a*	b*	a*	b*	a*	b*
Guatemala	102	103	119	125	137	147
El Salvador	102	109	124	127	140	148
Honduras	104	106	120	124	140	150
Nicaragua	104	108	126	130	143	149
Costa Rica	110	111	127	130	144	153
Panama	107	115	130	130	145	153

* Lower quartile (a) and upper quartile (b) in the distribution of a sociocultural index for the Central American family [MÉNDEZ, 1970].

4–5 cm to the height of children at the age of 7 years. This, in turn, suggests that improved nutrition can reduce the height deficit observed in developing countries.

It is recognized that anthropometric characteristics change with time. This is illustrated in figure 1, where the growth pattern in height for Belgians in 1871, established using the data of QUETELET [7], conforms with the present growth pattern of the lower sociocultural groups. This also suggests that the anthropometric differentials presently observed between sociocultural extremes may represent about a century in time.

To estimate secular trends in Central America, INCAP is at present examining the school children presently in schools studied previously during 1950–53. To illustrate preliminary findings, we present results for boys from two public schools (RN and RP) and an orphanage (HN). The three institutions are thought to have remained fairly stable with time, and at present are still serving the same general type of population served in 1952, i.e., essentially, families of laborers and unqualified workers.

The data presented in table II show that, on the average, in the last 20 years, children 8–14 years of age in the two public schools (RN and RP), are now 6.9 cm taller than were the children attending these schools in 1952. This estimate is similar to the change in height reported for Japanese children in the period 1920–1940 [6], and for English children from 1900 to

Table II. Mean differences in height for male children in selected public schools in Guatemala City, 1952–1972

Age, years	HN*		RN*		RP*	
	Δ Height, cm	%	Δ Height, cm	%	Δ Height, cm	%
8	−1.07 ± 1.99	−0.9	6.17 ± 1.86	5.3	6.70 ± 1.32	5.7
9	−1.90 ± 1.58	−1.5	10.91 ± 1.35	9.2	5.77 ± 1.22	4.7
10	−0.40 ± 1.86	−0.3	10.96 ± 1.37	8.9	7.40 ± 1.44	5.9
11	−0.95 ± 1.97	−0.7	4.80 ± 1.47	3.6	6.68 ± 1.57	5.1
12	0.91 ± 2.78	0.7	7.76 ± 1.74	5.8	6.72 ± 1.58	4.9
13	−1.40 ± 2.08	−1.0	6.95 ± 1.58	5.0	8.30 ± 2.55	6.0
14	−3.50 ± 2.07	−2.4	3.38 ± 2.77	2.3	3.95 ± 2.06	2.7
All ages	−1.19 ± 0.80	−0.9	7.28 ± 0.60	5.7	6.50 ± 0.60	5.0

* HN = Orphanage; RN and RP = public schools.

Δ Height = Mean height 1972 – mean height 1952.

% relative to height in 1952.

1925 [9]. There is no apparent change in the height of the child populations served by HN in 1952 and 1972.

The net gain in weight during the 20-year interval in Guatemala (table III) is estimated as 3 kg for the two public schools (RN and RP), and about 1.6 kg for the orphanage (HN). The secular trend, in this case, is less than the gain of approximately 4 kg reported for children of the same age and sex in England [9] and Japan [6] during the periods 1900–1925 and 1920–1940, respectively.

As can be expected from the data presented, the pattern of growth in terms of the secular trend of weight for height differs in the public schools and the orphanage studied in Guatemala. This difference is illustrated in figure 2, which clearly shows that the children presently in the orphanage (HN) are heavier for their height than the children in HN in 1952. On the other hand, the change in the two public schools (RN and RP) suggests a tendency to a slimmer physique, in agreement with observations in other countries [1, 9].

The data suggest that the secular trend in anthropometric variables, expressed in terms of rate of change (velocity), may provide a sensitive and reliable index for the quantitation of national progress in terms of selected contributory inputs. In turn, the accumulation of such information would be of value for establishing program priorities on the basis of local reality in the developing countries.

Table III. Mean differences in weight for male children in selected public schools in Guatemala City, 1952-1972

Age, years	HN*		RN*		RP*	
	Δ Weight, kg	%	Δ Weight, kg	%	Δ Weight, kg	%
8	-1.47 ± 1.71	- 6	2.64 ± 0.75	12	1.29 ± 0.66	6
9	-1.42 ± 1.23	- 5	3.12 ± 0.68	14	2.12 ± 0.74	9
10	1.07 ± 1.47	4	4.37 ± 0.93	18	2.73 ± 0.97	10
11	5.27 ± 1.17	17	1.85 ± 0.86	7	2.82 ± 1.02	10
12	4.14 ± 1.87	12	3.26 ± 1.34	11	2.08 ± 1.17	6
13	3.69 ± 1.38	10	3.29 ± 1.22	10	3.59 ± 1.75	11
14	-0.53 ± 2.84	- 1	4.97 ± 3.49	12	3.70 ± 2.70	10
All ages	1.54 ± 0.64	5	3.36 ± 0.47	12	2.65 ± 0.41	9

* HN = Orphanage; RN and RP = public schools.

Δ Weight = Mean weight 1972 - mean weight 1952.

% relative to weight in 1952.

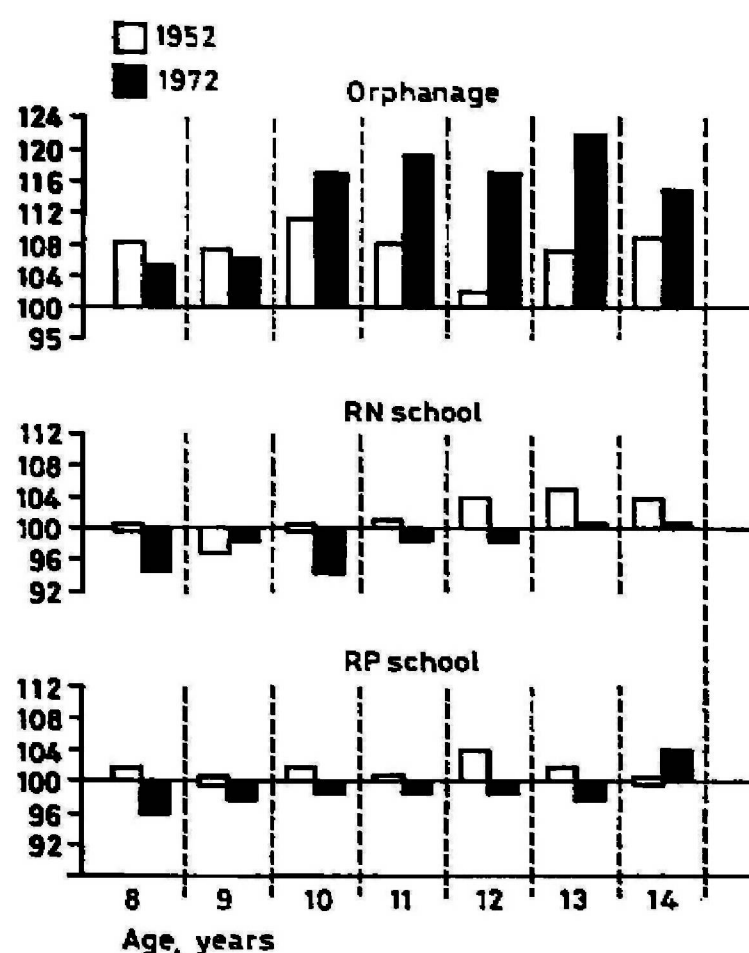


Fig. 2. Evolution of weight/height in males from 2 public schools and an orphanage in Guatemala City, 1952 and 1972.

In particular, the yearly evaluation of height and weight of children at the age of 7 years, when they first enter school, appears to be a practical procedure for the monitoring of nutritional status, which could be easily implemented in many countries with a high prevalence of malnutrition.

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