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## The Weights of Young African Children in a Township in Rhodesia

BY

H. WHITTLE, B.SC., M.B., CH.B.

*Senior House Officer in Paediatrics, Harare Hospital;*

A. WHITTLE, B.SOC.SCI.

*Social Assistant, African Administration Department,  
Salisbury;*

AND

A. WICKS, M.B., CH.B.

*Registrar in Paediatrics, Harare Hospital.*

No standards of normal weight for young children exist for the African population in Rhodesia. Ford (1964) suggested that the Havard Standards (Stuart and Stevenson, 1959) could be used as a guide in assessing malnutrition in different ethnic groups when no local standards of reference are available. This idea has been further elaborated by Jelliffe (1966), who suggested a General Standard of Reference, which was derived from the Havard data. This study establishes a standard for African children in Rhodesia and also compares the weight-for-age curve of these young children of mixed genetic background with that derived from the Havard data.

### SOCIAL BACKGROUND

Mufakose is a township situated ten miles outside Salisbury. It is reserved exclusively for Africans and consists of about 20,000 people living in municipally owned houses. A minimum income of £25 per month was required of tenants at the start of the township, but recently low cost two-roomed houses have also become available and these tenants are not subject to the means test. The families, averaging about seven persons, live in one- to four-bedroomed houses and pay a rent of between £3 and £4 10s. per month; this includes running water. Electricity is optional and costs an additional £1 10s. per month.

The majority of the inhabitants of the township, about 70 per cent., are Shona and 20 per

cent. of these are second generation urban dwellers. The others comprise various ethnic groups: Malawians, Sindebele, Portuguese East Africans and a scattering of Zambians and South Africans. All these people are Negroes and speak dialects of the Bantu language (Coon, 1965).

The traditional Shona diet is sadza, a stiff porridge made from ground maize, which is served with a relish made from vegetables and ground nuts, and on occasions supplemented by meat (Gelfand, 1964). However, this diet has been altered somewhat in the township and may include meat, fish, bread, milk and tea (Shamuyarira, 1965). Breast feeding is the rule and weaning, with a thin maize gruel, is started at five to six months and completed by 20 months, when the children are eating similar food to the adults. The impression is that children gain weight well until the start of weaning, when they start to suffer an abnormal reduction in rate of growth due to inadequate protein intake.

The income and personal details of the parents of the children studied in this survey were obtained by two social workers who visited their homes, but due to a change of address the parents of six children could not be traced. Table I shows the incomes of the families of the children involved in the survey. The data has been classified into Shona and non-Shona groups.

Table I  
INCOME OF FAMILIES IN THE SURVEY

Income per Month	Shona %	Non-Shona %	Overall %
Under £18 .....	36.4	42.5	38.7
Under £24 .....	24.2	25.0	24.5
Under £30 .....	9.1	7.5	8.5
Under £50 .....	18.2	15.0	17.0
£50 and over .....	12.1	10.0	11.3
Numbers surveyed .....	67	41	108

Some of the wives (14.3 per cent.) were working either part or full time to supplement father's earnings, and these contributions have been in-

cluded in the family income. The average number of children per Shona family was 4.8 and the average number per non-Shona family 4.6. The number of bedrooms per family was usually two or three.

Those receiving incomes of £50 or more per month were mainly professional people such as teachers and nurses; those in the £24-£50 bracket were skilled workers or clerks, and those in the below £18 group were labourers or self-employed people such as tailors and hawkers. In this sample the percentage of persons in the lower income groups (<£24) was similar to that of an official survey made of the whole community, but, as expected, the proportion of the parents in the higher income groups (£30+) was greater.

The standard of living in Mufakose and the average income of the township appears to be higher than the others around Salisbury, and the average annual wage of the fathers of the children in this survey (£280) is higher than the national average wage of Africans at this time (£114: Shamuyarira, 1965) and much higher than those living in the rural areas. Though the children in this survey come from relatively privileged families, it is salutary to remember that in 1953 the "poverty datum line," i.e., the bare subsistence level, for a family in Salisbury was calculated at £14 10s. a month (Shamuyarira, 1965).

#### METHODS

The child welfare clinic is a service provided free at the township. Mothers, after the birth of their babies either at the maternity centre in Mufakose or the nearby hospital, were asked to bring their children at six weeks of age to the clinic. The exact age of the infant was calculated from the maternity card which gave the date of birth and usually the weight at birth. Mothers were encouraged to bring their children to the clinic at two-weekly intervals for weighing and a physical check by the sister in charge. The children were weighed, clothed only in a napkin, on a beam balance scale by either one of the two qualified sisters, and the weight, date and a brief note of any complaints recorded on a card. All children were immunised against polio, tetanus, diphtheria and whooping cough at three months, four months and five months of age. At six months they were given B.C.G. and vaccinated against smallpox. Mothers were encouraged to start weaning their children at three months, and dried skim milk was supplied to the mothers from this time. For the first 18 months 1 lb. per week was given to the parent and thereafter  $\frac{1}{2}$  lb. per week until the child was two years old. The

frequency of attendance tended to fall as the child aged and usually stopped between age one to two years when mother was soon to deliver her next child. Often attendance was irregular, as children by custom are taken to the tribal areas, either to visit grandparents or because the mothers return home to help at the times of planting and harvesting.

From the clinic record, over the years 1964-67, cards were specially chosen. The criteria for selection were: (1) Date of birth known; (2) first attendance before three months of age; (3) regular attendance thereafter with a maximum break of two months in attendance; (4) absence of any serious disease or constantly recurring complaint; (5) attendance of a year at least. The weight of each child was noted at three-monthly intervals from birth, and if a date of attendance did not fall exactly at these times the weight was estimated as the mid-point between the weights recorded the week before and the week after. If a child did not attend within a week of the end of the three-monthly period, the weight at that particular age was not recorded. The weight of the napkin (0.15 kg.) was subtracted from each of the recordings. The percentage longitudinality of the data (Tanner, 1951) varied from 80 to 90 per cent. in the age range 0 to 15 months and then declined sharply.

It is apparent from the above criteria that the children selected for this survey were specially favoured and likely to provide a standard above that of the general population, but below that of the ideal derived from measurements on the children of the educated, prosperous elite (Jelliffe, 1966).

Blood was taken by venipuncture from a sample of healthy children attending the clinic in April, 1967. The haemoglobin content was estimated by means of a Spenser haemoglobinometer and the total proteins and albumin and globulin fraction estimated by the Biuret method. Thick blood films were made from each specimen and these stained and searched for malarial parasites; none was found.

#### RESULTS

Table II shows the average weights attained and the standard deviations for the Shona and non-Shona children. The figures in brackets indicate the numbers which make up each average. The data from both sexes were used. The *t* test was used to test the difference between the groups at each age and regarded as significant

Table II

AVERAGE WEIGHTS ATTAINED: SHONA AND NON-SHONA CHILDREN

Age Months	SHONA			NON-SHONA		
	No.	Wt. Kg.	S.D.	No.	Wt. Kg.	S.D.
0	60	3.4	.4	39	3.2	.4
3	58	6.1	.7	39	6.0	.8
6	66	7.6	.8	38	7.4	.8
9	67	8.4	.9	41	8.3	.9
12	63	9.0	1.0	39	8.9	1.1
15	60	9.5	1.0	38	9.3	1.0
18	47	9.8	1.0	27	9.7	1.1
21	30	10.5	1.1	10	10.7	1.3
24	10	—	—	4	—	—

if  $P=.05$ . The only significant difference found was that between the birth weight of the two groups and for the purpose of further analysis and comparison, the data for the two groups have been combined. The Shona and non-Shona groups combined are referred to as the Mufakose children and this also includes the six children whose parents could not be traced.

Table III shows the average weights attained for the Mufakose children. It also shows the General Standard and the 90 per cent. and 80 per cent. values of this standard (Jelliffe, 1966). The t test using the variance of the combined data was performed to test the significance of the differences. At birth the Havard children, i.e., those children whose weights are represented in the Havard Standards and thus also in the General Standard, are significantly heavier; at three months the Mufakose children are signifi-

Table III

AVERAGE WEIGHTS ATTAINED: MUFAKOSE CHILDREN AND GENERAL STANDARD

Age Months	MUFAKOSE			Gen. Std. Kg.	90% Std.	80% Std.
	No.	Kg.	S.D.			
0	105	3.3	.4	3.4	3.0	2.7
3	103	6.1	.7	5.7	5.1	4.5
6	109	7.5	.8	7.4	6.7	5.9
9	114	8.3	1.0	8.9	8.0	7.1
12	108	9.0	1.0	9.9	8.9	7.9
15	104	9.5	1.0	10.5	9.5	8.5
18	78	9.8	1.0	11.3	10.1	9.0
21	42	10.6	1.1	11.9	10.7	9.6
24	16	10.8	1.1	12.4	11.2	9.9

cantly heavier; at six months the difference is not significant. From nine months the Havard children are significantly heavier.

Table IV shows the ninetieth, fiftieth and tenth percentiles for the Mufakose children. Fig. 1 shows the percentiles for the Mufakose children compared graphically with the General Standard

Table IV

PERCENTILES FOR WEIGHTS ATTAINED: MUFAKOSE CHILDREN

Age Months	CENTILES IN KG.		
	90th	50th	10th
0	3.9	3.2	2.8
3	7.2	6.1	5.2
6	8.6	7.5	6.4
9	9.7	8.2	7.2
12	10.3	8.9	7.7
15	10.7	9.5	8.1
18	11.1	9.8	8.6
21	12.1	10.5	9.3
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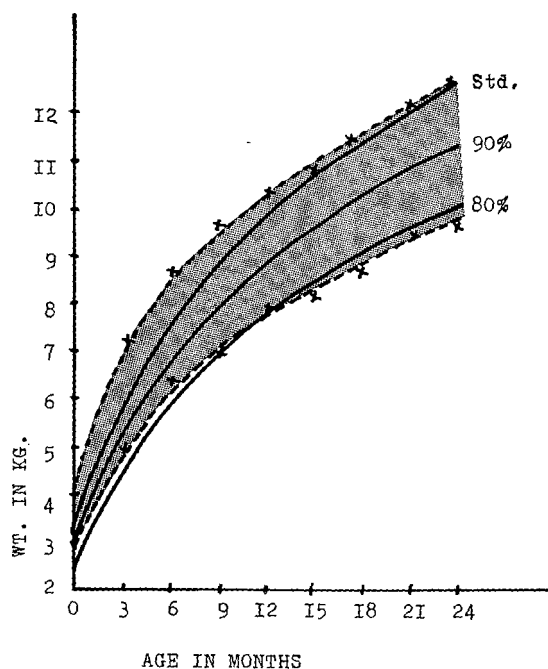


Fig. 1—Percentile range of Mufakose children compared to general Standard. Shaded area represents tenth to ninetieth percentile range.

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6	109	7.5	.8	7.4	6.7	5.9
9	114	8.3	1.0	8.9	8.0	7.1
12	108	9.0	1.0	9.9	8.9	7.9
15	104	9.5	1.0	10.5	9.5	8.5
18	78	9.8	1.0	11.3	10.1	9.0
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18	11.1	9.8	8.6
21	12.1	10.5	9.3
24	12.6	10.8	9.5

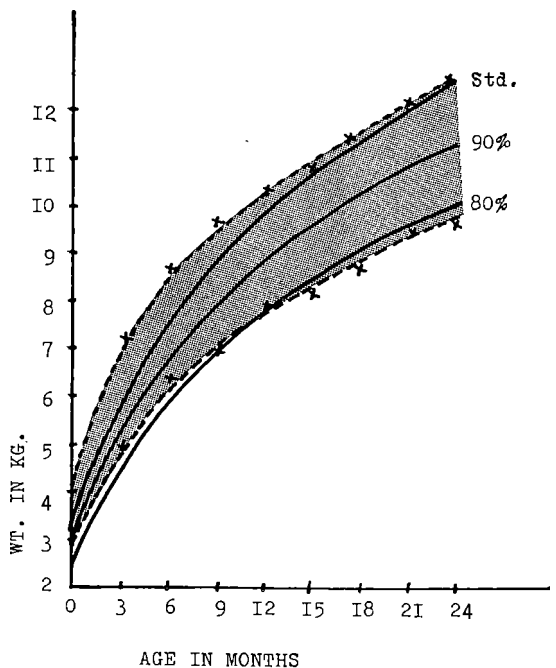


Fig. 1—Percentile range of Mufakose children compared to general Standard. Shaded area represents tenth to ninetieth percentile range.

and the 90 per cent. and 80 per cent. values of this standard.

Table V shows the average weight gains in kg. per three months for the Shona children, the Mufakose children and for the Havard children. In this survey the values were calculated by averaging the individual increments in weight gain per three-monthly interval (Tanner, 1951). As no weight velocity data are available for the General Standard, the values shown were calculated by subtraction from the averages of the weight attained. The t test, using the variance of the Mufakose data, was used to test if the differences were significant. The Mufakose children showed a significantly greater weight gain in the first three months, but thereafter, until 18 months, the Havard children showed significantly greater weight gains. From 18 to 24 months the difference was not significant, but the numbers in the survey at this age are small and no valid conclusion can be drawn for these ages.

Table V

AVERAGE WEIGHT GAINS: SHONA AND MUFAKOSE CHILDREN, GENERAL STANDARD

Three-Mthly Intervals	SHONA			MUFAKOSE			Gen. Std. Kg.
	No.	Kg.	S.D.	No.	Kg.	S.D.	
0-3	52	2.8	.6	94	2.9	.6	2.3
3-6	58	1.4	.4	99	1.4	.5	1.7
6-9	65	.8	.5	108	.9	.5	1.5
9-12	62	.7	.4	109	.7	.4	1.0
12-15	54	.5	.4	96	.5	.4	.7
15-18	45	.5	.4	74	.4	.4	.7
18-21	30	.6	.4	40	.6	.4	.6
21-24	—	—	—	14	.4	.4	.5

Table VI

AVERAGE BIOCHEMICAL VALUES: MUFAKOSE CHILDREN AGED 1-2 YEARS

Value	Units	No.	Av.	S.D.
Haemaglobin	gm./100 ml.	23	11.2	.8
P.C.V.	%	22	34	2.7
Total protein	gm./100 ml.	23	7.1	.2
Albumin	gm./100 ml.	23	4.2	.2
Globulin	gm./100 ml.	23	2.9	.2

Table VI shows the average values and standard deviations of the haemoglobin, packed cell volume and serum proteins of the sample.

DISCUSSION

After birth the weights attained of the Shona children did not differ significantly from those of the non-Shona children, who came from varied genetic backgrounds. This was expected, as all were children of Bantu-speaking peoples with similar physical characteristics and the economic circumstance and environment of the two groups differed little. The reason for the significant difference in birth weight is not clear.

In this study it was assumed that as no significant difference occurred in the weights attained between the two groups, a similar relationship would hold for the gain in weight for each three-monthly interval. This was only tested for the interval between birth and three months, which showed the difference not to be significant. A look at Table IV shows little difference between the weight gains of the Shona children and those of all the children, so it is unlikely that the weight gains of the non-Shona differed markedly from the Shona. Thus, as the weights attained and growth velocities of the two groups were similar, the data were combined and used for the purpose of further comparison.

Evidence has been collected that well-nourished infants of various genetic backgrounds attain weight levels close to those obtained in the Havard studies (Ford, 1964; King *et al.*, 1963; Ashcroft *et al.*, 1965), and Woodruff (1966) thinks that such general standards of reference are of value as a measure of nutrition in public health. Jelliffe (1966) has given a General Standard of Reference for weights attained, both sexes combined, which has been derived from the Havard Standards (Stuart and Stevenson, 1959) and also has calculated the 90, 80, 70 and 60 per cent. values of these weights. He suggests, following the work of Gomez *et al.* (1955), that weight data from surveys should be reported in relation to the four 10 per cent. levels below the General Standard.

The weights attained for age of the children in this township are significantly lower than those of the Havard children after the age of nine months and the fiftieth percentile falls to about 90 per cent. of the General Standard at two years. The tenth percentile falls near to 80 per cent. of the standard at this age. As these children come from a relatively privileged and disease-

free situation, they are likely to have a better nutritional status than those in many of the other urban townships and in most of the rural areas. A desirable standard of weight for age for all the young children in Rhodesia, both Shona and non-Shona, would thus be between the General Standard and the 90 per cent. values of this. However, a more realistic standard at present probably lies somewhere just below the 90 per cent. values of the General Standard.

The reason for the difference in weight between these children at Mufakose and those represented by the General Standard is not entirely clear. Their velocity of growth as judged by weight gain over a fixed period is greater in the first two or three months, but then falls behind that of the Havard children until 18 months, when small numbers make further comparison unjustified. A similar observation was made by Bailey (1964) in New Guinea and he thought that the introduction of supplementary feeding, with consequent reduction in protein intake, was probably the major cause of growth retardation. No exact data are available in this survey as to when weaning was started, but mothers were encouraged to begin around three months and were given dried skimmed milk to use as a protein supplement. It is not known whether this was used adequately, if at all, but it certainly did not prevent abnormal slowing in the rate of growth.

The serum proteins, estimated at ages between one and two years, gave a mean within the normal North American range (Orlandini *et al.*, 1955), and individual values showed no correlation with weight attained for age; a finding in agreement with Arroyave (1961) and Waterlow (1963), who think that the level of serum albumin is of little use in detecting subclinical protein malnutrition. The average level of haemoglobin of the children sampled was 11.2 G. per 100 ml., which is at the lower limit of normal suggested by W.H.O. (1963). Several of the children had haemoglobin levels below this. As no normals for serum proteins or haemoglobin have been published, the above values may act as a guide as to what is "normal" in healthy African infants in Rhodesia.

#### SUMMARY

This paper presents the results of a mixed longitudinal weight survey of young children, derived from the records of a clinic in a township in Rhodesia.

No significant difference was found between the

weights of the Shona children and the non-Shona children in the township.

The weights attained of the children were found to be significantly lower than those of the Havard Standards after the age of nine months. The children of the township had a greater weight velocity than the Havard children in the early months of life, but after three months their weight velocity was lower.

The use in Rhodesia of the General Standard of Reference for weight (Jelliffe, 1966) is discussed and a guide to normal haemoglobin and serum protein values for Rhodesian children is given.

#### Acknowledgments

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