Comparison of Body Weight and Height of Israeli Schoolchildren With the Tanner and Centers for Disease Control and Prevention Growth Charts

Abraham Goldstein, PhD*; Uri Haelyon, MD‡; Evgenia Krolik, MD‡; and Joseph Sack, MD‡

ABSTRACT. *Objective.* **To examine the suitability of the growth charts that are currently used in Israel and consider their replacement with a recent standard. In a sample of schoolchildren, the current Tanner and Whitehouse standards were compared with the new growth charts from the Centers for Disease Control and Prevention (CDC).**

Method. **A total of 746 Israeli healthy children (368 boys and 378 girls) aged 6 to 14 years were sampled from 2 super-regional schools (from the Jewish population). Height was measured using the Leicester height measure, and weight was measured using scales calibrated by the researchers.**

Results. **In height, 75% of the boys and 81% of the girls fell in the 10th to 90th percentile range of the Tanner standards. In weight, 71% of the boys and 81% of the girls were in the 10th to 90th percentile range. Israeli boys were taller ($\chi^2(1) = 30.53$) and heavier ($\chi^2(1) = 29.39$), and girls were taller ($\chi^2(1) = 13.81$) than predicted by the Tanner standards. The CDC 10th to 90th percentile range included 81% of the boys and 83% of the girls for height and 78% of the boys and 81% of the girls for weight. The girls in our sample were slightly shorter ($\chi^2(1) = 11.87$) and lighter ($\chi^2(1) = 9.52$) than predicted from the CDC charts. Nevertheless, neither boys' nor girls' body mass index measures (kg/h²) differed from the CDC charts.**

Conclusions. **Our data suggest that the CDC growth charts are adequate for assessing Israeli children and slightly better than the current standard. Thus, in the absence of local standards, we recommend the use of the revised CDC growth charts, which include the additional body mass index measure.** *Pediatrics* **2001;108(6). URL: http://www.pediatrics.org/cgi/content/full/108/6/e108; *growth, anthropometry.***

ABBREVIATIONS. CDC, Centers for Disease Control and Prevention; BMI, body mass index.

In the past decades, there have been sharp nutritional, demographic, and economic changes in Israel. The population of Israel increased from approximately 872 000 in 1948 to more than 6 million in 2001,[1] primarily as a result of immigration from various countries—from the former Soviet Union and from Ethiopia in the past decade. In addition, as in other countries of the world, there is a secular increase in body measures, whereas differences between ethnic groups decrease.[2]

Currently, clinicians use the Tanner and Whitehouse[3] standard tables and curves in assessing the height and weight of children. It is reasonable to expect that those standards, which were originally developed for British children, are not necessarily suitable for today's Israeli children.

Many countries develop their own growth standards, but the procedure requires extensive and expensive study. The World Health Organization[4] has recommended the adoption of the American growth charts where no local standard exists.

We decided to examine whether the currently used charts[3] are still suitable for Israeli children of today or the new standards from the Centers for Disease Control and Prevention (CDC)[5] are preferable. Height and weight measures of a sample of schoolchildren were compared with both standards. Our aim was not to create local growth tables but to determine whether, in general, our sample fits the distribution of the currently used tables. Therefore, our sample, although consisting of children of various ethnic groups, is not necessarily representative of the whole population. In addition, we used a cross-sectional sample of children of various ages instead of performing a longitudinal study. The goal of the present study was to indicate whether it is necessary to create a new local standard or the adoption of the CDC charts would be preferable to the Tanner standards.

METHODS

Participants were 746 Israeli healthy children (368 boys and 378 girls) aged 6 to 14 from 2 super-regional schools. Children who attend those schools come from a wide area, both rural and urban, in the central part of the country and include the various Jewish ethnic groups. The sample excluded children who experienced chronic, chromosomal, bone, or cartilage diseases.

All measurements were taken during early morning and with parental permission. The Leicester height measure determined children's height to the nearest 0.1 cm. Weight was measured, to the nearest 0.1 kg, using school scales carefully calibrated by the researchers. All children were measured by 2 of the authors (K.E., H.U.).

Statistics

Comparisons between our sample and the 2 standards were performed using the median as a central measure. The goodness-

From *Experimental Psychology, Bar-Ilan University, ‡Pediatric Endocrinology, Sheba Medical Center, Sackler School of Medicine, Ramat-Gan, Israel.

Received for publication Apr 9, 2001; accepted Jul 13, 2001.

Reprint requests to (A.G.) Department of Psychology, Bar-Ilan University, Ramat-Gan, 52900, Israel. E-mail: goldsa@mail.biu.ac.il

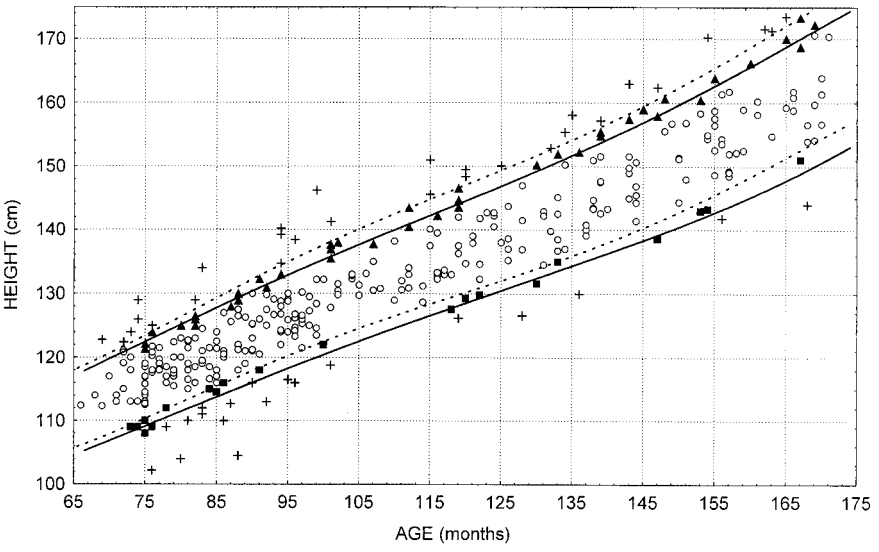

Fig 1. Height of boys by age. Solid lines depict the Tanner 10th to 90th percentiles; dotted lines depict the CDC 10th to 90th percentiles. ○, data points in the Israeli sample; ▲, ■, children outside the Tanner and CDC 10th to 90th percentile range, respectively; †, children outside the 10th to 90th percentile range of both standards.

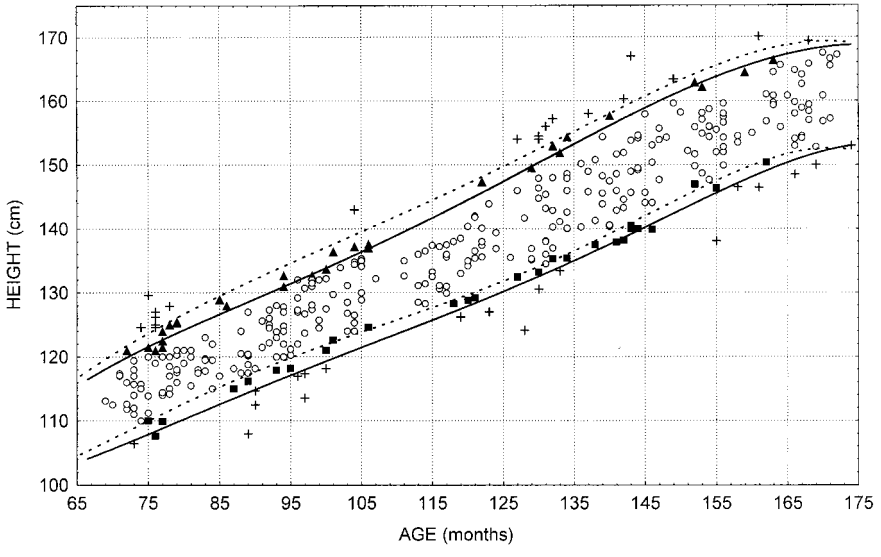

Fig 2. Height of girls by age. Solid lines depict the Tanner 10th to 90th percentiles; dotted lines depict the CDC 10th to 90th percentiles. ○, data points in the Israeli sample; ▲, ■, children outside the Tanner and CDC 10th to 90th percentile range, respectively; †, children outside the 10th to 90th percentile range of both standards.

of-fit of our sample to both distributions was tested with nonparametric tests (χ^2), and an α level of 0.05 was adopted. Statistical analyses were performed with standard statistical software packages.

RESULTS

Figures 1 to 4 depict the distribution of height and weight measures of our sample against the Tanner and the CDC standard. As can be seen in the figures, there was no significant deviation from either standard.

In the height measure, 75% of the boys and 81% of the girls fell in the 10th to 90th percentile range of the Tanner standards. Similarly, using the CDC height standards, 81% of the boys and 83% of the girls were in the 10th to 90th percentile range.

The children in our sample were taller than predicted by the Tanner standards: 64% of the boys ($\chi^2(1) = 30.53$; $P < .001$) and 60% of the girls ($\chi^2(1) = 13.81$; $P < .001$) had above-median height. In contrast, compared with the CDC standards, girls in our sample generally were shorter. Although 45% of the boys were above the CDC median ($\chi^2(1) = 3.52$; NS), only 41% of the girls ($\chi^2(1) = 11.87$; $P < .001$) had above-median height.

Regarding body weight, 71% of the boys and 81% of the girls fell within the Tanner 10th to 90th percentile range, whereas 78% of the boys and 81% of the girls fell in the 10th to 90th percentile range of the CDC standards.

Boys in our sample were significantly heavier than expected by the Tanner standards (64% above median, $\chi^2(1) = 29.39$; $P < .001$) and were no different from the CDC standard. The girls' weight was not different from the Tanner standards, but only 42% were above the CDC median ($\chi^2(1) = 9.52$; $P < .01$).

In sum, our sample of Israeli children still fits generally to the Tanner distribution. However, their height and weight measures, especially of boys, were significantly higher. In contrast, our sample had a slightly better fit to the CDC charts overall, despite the girls' being smaller. Nevertheless, when using the body mass index (BMI) measures (kg/h^2), neither

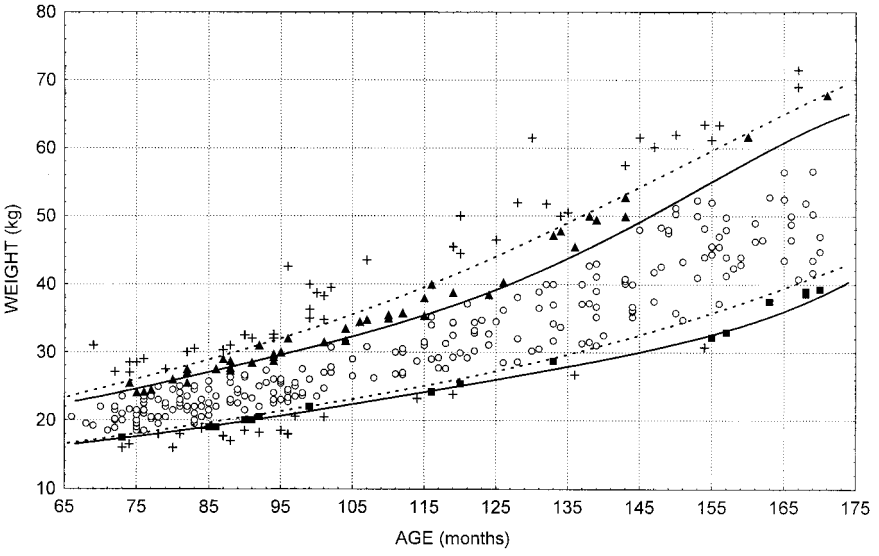

Fig 3. Weight of boys by age. Solid lines depict the Tanner 10th to 90th percentiles; dotted lines depict the CDC 10th to 90th percentiles. ○, data points in the Israeli sample; ▲, ■, children outside the Tanner and CDC 10th to 90th percentile range, respectively; †, children outside the 10th to 90th percentile range of both standards.

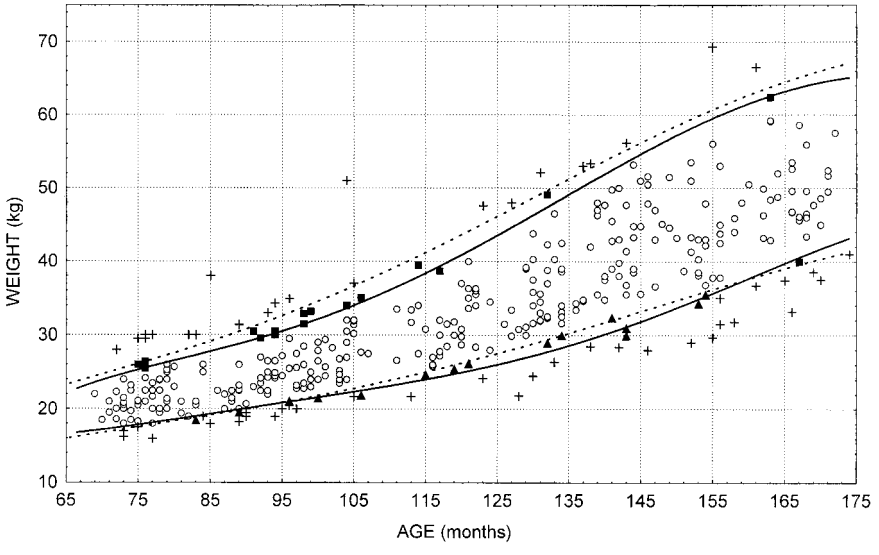

Fig 4. Weight of girls by age. Solid lines depict the Tanner 10th to 90th percentiles; dotted lines depict the CDC 10th to 90th percentiles. ○, data points in the Israeli sample; ▲, ■, children outside the Tanner and CDC 10th to 90th percentile range, respectively; †, children outside the 10th to 90th percentile range of both standards.

boys nor girls differ from the CDC growth charts (Figs 5 and 6).

DISCUSSION

The data show that although the Tanner charts still fit the Israeli children fairly well, the children of our sample are slightly taller and slightly heavier, probably reflecting the secular changes over the years and improved health and nutrition. A caveat should be noted about our sample, however. Because it was not a representative sample, not all economic strata were included. The sample consisted primarily of children from middle-class families, and not children of extremely low economic status.

Our data suggest that the use of the CDC growth charts is adequate for assessing Israeli children and slightly better than the Tanner standard being used. In addition, the CDC standards include the BMI measure, which our sample fits very well. Thus, from this preliminary study, we recommend, in the absence of local standards, the use of the revised CDC growth charts.

Although smaller, the population of Israel is similar to that of the United States. Both are countries heavily populated by immigrants and include a wide variety of ethnic groups. Thus, it is reasonable to expect that future adjustments to the CDC growth charts as a result of changes in the American population will fit the changes in the Israeli population as well. The adoption of the new standard will yield better diagnoses of individuals and groups and should be a simple procedure, especially because the CDC charts are available to the public online.

We believe that this method of comparison between standardized tables and local samples might be generalized and used in other countries in which no standard charts exist. It is a relatively simple method that may be used instead of the expensive and time-consuming effort necessary to develop local standard tables. Because nonparametric tests are

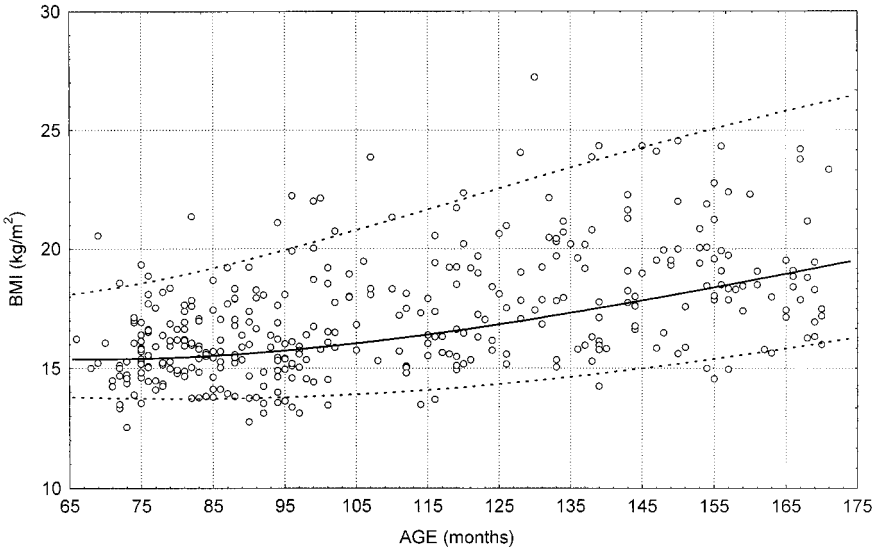

Fig 5. BMI of boys by age. Circles represent each data point in the Israeli sample; lines depict the CDC median and 10th to 90th percentiles.

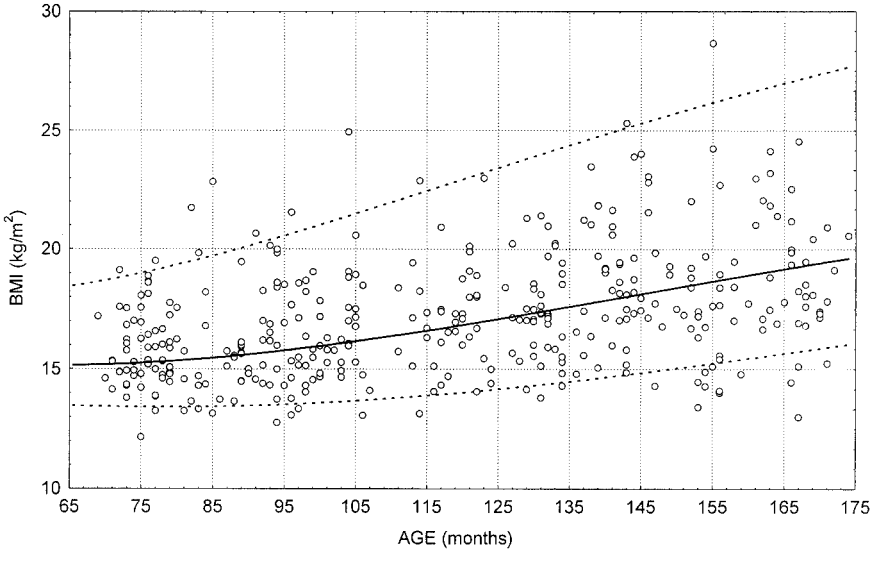

Fig 6. BMI of girls by age. Circles represent each data point in the Israeli sample; lines depict the CDC median and 10th to 90th percentiles.

used, the size of the sample is not as crucial, as long as the entire age range is covered. Countries that lack the means for constructing their own tables can compare a local sample to various standardized tables of countries with similar population characteristics and determine the standard that should be adopted.

Standards need to be updated continually because of the secular increase of body measures and other demographic changes. Even in countries in which local standards exist, this comparison method may be used to test whether an adjustment to the standard is needed, before undertaking major revisions.

Finally, this simple method may be used to compare body measures between populations. One of the authors (H.U.) has used this method to compare Israeli samples with local European, Asian, and international standards.[6] More important, this method of comparison may be used within a particular population to compare specific subgroups to the standard, thus aiding in the assessment of risk groups.

REFERENCES

1. Central Bureau of Statistics. Advance Press Release. Jerusalem, Israel. Available at: http://www.cbs.gov.il
2. Laor A, Seidman DS, Danon YL. Changes in body height among selected ethnic groups. *J Epidemiol Community Health*. 1991;45:169–170
3. Tanner JM, Whitehouse RH. Clinical longitudinal standards for height, weight, height velocity, weight velocity, and stages of puberty. *Arch Dis Child*. 1976;51:170–179
4. *Measuring Change in Nutritional Status. Guidelines for Assessing the Nutritional Impact of Supplementary Feeding Programmes for Vulnerable Groups*. Geneva, Switzerland: World Health Organization; 1983
5. Kuczmarski RJ, Ogden CL, Grummer-Strawn LM, et al. CDC growth charts: United States. *Adv Data*. 2000;Jun 8:1–27
6. Haelyon U. *Comparing Body Measures of Israeli Children With Children of Other Countries* [unpublished doctoral thesis]. Tel-Aviv, Israel: Tel-Aviv University, Sackler School of Medicine; 2000

Comparison of Body Weight and Height of Israeli Schoolchildren With the Tanner and Centers for Disease Control and Prevention Growth Charts

Abraham Goldstein, Uri Haelyon, Evgenia Krolik and Joseph Sack

Pediatrics 2001;108;e108
DOI: 10.1542/peds.108.6.e108

Comparison of Body Weight and Height of Israeli Schoolchildren With the Tanner and Centers for Disease Control and Prevention Growth Charts

Abraham Goldstein, Uri Haelyon, Evgenia Krolik and Joseph Sack

Pediatrics 2001;108;e108
DOI: 10.1542/peds.108.6.e108