

Growth charts based on measurements of Malay pre-schoolchildren

by A. E. Dugdale

Department of Paediatrics,
University of Malaya,
Kuala Lumpur.

D. A. MacKay

Division of Rural Health Research and
G.W. Hooper Foundation,
Institute for Medical Research,
Kuala Lumpur.

R. K. H. Lim

Division of Nutrition Research,
Institute for Medical Research,
Kuala Lumpur.

and K. H. Notaney

Malaysian Ministry of Defence,
Kuala Lumpur.

Introduction

GROWTH IS A USEFUL indicator of the well-being of children, particularly in the toddler and pre-school age group where normal growth is rapid and malnutrition and disease are common. A child's growth achievement and nutritional status can most easily be assessed by comparing several body measurements with norms derived from a relatively healthy, well-nourished population of genetically similar children (Jelliffe, 1966).

Dugdale (1969) and Chen and Dugdale (1970)

have published such norms in the form of growth charts for Malaysian infants and schoolchildren respectively, but similar information for children in the intermediate age range has been lacking. We, therefore, are presenting charts derived from our measurements of a group of some 660 Malay children below school age.

Material and Methods

The subjects were all of the Malay ethnic group, the children of soldiers in the Malaysian Army who were stationed in the Kuala Lumpur area.

All children were examined by physicians, and any with gross physical defects were excluded from the study. We also excluded those whose exact ages could not be determined from birth certificates or maternal recall.

Measurements were made by a specially-trained team of technicians in January 1968, following the methods suggested by Jelliffe (1966). All measurements except weight were made in triplicate, as follows:

1. *Weight*, with shorts only, taken on an Avery beam balance accurate to $\frac{1}{4}$ ounce.
2. *Length*, taken with the child held supine on a measuring board accurate to 0.1 cm.
3. *Head circumference*, taken to the nearest 0.1 cm. with a steel tape in the horizontal plane of greatest dimension just above the eyes.
4. *Triceps skinfold thickness*, measured with Lange calipers held horizontally at the measured posterior midpoint between the acromion and the olecranon of the left arm, held in relaxed 90° flexion.
5. *Mid-arm circumference*, measured to the nearest 0.1 cm. at the same position as the skinfold thickness.
6. *Mid-arm muscle circumference*, calculated by the formula: muscle circumference = mid-arm circumference — (3.14 x triceps skinfold thickness).

The number of individual measurements available were: weight, 648; length, 653; head circumference, 655; triceps skinfold thickness, 665; mid-arm circumference, 654; and mid-arm muscle circumference, 654.

Data were punched on 80-column cards, which were then arranged in order of age. For each measurement, the total group was then divided by age into nine equal subgroups (the oldest subgroup sometimes having one or more extra cards). Within each subgroup, the cards were arranged in ascending order of the measurement considered and the 90th, 10th and 50th (median) percentile values extracted. Curves were then fitted to these percentile values with a minimum of visual smoothing, and charts were constructed.

Results

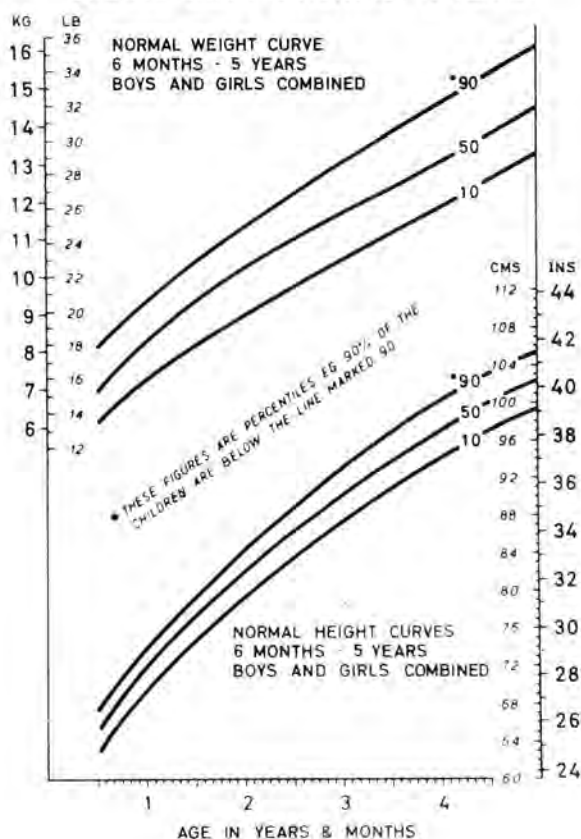
The resulting charts are shown in figures 1, 2, and 3. The data for the nine subgroup points on which each percentile curve is based may be obtained from any of the authors.

Discussion

We have presented elsewhere (McKay, et al. 1971) more detailed analysis of these data in comparison with other groups of children, of the relative usefulness of the different measurements used, and of the appropriateness of using these norms as "standards" in assessing the health of children in this country.

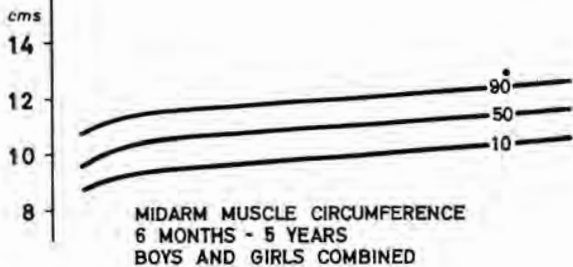
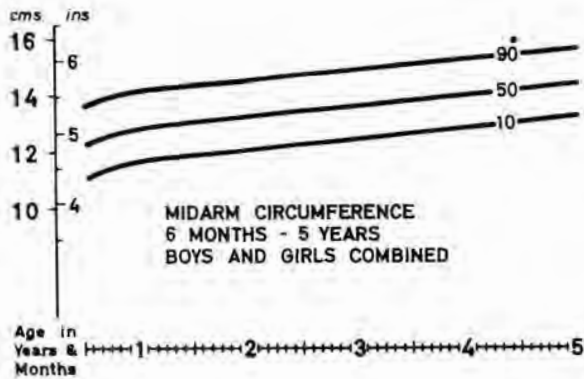
The most useful measurements for routine nutritional assessment appear to be weight, length (or height), and mid-arm circumference. Mid-arm circumference is the least affected by age uncertainty and is easy to use in field surveys (Jelliffe and Jelliffe, 1969). The measurement of skinfold thickness and the calculation of mid-arm muscle circumference may indicate the relative adequacy of protein versus total calories in the diet (Dugdale et al., 1970). Head circumference is related mainly to brain size and is used mostly as an index of general development in the first three years of life

GROWTH CHART 6 MONTHS - 5 YEARS



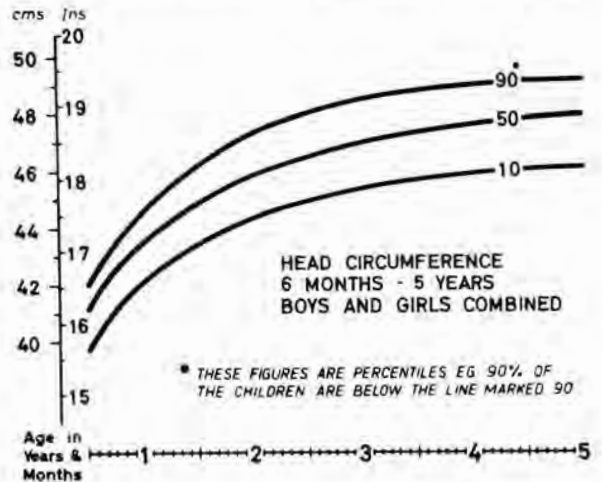
GROWTH CHARTS OF MALAY PRE-SCHOOL CHILDREN

GROWTH CHART 6 MONTHS - 5 YEARS

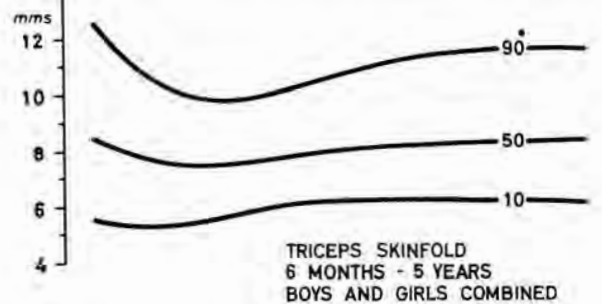


* THESE FIGURES ARE PERCENTILES EG 90% OF THE CHILDREN ARE BELOW THE LINE MARKED 90

GROWTH CHART 6 MONTHS - 5 YEARS



* THESE FIGURES ARE PERCENTILES EG 90% OF THE CHILDREN ARE BELOW THE LINE MARKED 90



rather than as an indicator of malnutrition (Jelliffe, 1966).

We suggest plotting a child's measurements on these charts as a practical aid to assessing growth and health. Our experience indicates that children with measurements below the tenth percentile on these charts should be considered a risk of significant malnutrition or other growth-retarding pathology, even though by definition 10% of the reference population of Army dependents falls into this range. Values plotted between the tenth and fiftieth percentiles indicate "below average" growth, and children consistently in this intermediate range may be experiencing marginal malnutrition. Children whose measurements are above the fiftieth percentile are unlikely to be in nutritional difficulty.

Copies of these charts in a form suitable for clinic use are available from the Department of

Paediatrics, Faculty of Medicine, University of Malaya.

Acknowledgements

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