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## Anthropometry in the Assessment of the Current Nutritional Status of School Children

BY

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### INTRODUCTION

Nutritional status is determined by food intake and infection. As these dependent variables are difficult to quantify, particularly over extended periods of time, anthropometric measurements are used to obtain an indirect assessment of nutritional status.

The present use of anthropometric measurements provide little indication of the current nutritional status of school children. This is because measurements of height and weight have usually been expressed in relation to age; these relationships reflect both antecedent and contemporary nutritional status. A child malnourished chronically in infancy or in early childhood may be retarded in height and under weight for age, and yet be rehabilitated, by the time he reaches school age.

When, however, weight is expressed as a proportion of a standard weight for height, an index is obtained of current nutritional status (Seone and Latham, 1971). The objective of this study was to assess the use of height for weight calculations as a criterion of the necessity for supplementary feeding programmes.

### METHODS

Measurements of height and weight (no shoes light clothing weighing about 0.5 kg) were taken on primary school children in three main areas of Rhodesia. The areas were urban (URB), peri-urban (PER) and Tribal Trust Land (TTL).

The data collected personally by the authors were those on all children in groups URB and

PER and on children in group TTLC. The remaining data (TTLA and TTLB) were kindly supplied by Sister M. C. Fyfe, Schools' Nurse (Midlands) and Mr. R. Theisen, Research Fellow in Sociology, University of Rhodesia, respectively.

The URB children were those attending the school at the B.S.A. Police Training Camp in Salisbury. They were children of policemen (A), of prison warders (B) and of labourers (C). The PER children attended school at the Tobacco Research Board station, 15 km south of Salisbury. They were children of station employees (A), of workers at Salisbury airport (B) and of workers at quarries and farms in the vicinity of the station (C). The TTLA children were those attending St. Philemons School in the Que Que Tribal Trust Land. Children in group TTLB attended a number of schools in the same area. The final subgroup (TTLC) comprised children at three schools situated about 50 km south of Binga in the Zambezi Valley.

The numbers of children in each group and dates of measurement are given in Table 1.

### RESULTS

Two examples of classifications according to degrees of wasting and retardation, as proposed by Waterlow (1972), are given in Tables II and III. Only 2 x 4 classifications were required for groups URB and PER as there were no children in these groups who had a percentage expected weight for height (EWH) below 80. All TTL subgroups had at least one child in this latter category. The proportion of children in each subgroup who would be regarded as wasted or stunted according to the percentages of expected adopted for normality are given in Table IV.

### DISCUSSION

When using anthropometric measurements to assess the nutritional status of children, the objectives of the study must be kept clearly in mind (Seone and Latham, 1971). The objectives of this investigation were to establish criteria for the diagnosis of current malnutrition in school age children.

Table I

NUMBERS OF CHILDREN IN EACH GROUP AND DATES OF MEASUREMENT

GROUP									TOTAL	
URB			PER			TTL			Boys	Girls
A	B	C	A	B	C	A	B	C		
182	80	90	80	90	95	150	134	109	553	457
*Oct. 1974			Sept. 1974			Aug. 1974	May 1973	Dec. 1974	Total: all children 1010	

\*Dates of measurement

Table II

CLASSIFICATION OF URBA CHILDREN ACCORDING TO DEGREES OF RETARDATION AND WASTING

RETARDATION					
GRADE		0	1	2	3
% Expected height for age		>95	95-87,5	87,5-80	<80
Wasting	Grade % Expected Weight for Height				
	0 >90	86(47,2)	86(47,2)	6(3,3)	0(0)
	1 90-80	1(0,6)	2(1,1)	1(0,6)	0(0)

In Tables II and III expected values=Boston 50th percentile. Numbers in parenthesis are percentages of children examined in each group.

Table III

CLASSIFICATION OF TTLB CHILDREN ACCORDING TO DEGREES OF RETARDATION AND WASTING

RETARDATION					
Grade		0	1	2	3
% Expected height for age		>95	95-87,5	87,5-80	<80
Wasting	Grade % Expected Weight for Height				
	0 >90	29(21,6)	31(23,1)	14(10,4)	11(8,2)
	1 90-80	13(9,7)	12(9,0)	7(5,2)	2(1,5)
	2 <80	10(7,5)	2(1,5)	2(1,5)	1(0,7)

Table IV

PERCENTAGES OF CHILDREN BELOW 90 PER CENT EXPECTED WEIGHT FOR HEIGHT AND BELOW 95 PER CENT EXPECTED HEIGHT FOR AGE IN EACH GROUP

Category	GROUP								
	URB			PER			TTL		
	A	B	C	A	B	C	A	B	C
90 per cent. weight for height	2,2	3,8	5,5	2,5	5,5	4,2	10,0	36,6	13,7
95 per cent. height for age	52,2	67,5	58,9	65,0	64,4	57,9	64,3	61,2	30,3

The extent of deviation of a child's weight for age from accepted standards has been widely used to separate well nourished from malnourished infants and pre-school children (Gomez *et al.*, 1956). While this approach offers a quick and useful tool for the assessment of the extent of malnutrition in such children in a community, it is of little value for assessment of the current nutritional status of school children. Apart from the problem of obtaining accurate knowledge of ages, it does not distinguish, for example, between children who are small and who have normal body proportions and those who are tall and thin.

Retardation of height, of school age children, obtained from determinations of height for age, is indicative either of long-term chronic malnutrition or of acute, severe malnutrition in early childhood followed by an intervening period of rehabilitation. The degree of retardation of height, like determination of weight for age, does not provide information on the current nutritional status of school children.

In order to obtain the information required it is necessary to measure the weight and height of children simultaneously.

In this study children were classified as being malnourished or wasted if their EWH was below 90 per cent. The choice of a particular percentage can only be arbitrary. Seone and Latham (1971) suggested that normal weight for height be set at 95 per cent. or above expected whereas Waterlow proposed 90 per cent. In our view the latter figure is more appropriate, particularly for point measurements, because it is more likely to reflect wasting of body muscles and not just short-term fluctuations in body hydration. There can be extremely large variability from one day to the next of the body weight of young children when measured under field conditions (Waterlow, 1963).

It would be expected, a priori, that in a population of adequately nourished children, only a small proportion would have signs of wasting. This thesis was borne out by the finding that only 4,2 per cent. (Table 4) of children had EWH below 90 per cent. of expected in groups URB and PER. Questioning of the parents of one of the two children in group PERA who had low weights for height revealed the probable reason for the signs of wasting. The child had 10 surviving siblings, nine of whom were living in the same house. The family "never had breakfast because of insufficient money" and had "enough food to eat for only two days per month". All other parents interviewed at the Tobacco Research Station stated that their children ate breakfast before going to school and consistently had enough food to eat. The circumstances of the anomalous family could have been markedly improved had the father not acquired a substantial wardrobe of clothes! The parents of the other child in group PERA who had a low weight for height were not available for interview.

The differences between subgroups TTLA and TTLB in the proportion of children who had EWH below 90 per cent. (Table 4) are of particular interest. All children came from an area which is described as having a generally primitive state of agricultural practice associated with declining land fertility (Theisen, 1974). A high proportion of children in the area have bilharzia (Fyfe, personal communication) but, in the absence of information on individual children, it is not possible to establish whether the disease contributed to the difference noted above. The most likely explanation for the difference lies in the adequacy of food supplies.

Most of the children in subgroup TTLB whose percentage EWH was below 90 came from families which were classified as being in categories -2 and -1 on Theisen's "nutritional stress scale" (Theisen, 1974).

On the other hand the relatively small proportion of children in subgroup TTLA who had low percentage EWH could be attributed to the relative abundance of food in the area, prior to the time of measurement, as the result of adequate harvests following unusually heavy rains.

Detailed information on health statistics and food consumption would be required to account for the differences in proportion of children with low percentage EWH between urban and rural communities.

Present findings on expected heights for age (Table 4) indicate that a high proportion of children in all groups had heights below the Boston 10th percentile (95 per cent. height for age = approximately Boston 10th percentile in school age children and Boston 3rd percentile in infants and preschool children). The anomalously low proportion of such children in subgroup TTLC could possibly be attributed to inaccuracies in the establishment of ages.

While low heights for age in school age children have been taken as evidence of antecedent malnutrition (Cravioto and De Licardie, 1968), there are a wide range of variables other than nutritional which differentiates the families of tall children from those of short ones (Cravioto *et al.*, 1967). These variables make it difficult directly to attribute short stature to malnutrition *per se*.

These considerations are pertinent to the question of whether children who are retarded in height and who have low weights for age, but who are not wasted, are likely to benefit from a supplementary feeding scheme. The answer is equivocal but they probably would not because the normality of their body proportions indicates that their current food intakes are not a limiting factor to their growth. In other words, the provision of extra food is unlikely to alter the potential for further increase in the mature height of school children whose full potential mature height has been reduced either by antecedent malnutrition or by some other factor.

As stressed by Gurney *et al.* (1972) and Waterlow (1972), prerequisites for the use of anthropometric measures are that the measurements are easy to obtain with cheap, unelaborate apparatus and that the indices obtained are both reasonably simple to understand and

calculate and that they provide a guide to action. The classification proposed by Waterlow (1972) for degree of wasting fulfils these conditions and is of value in the assessment of need for supplementary feeding of school children. It eliminates problems of uncertainty over the establishment of ages and over action required with children who are under height and under weight for their age. For example, children in subgroup TTLA, in which only 10 per cent. could be classified as wasted would probably not require supplementary feeding.

Decisions on the necessity for school feeding programmes can be based on the proportion of children in each school or area whose EWH is below 90 per cent. No threshold proportion can be defined as it will vary with the national or regional prevalence of wasting at particular times and with the resources available for remedial action. Similarly, decisions to continue supplementary feeding schemes can be based on the progress of the children who were initially classified as being wasted.

This method of assessment of current nutritional status can also be used to monitor the effects of changes in patterns of family food consumption arising from the inflationary trend in prices of foods and from increases in levels of unemployment.

Further information is required from dietary surveys to validate the choice of grades of wasting proposed by Waterlow (1972) and used in this study. The choice of grades could also possibly be validated through studies on signs of chronic fatigue, lack of vigour, listlessness and inactivity in populations at risk.

#### SUMMARY

Measurements of height, weight and triceps skinfold thickness were taken on African school children in three urban, peri-urban and tribal trust land communities in Rhodesia in order to assess their current nutritional status. The children were classified according to their degree of stunting (percentage expected height for age) which reflects antecedent nutritional status, and degree of wasting (percentage expected weight for height), a reflection of current nutritional status. Only 4.2 per cent. of urban and peri-urban children were found to be wasted (weight for height below 90 per cent. of expected). Percentages of children in the three tribal trust land communities who were wasted 10.0, 13.7 and 36.6. The highest percentage was observed in a community

which had an acute shortage of food arising from a recent severe drought. Skinfold thickness were not found to be useful for the assessment of marginal malnutrition. The conclusion is drawn that degree of wasting may be used as a criterion of the necessity for school feeding schemes in situations of drought or poverty.

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