

PHYSICAL GROWTH MEASUREMENTS OF PRESCHOOL URBAN TURKISH CHILDREN*

*Kalbiye Yalaz MD**, Shirley Epir PhD****

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The measurement of height, weight, head and chest circumferences is a basic procedure in pediatric practice being particularly useful for monitoring the growth of individual children in the first six years of life. These records of growth have several uses. They provide concrete and definite criteria for normal growth and are relatively free from judgmental errors. It is essential, of course, that growth charts, or standards, be appropriate. That is, they should represent the averages of a population of children reasonably similar to the individual child being evaluated¹. It was for this reason that WHO recommended the use of local standards whenever possible². Local norms provide a more realistic goal for growth in developing countries, such as Turkey, where growth rates may be affected not only by genetic differences but by inadequate diet as well².

It was the purpose of this study to establish local standards of growth for urban Turkish children. The present study was part of a larger project for standardizing the Denver Developmental Screening Test (DDST) for Turkish children. The goal was to obtain growth and developmental data on a cross-section of healthy children from metropolitan Ankara³.

Material and Methods

Subjects. Head measurements and, in all but a few cases, height, weight and chest measurements were obtained for 1089 children (548 boys, 541 girls) aged between 15 days and 6 years 4 months. Table I gives the distribution of these children by age and sex. These children also participated in the larger DDST project. Details on the criteria for selection and on the demographic characteristics of the sample can be found in the manual for the Turkish standardization of DDST³. In brief, the sample included only healthy children attending well-baby clinics, private offices and nurseries in various parts of the city of Ankara. Specifically excluded were: premature

* From the Hacettepe University Institute of Child Health, Ankara.

** Professor of Pediatrics and Pediatric Neurologist, Hacettepe University Institute of Child Health.

*** Research Psychologist, Hacettepe University Institute of Child Health.

TABLE I
Number of Children by Sex and Age

<u>Age (months)</u>	<u>Boys</u>	<u>Girls</u>
1	28	21
2	18	19
3	25	22
4	17	23
5	25	25
6	19	24
7	26	21
8	27	30
9	27	19
10	20	20
11	26	21
12	18	24
13	19	15
14	19	20
15	19	20
18	36	35
21	25	26
24	25	22
30	23	29
36	13	18
42	17	18
48	19	17
54	19	14
60	19	26
72	19	12
Total	548	541

births, multiple and cesarean births, children with congenital or other physical abnormalities or with neurological disorders. Only one child per family and only children living in metropolitan Ankara were included in the sample. The parents' educational level was used as a marker for socio-economic status and was therefore another criterion in the selection of the children. Within each age group children of parents from each level, that is those with no education, and those with primary, secondary and higher education were all represented. In this project, the mother's education was given equal importance with the father's since research has consistently shown a high relationship between this single variable and measurements of

children's growth and development⁴. Table II shows the distribution of parents by educational level. It should be noted that these data are for the total sample (i.e. 1176) used in the DDST project.

TABLE II
Educational Level of Parents

Educational level	Mother		Father	
	n	%	n	%
No formal education	135	12	23	2
Primary school	471	40	314	27
Middle school	154	13	161	14
Lycée	260	22	289	24
University or equivalent	156	13	389	33
Total	1176	100	1176	100

Procedure. Four pediatric residents from Hacettepe Children's Hospital who served as testers for the DDST project also obtained the physical measurements of the children. Head and chest measurements were made with a plastic, non-stretch tape. The head circumference was measured by applying the tape over the supra-orbital and occipital protuberances. Chest measurements were made during mid-respiration at the level of the nipples. Height and weight were measured on standard equipment available at the clinics or offices where the children were measured and tested. Weight measurements were taken with the child undressed, in a prone position up to the age of two and afterwards in a standing position.

Analysis. Means and standard deviations were calculated for each age group and for each of the four measurement variables. A 3 degree polynomial regression analysis was used to obtain smooth growth curves, for boys and girls separately. The correlation coefficients between fitted curves and original data for all sets of data were $r = 0.99$. None of the Durbin-Watson Tests were significant. Standard deviations were submitted to the same curve fitting procedure.

Results

Tables III and IV give the means and standard deviations at each age for the four sets of body measurements, for boys and girls respectively. The data are derived from the smoothed curves.

The same data are presented as growth curves in Figures 1 through 4. Two standard deviations below and above the mean, which include 96% of the children, were

TABLE III
Weight, Height, Head and Chest Circumferences: Boys

Age (months)	Weight (kg)		Height (cm)		Head circumference (cm)		Chest circumference (cm)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	4.3	0.6	55.6	2.5	37.4	1.0	37.3	1.7
2	5.3	0.6	58.4	3.2	38.9	1.0	39.4	1.8
3	6.1	0.7	60.9	3.5	40.2	1.1	41.1	1.9
4	6.8	0.8	63.3	3.7	41.3	1.1	42.4	2.1
5	7.5	0.9	65.5	3.6	42.2	1.1	43.4	2.2
6	7.9	1.0	67.5	3.5	43.0	1.2	44.1	2.2
7	8.3	1.0	69.3	3.3	43.7	1.2	44.6	2.3
8	8.7	1.1	70.9	3.1	44.2	1.3	45.1	2.3
9	9.0	1.2	72.3	3.0	44.7	1.3	45.4	2.3
10	9.3	1.2	73.6	3.0	45.1	1.4	45.8	2.3
11	9.6	1.2	74.7	3.2	45.5	1.4	46.2	2.2
12	9.8	1.1	75.6	3.6	45.9	1.4	46.9	2.2
13	10.2	1.1	76.4	3.9	46.1	1.3	47.7	2.2
14	10.4	1.2	77.3	3.9	46.3	1.3	47.9	2.3
15	10.5	1.3	78.2	3.9	46.5	1.3	48.0	2.3
18	11.0	1.3	80.7	3.9	47.0	1.3	48.3	2.3
21	11.5	1.4	83.0	3.9	47.4	1.3	48.6	2.3
24	12.0	1.5	85.3	4.0	47.8	1.3	49.0	2.3
30	13.1	1.6	89.5	4.1	48.4	1.3	49.9	2.3
36	14.1	1.8	93.3	4.3	48.9	1.3	50.8	2.2
42	15.2	1.9	96.9	4.5	49.3	1.3	51.9	2.1
48	16.2	2.1	100.2	4.9	49.7	1.3	52.9	2.0
54	17.2	2.2	103.5	5.5	50.0	1.3	53.9	2.0
60	18.2	2.4	106.7	6.3	50.3	1.3	54.8	2.1
72	20.0	2.7	113.5	8.9	50.8	1.4	56.0	2.6

used to define the normal range for each set of measurements. As such, the lower line of each group represents the 2nd percentile and the upper line the 98th percentile.

Discussion

Physical growth measurements are convenient criteria for evaluating physical development in the early years and are particularly useful in the early identification of

TABLE IV
Weight, Height, Head and Chest Circumferences: Girls

Age (months)	Weight (kg)		Height (cm)		Head circumference (cm)		Chest circumference (cm)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	4.0	0.7	54.7	1.8	36.4	1.1	36.3	1.5
2	4.9	0.7	57.3	2.4	37.9	1.1	38.3	1.8
3	5.7	0.8	59.8	2.8	39.1	1.1	39.8	2.0
4	6.4	0.8	61.9	3.0	40.2	1.1	41.1	2.1
5	6.9	0.9	63.9	3.1	41.1	1.1	42.1	2.1
6	7.5	1.0	65.7	3.1	41.9	1.1	42.9	2.1
7	7.9	1.0	67.3	3.0	42.5	1.1	43.5	2.0
8	8.2	1.1	68.8	2.9	43.1	1.2	43.9	2.0
9	8.5	1.1	70.1	2.8	43.6	1.2	44.3	1.9
10	8.7	1.1	71.4	2.8	44.0	1.2	44.7	1.9
11	8.9	1.0	72.5	2.8	44.3	1.2	45.0	1.9
12	9.0	1.0	73.6	2.8	44.6	1.3	45.3	2.0
13	9.2	1.0	74.6	3.2	44.9	1.3	45.4	2.0
14	9.6	1.2	76.1	3.4	45.3	1.3	45.8	2.0
15	9.8	1.2	76.9	3.7	45.5	1.3	46.2	2.0
18	10.7	1.3	79.5	4.3	46.1	1.3	47.2	2.0
21	11.4	1.4	81.9	4.9	46.6	1.3	48.0	2.1
24	12.1	1.5	84.4	5.3	47.0	1.4	48.7	2.1
30	13.2	1.6	88.9	6.1	47.7	1.4	49.9	2.2
36	14.1	1.8	93.1	6.6	48.2	1.4	50.6	2.3
42	14.9	2.0	96.9	6.9	48.6	1.5	51.2	2.3
48	15.7	2.2	100.4	6.9	48.9	1.5	51.6	2.4
54	16.5	2.4	103.6	6.9	49.1	1.5	52.1	2.4
60	17.2	2.5	106.4	6.9	49.3	1.5	52.7	2.4
72	19.2	2.9	110.8	6.7	49.8	1.6	54.8	2.5

certain abnormalities. For these purposes, charts, or standards, based on local data are desirable², since local standards reflect the potentially different patterns of growth resulting from racial and dietary differences. WHO has recommended using the elite for normative studies in developing countries²; however it was felt in this case, that standards based entirely on the elite of urban Turkey would be as unrealistic a goal for the general urban population as general standards of reference such as the Harvard Standards⁵. Therefore, this study did not aim to represent the best nourished urban children, but rather the healthiest of a cross section of urban chil-

dren. As such, we feel it is a better yardstick for the individual child most frequently seen in out-patient and well-baby clinics. There are, furthermore, growth charts in Turkey based on a more elite urban sample⁶. Data are also available on a more varied group of urban children⁷, but in this latter study, health history was not a factor in selection. Further, head measurements were obtained in neither of these studies. The data in the present study included head measurements, which we feel are as necessary as height and weight for proper evaluation of a child's development⁸.

In our study, care was taken to use the equipment and the procedure routinely used by practicing pediatricians, thereby making the pediatricians' measurements of the individual child readily comparable to these standards.

These data were collected in 1981 and therefore should be relevant for a few more years. It should be stressed, however, that all measurement data need to be updated periodically⁹. In a country changing as rapidly as Turkey, such updating may be needed more frequently than in developed countries.

Finally, it is important to note that our study is a cross-sectional study and so represents the average pattern of development. Longitudinal studies which follow the same children over a long period of time, such as the one by Tanındı *et al*¹⁰, should be used as a supplement to our standards. These longitudinal data show how individual children vary from the average pattern of development.

Summary

Height, weight, head and chest measurements were obtained for 1089 children aged between 15 days and 6 years 4 months. The sample included only healthy children and represented the various socio-economic levels in the city of Ankara. Growth charts and graphs were prepared separately for boys and girls. Recommendations for their use were considered.

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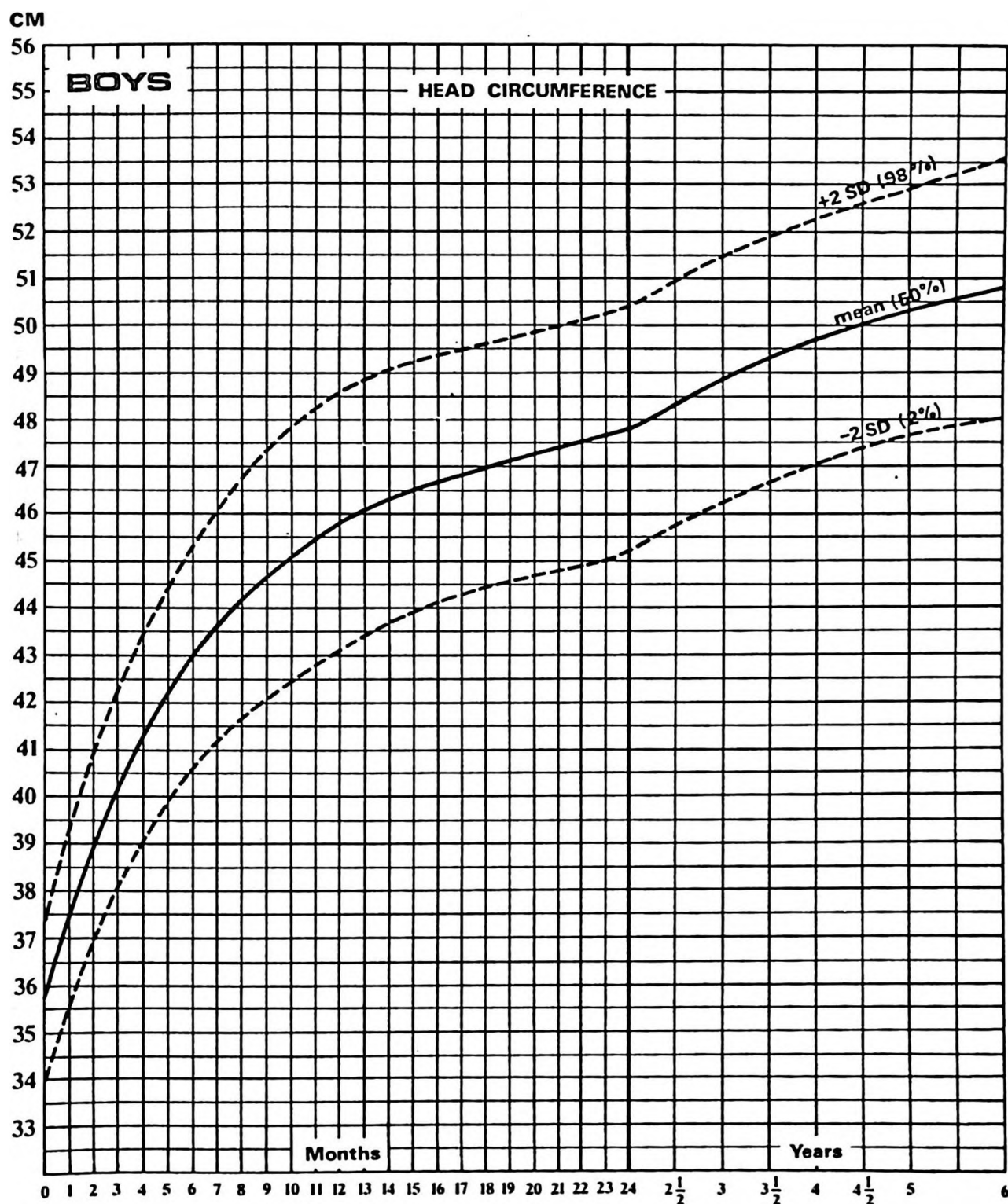


Figure 1.

Head circumference: means and standard deviations for boys.

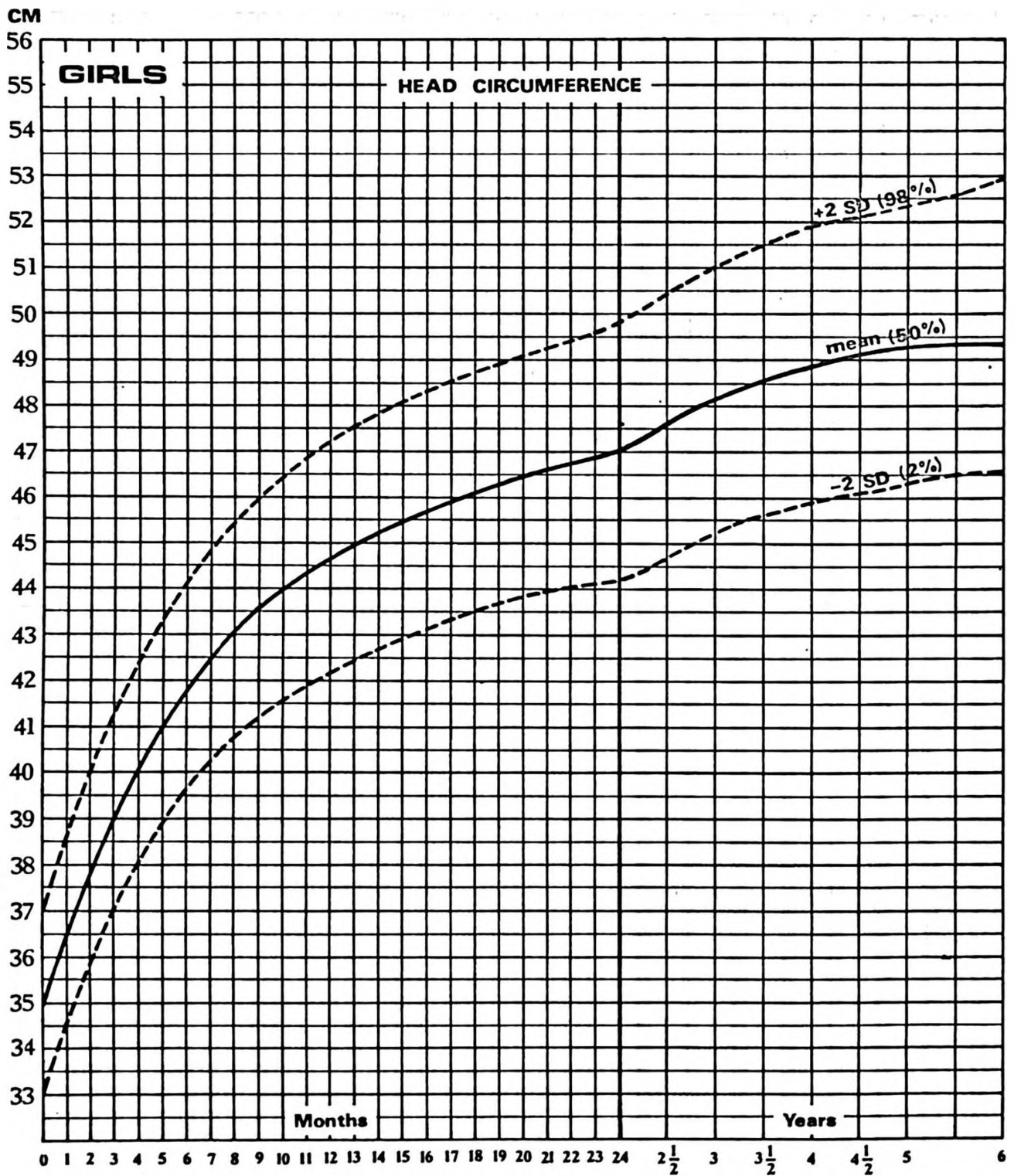


Figure 2.

Head circumference : means and standard deviations for girls.

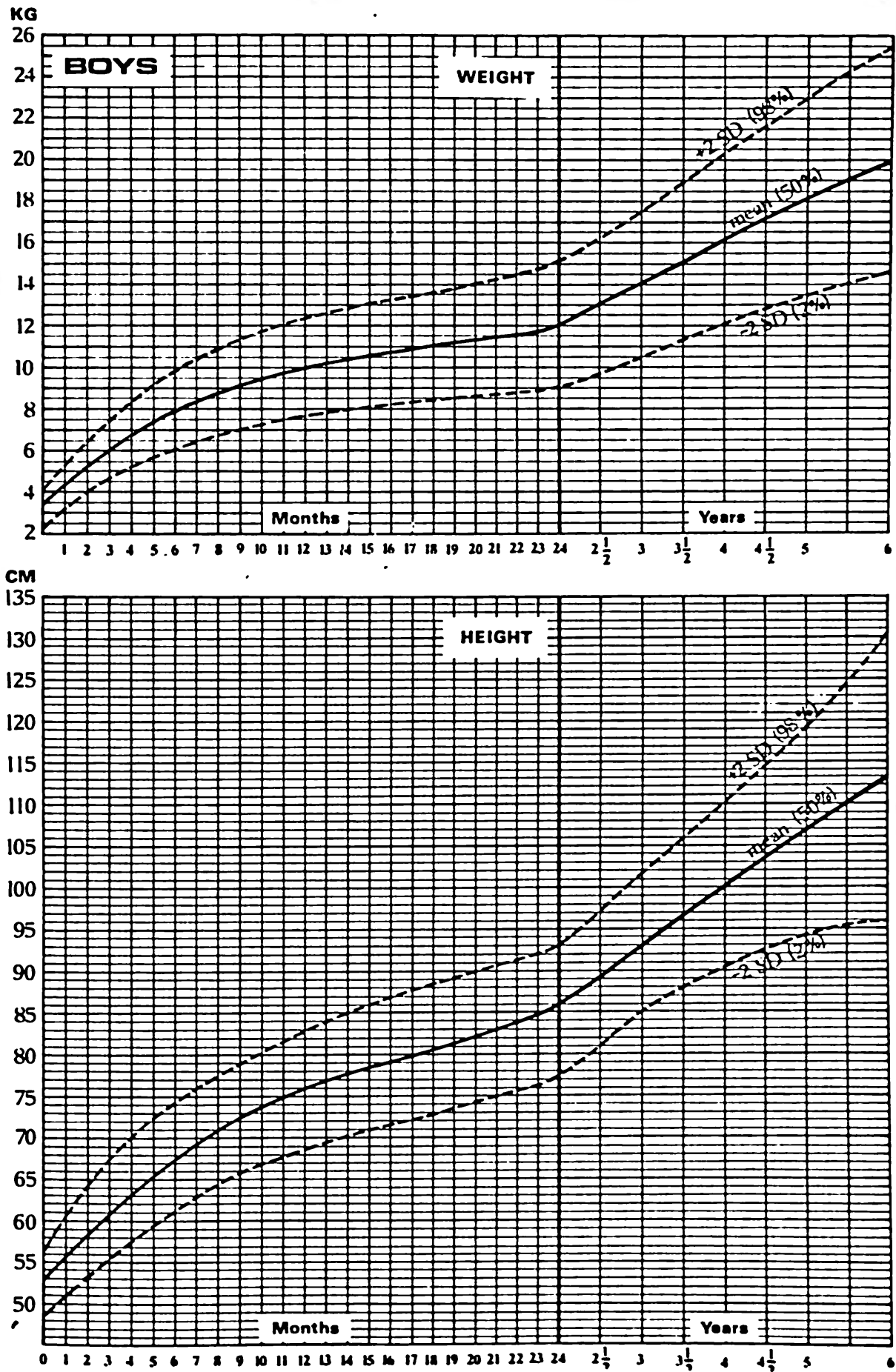


Figure 3.

Weight and height: means and standard deviations for boys.

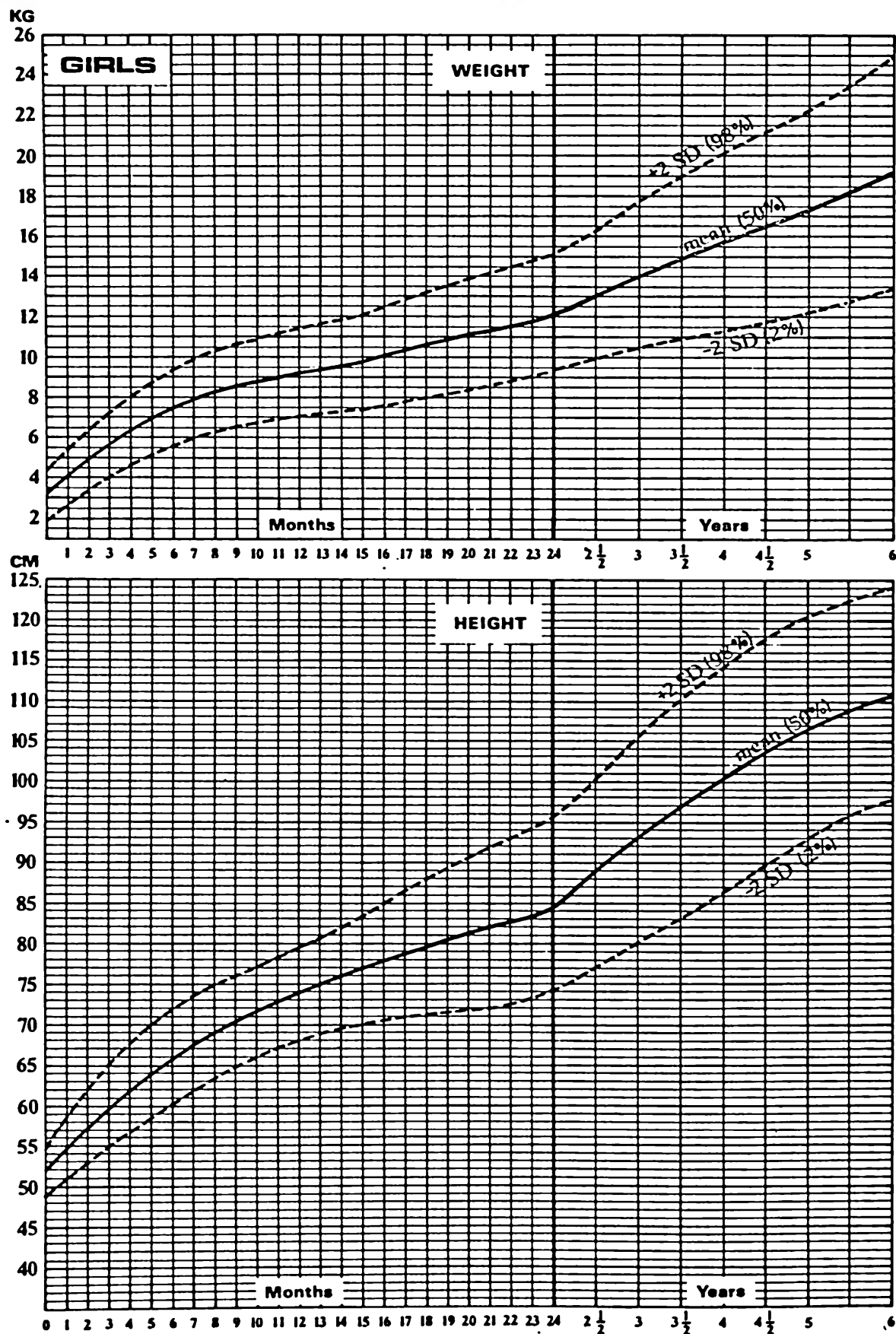


Figure 4.

Weight and height: means and standard deviations for girls.

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