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# METHODOLOGICAL NOTES ON TWO CROSS-SECTIONAL GROWTH STUDIES

GY. FARKAS and ZS. JUST

*Department of Anthropology, József Attila University, H-6701 Szeged P.O.B. 660, Hungary*

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## Abstract

Comparisons were made of the body height and weight parameters established in two large cross-sectional growth studies. These separate studies reveal common features, but also differences. The unpaired t-test demonstrated the following significant differences: among the 32 age groups (created by dividing the core samples into 6-month age groups ranging from 3 to 18 years of age), significant differences in height appeared in 15 cases among the boys and in 9 cases among the girls. As regards the weights, 14 of the age groups among the boys and 25 of the age groups among the girls revealed significant differences. These constitute 49.2% of the total cases.

This comparison draws attention to the importance of the reliability of measuring and the choice of anthropological sampling.

*Key words*: growth standards, Hungary

## Introduction

National standards are essential in monitoring the physical condition of children. All ethnic groups differ from others in taxonomic, ethnogenetic, historical and other aspects. In establishing the body development of the young of a certain ethnic group, therefore the most appropriate standards are those derived from the somatometric data of the same ethnic group.

For many years, American standards served as the benchmark in Hungary. Although sporadic local growth studies have been carried out in Hungary, these were not suitable for setting up national growth standards for the following reasons:

- the measurements were made by different persons,
- the investigations were not systematic and intensive,
- the age groupings differed in the various studies.

Growth studies must comply with basic requirements. If the data are to be used as a reference, care must be taken to ensure representative and random sampling. The

evaluations must also follow standardization. Among the Hungarian growth studies, the largest difference usually appears in the age grouping.

These facts led the Department of Anthropology in Budapest to organize a nation-wide cross-sectional sampling under the supervision of OTTÓ EIBEN. The investigation was designed to yield information on the physical status and body development of Hungarian children as a function of the influence of the socialist society:

- within the frame of the socialist social structure up to the 1980s;
- under the conditions of urbanization due to socialist industrialization;
- under the influence of the class restructuring of the population during the 30 years of the socialist society;
- within the bounds of urban and rural ways of life (EIBEN and PANTÓ, 1981).

Since the time of those studies, it has emerged that the achievement of a truly socialist society in Hungary appears to be merely a utopia, and secularization of the young can be attained even without socialism.

Data collection extended throughout Hungary and involved 1.5-2% of the population in the age range 3-18 years (EIBEN, 1986).

In consequence of the uncoordinated growth studies in Hungary, the Department of Anthropology in Szeged also organized such a project at the beginning of the 1980s, under the supervision of GYULA FARKAS (FARKAS, 1990). This was aimed at investigating the relationship between the menarche and the socio-economic and physical factors, but the height, weight and normal chest circumference were also studied.

## Material and method

As the two projects were virtually simultaneous, their comparison seems obvious.

In the remainder of this paper, the research carried out at the Department of Anthropology at Lóránd Eötvös University will be referred to as NGS, the abbreviation for National Growth Standard, while the investigation carried out by the Department of Anthropology at Attila József University will be referred to by the abbreviation Sz, for Szeged.

The NGS and Sz samples share the following features:

- both samplings compiled data on Hungarian children;
- the data collections were carried out at the beginning of the 1980s;
- both boys and girls were measured, in age groups ranging from 3 to 18.5 years;
- the samples were comprehensive;
- the measurements followed the standards set by Martin;
- the evaluations were carried out by computer in 6-month age groups;
- the measurements were made by different persons.

The samples differ in the following ways:

- NGS sampling is a proportional one, taking into consideration the total numbers of boys and girls in a given county, while half of the total Sz sample is from Csongrád County, representing 95% of the 3-18-year-old boys and girls living in that county; the remainder of the sample was collected by random sampling from the other 18 counties of the country;
- NGS measurements were recorded by different persons; in the case of the Sz sample, specific measurements were always made by the same person with the same instrument;
- NGS used a spring scale to measure the weight with 500 gram accuracy (BARABÁS et al., 1990), whereas Sz used a medical scale with 50 gram accuracy;

- normal NGS values were given in percentile, whereas Sz gave an interval of $x \pm 1.96$ s;
- the difference in the sample size is significant with regard to the girls, but less so for the boys;
- the sample sizes differ in the specific age groups.

The present study was set up to elucidate whether or not there are differences between the two samples with regard to the mean measurements for the various age categories. Boys and girls were evaluated separately.

Normal chest circumference was not comparable, as the age groupings in the two samples were dissimilar. The appropriate pairs of means were tested by the t-test.

## Results

Parameters of height and weight are shown in Tables 1-4, where the means, the sample sizes and the standard deviations for the specific age groups of the NGS study are denoted by number 1, and those of the Sz study by number 2. The difference between the means of the samples in relation to age is denoted by "d", "t" is the result of the t-test and "P" signifies the level of significance.

Results are summarized in Table 5.

This Table illustrates that, as concerns the 32 age groups, created by dividing the core samples into 6-month age groups from 3 to 18 years of age:

1. the Sz sample indicated that the height was greater in 24 cases among the boys and in 25 cases among the girls;
2. these differences were significant in 15 age groups among the boys and in 9 age groups among the girls;
3. 5 of the above significant deviations were greater for the Sz sample, and 10 for the NGS sample; among the 9 significant deviations of the heights of the girls, 1 was greater for the Sz sample, and 8 for the NGS sample.
4. With regard to the weight, 24 of the age group data for the boys and 31 of those for the girls were greater in the Sz sample.
5. Of the differences in point 4, these were significant in 14 of the age groups among the boys, and 25 of the age groups among the girls.
6. 13 of the 14 significant differences in the measurements on the boys were greater in the Sz sample and 1 in the NGS sample. As concerns the measurements on the girls all the 25 significantly different age group values were greater in the Sz sample.
7. Among the 63 significant differences, 12 were significant at the 0.005 level, and 51 at a level less than 0.05.

*Table 1.* Parameters relating to boys' heights in 6-month age groups.

| Age | $\overline{x}_1$ | $\overline{x}_2$ | d | $n_1$ | $n_2$ | $s_1$ | $s_2$ | S | t | P |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 98.13 | 96.24 | 1.89 | 65 | 98 | 3.70 | 3.97 | 3.86 | 3.06 | **1** |
| 3.5 | 99.59 | 99.39 | 0.20 | 101 | 310 | 4.37 | 4.20 | 4.24 | 0.41 | ns |
| 4 | 103.79 | 102.80 | 0.99 | 94 | 394 | 4.37 | 4.36 | 4.36 | 1.98 | **5** |
| 4.5 | 107.23 | 106.14 | 1.09 | 109 | 518 | 7.05 | 4.43 | 4.98 | 2.08 | **5** |
| 5 | 110.09 | 109.01 | 1.08 | 122 | 492 | 5.25 | 4.84 | 4.92 | 2.17 | **5** |
| 5.5 | 112.48 | 112.71 | -0.23 | 137 | 543 | 4.46 | 4.88 | 4.80 | 0.50 | ns |
| 6 | 116.42 | 116.34 | 0.08 | 151 | 615 | 4.18 | 5.30 | 5.10 | 0.17 | ns |
| 6.5 | 117.84 | 119.07 | -1.23 | 191 | 599 | 4.97 | 5.51 | 5.38 | 2.75 | **1** |
| 7 | 121.28 | 122.21 | -0.93 | 214 | 688 | 5.79 | 5.34 | 5.45 | 2.18 | **5** |
| 7.5 | 124.66 | 125.00 | -0.34 | 184 | 717 | 5.40 | 5.49 | 5.47 | 0.75 | ns |
| 8 | 127.29 | 127.56 | -0.27 | 198 | 658 | 5.14 | 5.37 | 5.32 | 0.60 | ns |
| 8.5 | 130.09 | 130.62 | -0.53 | 188 | 693 | 5.95 | 5.69 | 5.75 | 1.12 | ns |
| 9 | 132.02 | 133.24 | -1.22 | 194 | 695 | 6.04 | 6.21 | 6.17 | 2.43 | **2** |
| 9.5 | 134.85 | 136.03 | -1.18 | 189 | 719 | 6.52 | 6.42 | 6.44 | 2.24 | **5** |
| 10 | 138.04 | 139.06 | -1.02 | 403 | 713 | 6.14 | 6.32 | 6.26 | 2.62 | **1** |
| 10.5 | 141.14 | 140.39 | 0.75 | 1164 | 693 | 6.26 | 6.25 | 6.25 | 2.50 | **2** |
| 11 | 143.07 | 143.30 | -0.27 | 1563 | 718 | 6.54 | 6.75 | 6.61 | 0.77 | ns |
| 11.5 | 145.71 | 146.18 | -0.47 | 1636 | 658 | 6.78 | 7.12 | 6.88 | 1.48 | ns |
| 12 | 148.57 | 148.95 | -0.38 | 1663 | 666 | 7.41 | 7.11 | 7.33 | 1.13 | ns |
| 12.5 | 151.22 | 152.34 | -1.12 | 1663 | 700 | 7.91 | 8.23 | 8.01 | 3.11 | **0.2** |
| 13 | 155.11 | 155.67 | -0.56 | 1735 | 711 | 8.32 | 8.26 | 8.30 | 1.52 | ns |
| 13.5 | 158.40 | 158.87 | -0.47 | 1711 | 706 | 8.51 | 8.53 | 8.52 | 1.23 | ns |
| 14 | 162.19 | 162.60 | -0.41 | 1585 | 747 | 8.62 | 8.38 | 8.54 | 1.08 | ns |
| 14.5 | 165.08 | 166.16 | -1.08 | 1516 | 774 | 8.58 | 8.43 | 8.53 | 2.87 | **1** |
| 15 | 167.83 | 168.72 | -0.89 | 1158 | 889 | 7.99 | 7.90 | 7.95 | 2.51 | **2** |
| 15.5 | 170.51 | 171.40 | -0.89 | 1095 | 847 | 7.27 | 7.38 | 7.32 | 2.66 | **1** |
| 16 | 171.63 | 172.19 | -0.55 | 1021 | 852 | 7.06 | 6.76 | 6.93 | 1.74 | ns |
| 16.5 | 173.21 | 173.41 | -0.20 | 905 | 796 | 6.64 | 6.66 | 6.65 | 0.61 | ns |
| 17 | 173.43 | 174.41 | -0.98 | 834 | 758 | 6.68 | 7.10 | 6.88 | 2.84 | **1** |
| 17.5 | 174.39 | 174.88 | -0.49 | 525 | 596 | 6.47 | 6.58 | 6.53 | 1.25 | ns |
| 18 | 175.48 | 175.58 | -0.10 | 408 | 436 | 6.86 | 6.87 | 6.86 | 0.21 | ns |
| 18.5 | 174.56 | 172.10 | 2.46 | 126 | 244 | 6.65 | 15.35 | 13.06 | 1.72 | ns |
| sum. | | | | 22848 | 20243 | | | | | |

Note: $\mathbf{x_1}$, $\mathbf{n_1}$ and $\mathbf{s_1}$ are the parameters of the Sz sample, while $\mathbf{x_2}$, $\mathbf{n_2}$ and $\mathbf{s_2}$ are those of the NGS sample, **d** is the deviation between $x_1$ and $x_2$, **S** is the common standard deviation, **t** is the result of the t-test, and **P** is the level of significance.

*Table 2.* Parameters relating to girls' heights in 6-month age groups.

| Age | $\overline{x}_1$ | $\overline{x}_2$ | d | $n_1$ | $n_2$ | $s_1$ | $s_2$ | S | t | P |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 97.01 | 95.99 | 1.02 | 57 | 118 | 3.86 | 3.67 | 3.73 | 1.69 | ns |
| 3.5 | 98.52 | 98.95 | -0.43 | 93 | 317 | 3.82 | 3.93 | 3.91 | 0.93 | ns |
| 4 | 103.35 | 101.76 | 1.59 | 112 | 441 | 3.95 | 4.46 | 4.36 | 3.44 | **0.1** |
| 4.5 | 105.75 | 105.53 | 0.22 | 118 | 469 | 3.89 | 4.58 | 4.45 | 0.48 | ns |
| 5 | 109.83 | 109.18 | 0.65 | 135 | 497 | 4.53 | 4.82 | 4.76 | 1.41 | ns |
| 5.5 | 113.16 | 112.67 | 0.49 | 136 | 565 | 4.57 | 4.82 | 4.77 | 1.07 | ns |
| 6 | 115.76 | 115.97 | -0.21 | 152 | 629 | 5.24 | 5.25 | 5.24 | 0.44 | ns |
| 6.5 | 117.28 | 118.72 | -1.44 | 188 | 626 | 5.15 | 5.30 | 5.27 | 3.29 | **0.1** |
| 7 | 120.99 | 121.63 | -0.64 | 187 | 579 | 5.77 | 5.15 | 5.31 | 1.43 | ns |
| 7.5 | 123.62 | 124.16 | -0.54 | 184 | 624 | 5.10 | 5.71 | 5.58 | 1.15 | ns |
| 8 | 126.18 | 127.32 | -1.14 | 209 | 648 | 5.14 | 5.72 | 5.58 | 2.57 | **2** |
| 8.5 | 129.11 | 129.65 | -0.54 | 187 | 715 | 6.32 | 5.84 | 5.94 | 1.11 | ns |
| 9 | 131.96 | 132.67 | -0.71 | 215 | 680 | 6.91 | 6.28 | 6.44 | 1.41 | ns |
| 9.5 | 134.79 | 135.24 | -0.45 | 207 | 642 | 6.65 | 6.15 | 6.28 | 0.90 | ns |
| 10 | 138.82 | 138.13 | 0.69 | 414 | 622 | 6.86 | 6.60 | 6.71 | 1.62 | ns |
| 10.5 | 141.52 | 141.58 | -0.06 | 1444 | 663 | 6.78 | 6.83 | 6.80 | 0.19 | ns |
| 11 | 144.45 | 144.72 | -0.27 | 1871 | 693 | 7.04 | 7.17 | 7.08 | 0.86 | ns |
| 11.5 | 147.34 | 147.49 | -0.15 | 2041 | 674 | 7.35 | 6.98 | 7.26 | 0.47 | ns |
| 12 | 150.67 | 150.81 | -0.14 | 1920 | 680 | 7.27 | 7.62 | 7.36 | 0.43 | ns |
| 12.5 | 153.50 | 153.89 | -0.39 | 2034 | 710 | 6.94 | 6.99 | 6.95 | 1.29 | ns |
| 13 | 155.79 | 155.89 | -0.10 | 2031 | 685 | 6.75 | 6.95 | 6.80 | 0.33 | ns |
| 13.5 | 157.76 | 157.97 | -0.21 | 2004 | 665 | 6.50 | 6.60 | 6.53 | 0.72 | ns |
| 14 | 159.13 | 159.23 | -0.10 | 1954 | 655 | 6.17 | 6.26 | 6.19 | 0.36 | ns |
| 14.5 | 159.77 | 160.60 | -0.83 | 1972 | 750 | 6.01 | 6.35 | 6.11 | 3.17 | **0.2** |
| 15 | 160.75 | 161.28 | -0.53 | 2137 | 789 | 6.05 | 6.37 | 6.14 | 2.07 | **5** |
| 15.5 | 160.95 | 161.84 | -0.89 | 1905 | 662 | 5.97 | 6.24 | 6.04 | 3.27 | **0.2** |
| 16 | 161.14 | 161.88 | -0.74 | 1690 | 723 | 5.94 | 5.99 | 5.96 | 2.80 | **1** |
| 16.5 | 161.39 | 161.95 | -0.56 | 1453 | 683 | 6.36 | 5.78 | 6.18 | 1.95 | **5** |
| 17 | 161.62 | 162.28 | -0.66 | 1362 | 630 | 6.15 | 5.98 | 6.10 | 2.25 | **5** |
| 17.5 | 161.84 | 161.95 | -0.11 | 1074 | 508 | 6.19 | 6.03 | 6.14 | 0.03 | ns |
| 18 | 162.03 | 162.45 | -0.42 | 836 | 427 | 5.83 | 5.93 | 5.86 | 1.20 | ns |
| 18.5 | 161.36 | 160.12 | 1.24 | 253 | 199 | 6.33 | 13.23 | 9.97 | 1.31 | ns |
| sum. | | | | 30575 | 18968 | | | | | |

Note: $\mathbf{x_1}$, $\mathbf{n_1}$ and $\mathbf{s_1}$ are the parameters of the Sz sample, while $\mathbf{x_2}$, $\mathbf{n_2}$ and $\mathbf{s_2}$ are those of the NGS sample, **d** is the deviation between $x_1$ and $x_2$, S is the common standard deviation, **t** is the result of the t-test, and **P** is the level of significance.

*Table 3.* Parameters relating to boys' weights in 6-month age groups.

| Age | $\overline{x}_1$ | $\overline{x}_2$ | d | $n_1$ | $n_2$ | $s_1$ | $s_2$ | S | t | P |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 15.72 | 14.57 | 1.15 | 65 | 98 | 1.57 | 1.70 | 1.65 | 4.36 | **0.1** |
| 3.5 | 15.77 | 15.40 | 0.37 | 101 | 310 | 1.73 | 2.02 | 1.95 | 1.65 | **ns** |
| 4 | 17.48 | 16.10 | 1.38 | 94 | 394 | 2.41 | 1.93 | 2.03 | 5.92 | **0.1** |
| 4.5 | 18.27 | 17.00 | 1.27 | 109 | 518 | 2.19 | 2.19 | 2.19 | 5.50 | **0.1** |
| 5 | 19.13 | 17.89 | 1.24 | 122 | 492 | 2.87 | 2.53 | 2.60 | 4.71 | **0.1** |
| 5.5 | 19.91 | 19.13 | 0.78 | 137 | 543 | 2.53 | 2.86 | 2.80 | 2.92 | **1** |
| 6 | 21.36 | 20.54 | 0.82 | 151 | 615 | 2.85 | 3.26 | 3.19 | 2.85 | **1** |
| 6.5 | 21.89 | 21.53 | 0.36 | 191 | 599 | 2.98 | 3.52 | 3.40 | 1.28 | **ns** |
| 7 | 23.66 | 22.63 | 1.03 | 214 | 688 | 4.17 | 3.64 | 3.77 | 3.49 | **0.1** |
| 7.5 | 24.69 | 24.11 | 0.58 | 184 | 717 | 3.65 | 4.05 | 3.97 | 1.77 | **ns** |
| 8 | 26.33 | 25.40 | 0.93 | 198 | 658 | 4.24 | 4.40 | 4.36 | 2.63 | **1** |
| 8.5 | 27.79 | 27.31 | 0.48 | 188 | 693 | 4.47 | 5.18 | 5.04 | 1.16 | **ns** |
| 9 | 28.69 | 28.49 | 0.20 | 194 | 695 | 5.06 | 5.64 | 5.52 | 0.45 | **ns** |
| 9.5 | 30.76 | 30.46 | 0.30 | 189 | 719 | 5.56 | 6.48 | 6.30 | 0.58 | **ns** |
| 10 | 32.90 | 32.51 | 0.39 | 403 | 713 | 6.46 | 6.83 | 6.70 | 0.93 | **ns** |
| 10.5 | 34.89 | 33.13 | 1.76 | 1165 | 693 | 7.21 | 6.41 | 6.92 | 5.30 | **0.1** |
| 11 | 36.34 | 35.44 | 0.90 | 1563 | 718 | 7.41 | 7.57 | 7.46 | 2.68 | **1** |
| 11.5 | 38.26 | 37.35 | 0.91 | 1636 | 658 | 8.10 | 8.51 | 8.22 | 2.40 | **2** |
| 12 | 40.50 | 39.59 | 0.91 | 1663 | 666 | 8.72 | 8.98 | 8.80 | 2.26 | **5** |
| 12.5 | 42.52 | 42.15 | 0.37 | 1663 | 700 | 9.48 | 9.89 | 9.60 | 0.86 | **ns** |
| 13 | 45.74 | 44.53 | 1.22 | 1735 | 711 | 10.06 | 10.01 | 10.05 | 2.71 | **1** |
| 13.5 | 48.17 | 47.61 | 0.56 | 1711 | 706 | 10.49 | 10.17 | 10.40 | 1.20 | **ns** |
| 14 | 51.86 | 50.97 | 0.89 | 1585 | 747 | 11.01 | 10.54 | 10.86 | 1.85 | **ns** |
| 14.5 | 54.26 | 55.27 | -1.01 | 1516 | 774 | 10.82 | 11.50 | 11.05 | 2.07 | **5** |
| 15 | 57.08 | 57.72 | -0.64 | 1158 | 889 | 10.60 | 10.69 | 10.64 | 1.35 | **ns** |
| 15.5 | 59.65 | 60.56 | -0.91 | 1095 | 847 | 10.55 | 10.28 | 10.43 | 1.91 | **ns** |
| 16 | 61.58 | 62.33 | -0.75 | 1021 | 852 | 10.08 | 10.69 | 10.36 | 1.56 | **ns** |
| 16.5 | 64.07 | 64.34 | -0.27 | 905 | 796 | 10.94 | 10.04 | 10.53 | 0.53 | **ns** |
| 17 | 64.92 | 65.46 | -0.54 | 834 | 758 | 10.13 | 9.57 | 9.87 | 1.70 | **ns** |
| 17.5 | 65.72 | 66.65 | -0.93 | 525 | 596 | 9.79 | 9.93 | 9.86 | 1.58 | **ns** |
| 18 | 67.33 | 67.56 | -0.23 | 408 | 436 | 9.61 | 9.77 | 9.69 | 0.34 | **ns** |
| 18.5 | 65.64 | 65.05 | 0.59 | 126 | 244 | 8.89 | 13.71 | 12.29 | 0.44 | **ns** |
| sum. | | | | 22849 | 20243 | | | | | |

Note: $\mathbf{x_1}$, $\mathbf{n_1}$ and $\mathbf{s_1}$ are the parameters of the Sz sample, while $\mathbf{x_2}$, $\mathbf{n_2}$ and $\mathbf{s_2}$ are those of the NGS sample, **d** is the deviation between $x_1$ and $x_2$, S is the common standard deviation, **t** is the result of the t-test, and **P** is the level of significance.

*Table 4*. Parameters relating to girls' weights in 6-month age groups.

| Age | $\overline{x}_1$ | $\overline{x}_2$ | d | $n_1$ | $n_2$ | $s_1$ | $s_2$ | S | t | P |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 15.51 | 14.06 | 1.45 | 57 | 118 | 2.28 | 1.73 | 1.93 | 4.67 | **0.1** |
| 3.5 | 15.42 | 14.90 | 0.52 | 93 | 317 | 1.72 | 1.92 | 1.88 | 2.35 | **2** |
| 4 | 17.00 | 15.54 | 1.46 | 112 | 441 | 2.37 | 2.13 | 2.18 | 6.32 | **0.1** |
| 4.5 | 17.63 | 16.60 | 1.03 | 118 | 469 | 2.41 | 2.25 | 2.28 | 4.38 | **0.1** |
| 5 | 19.06 | 17.96 | 1.10 | 135 | 497 | 2.91 | 2.52 | 2.61 | 4.35 | **0.1** |
| 5.5 | 20.33 | 19.30 | 1.03 | 136 | 565 | 3.12 | 3.01 | 3.03 | 3.56 | **0.1** |
| 6 | 21.29 | 20.44 | 0.85 | 152 | 629 | 3.37 | 3.59 | 3.55 | 2.65 | **1** |
| 6.5 | 21.23 | 21.27 | -0.04 | 188 | 626 | 4.46 | 3.63 | 3.84 | 0.13 | ns |
| 7 | 23.12 | 22.56 | 0.56 | 187 | 579 | 3.14 | 3.87 | 3.71 | 1.80 | ns |
| 7.5 | 24.48 | 23.60 | 0.88 | 184 | 624 | 4.21 | 4.49 | 4.43 | 2.37 | **2** |
| 8 | 25.42 | 25.02 | 0.40 | 209 | 648 | 4.49 | 4.44 | 4.45 | 1.13 | ns |
| 8.5 | 27.13 | 26.42 | 0.71 | 187 | 715 | 4.93 | 5.05 | 5.03 | 1.72 | ns |
| 9 | 28.61 | 28.52 | 0.09 | 215 | 680 | 5.83 | 5.67 | 5.71 | 0.20 | ns |
| 9.5 | 30.94 | 29.88 | 1.06 | 207 | 642 | 7.00 | 6.44 | 6.58 | 2.02 | **5** |
| 10 | 33.19 | 31.29 | 1.90 | 415 | 622 | 7.62 | 6.32 | 6.87 | 4.36 | **0.1** |
| 10.5 | 35.32 | 33.84 | 1.48 | 1444 | 663 | 7.51 | 7.57 | 7.53 | 4.19 | **0.1** |
| 11 | 37.29 | 36.40 | 0.89 | 1871 | 693 | 8.19 | 8.05 | 8.15 | 2.45 | **2** |
| 11.5 | 39.63 | 37.73 | 1.90 | 2040 | 674 | 9.09 | 7.98 | 8.83 | 4.84 | **0.1** |
| 12 | 42.58 | 41.03 | 1.55 | 1920 | 680 | 9.25 | 9.41 | 9.29 | 3.74 | **0.1** |
| 12.5 | 45.40 | 43.81 | 1.59 | 2035 | 710 | 9.67 | 9.30 | 9.58 | 3.81 | **0.1** |
| 13 | 47.04 | 47.03 | 0.01 | 2030 | 685 | 9.04 | 9.74 | 9.22 | 0.03 | ns |
| 13.5 | 49.72 | 48.23 | 1.49 | 2004 | 665 | 9.73 | 9.57 | 9.69 | 3.44 | **0.1** |
| 14 | 51.09 | 50.10 | 0.99 | 1953 | 655 | 8.95 | 9.07 | 8.98 | 2.44 | **2** |
| 14.5 | 53.15 | 51.33 | 1.82 | 1973 | 750 | 9.14 | 8.39 | 8.94 | 4.75 | **0.1** |
| 15 | 54.34 | 53.25 | 1.09 | 2129 | 789 | 8.74 | 8.85 | 8.77 | 2.98 | **1** |
| 15.5 | 54.89 | 54.07 | 0.82 | 1901 | 662 | 8.28 | 8.74 | 8.40 | 2.16 | **5** |
| 16 | 55.55 | 54.23 | 1.32 | 1690 | 723 | 8.31 | 8.13 | 8.26 | 3.60 | **0.1** |
| 16.5 | 55.93 | 55.00 | 0.93 | 1453 | 683 | 8.10 | 8.30 | 8.16 | 2.46 | **2** |
| 17 | 56.27 | 54.77 | 1.50 | 1362 | 630 | 7.90 | 8.97 | 8.25 | 3.77 | **0.1** |
| 17.5 | 56.43 | 54.61 | 1.82 | 1072 | 508 | 8.00 | 7.89 | 7.96 | 4.24 | **0.1** |
| 18 | 56.44 | 55.70 | 0.74 | 836 | 427 | 8.10 | 9.25 | 8.51 | 1.46 | ns |
| 18.5 | 55.81 | 52.92 | 2.89 | 253 | 199 | 7.93 | 10.79 | 9.30 | 3.28 | **0.2** |
| össz. | | | | 30561 | 18968 | | | | | |

Note: $\mathbf{x_1}$, $\mathbf{n_1}$ and $\mathbf{s_1}$ are the parameters of the Sz sample, while $\mathbf{x_2}$, $\mathbf{n_2}$ and $\mathbf{s_2}$ are those of the NGS sample, **d** is the deviation between $x_1$ and $x_2$, **S** is the common standard deviation, **t** is the result of the t-test, and **P** is the level of significance.

*Table 5*. Numbers of deviations between the examined samples.

| Averages of the two samples | Height | | Weight | |
|---|---|---|---|---|
| | Boys | Girls | Boys | Girls |
| Sz > NGS | 8 | 7 | 24 | 1 |
| not significant | 17 | 23 | 18 | 2 |
| significant | 15 | 9 | 17 | 25 |

## Discussion

These results raise the question of the cause of these deviations between the NGS and Sz samples.

Our first suggestion is the difference in the sampling techniques. This could be proved if the deviations were consistent. Table 5 shows that the NGS means are higher for both sexes as far as the height is concerned and also for the girls' weight, but for the boys' weight the Sz means are higher. Therefore, although different sampling technique may cause differences, this is not the sole reason.

The different sample sizes of the various age groups can also lead to significant differences, but the inconsistent deviations contradict this reasoning. This is illustrated by the data in Table 2, where the sample sizes of the 6-9.5-year age groups are larger in the Sz sample, whereas the 10.5-18-year age groups are greater in the NGS sample; however, in all of these age groups, the means are lower in the Sz sample.

Different techniques in scaling body weight could be another cause of the differences, but in the case of the boys higher values of weight can be observed in the Sz sample, while in the case of girls the NGS weight means are larger. The only consistent deviations appear in the heights and weights of both boys and girls in the 3-5-year age ranges, with the exception of the girls' height in the 3.5-year age category, in which the Sz means are higher in 20 cases, 14 of them significantly so.

As the weight is low at these early ages, the scaling technique could lead to different results as NGS operated with 500 gram accuracy, while Sz used a scale with 50 gram accuracy.

In conclusion, the above-mentioned facts do not satisfactorily explain the differences, though these constitute 49.2% of the total cases.

It can be mentioned that the menarche medians are fully equivalent, with a median age of 12.79 years. The evaluations (probit analysis) followed different procedures and even the different sample sizes could lead to different results.

This question can be settled only with a new sampling with a standardized procedure, standardized measurements and standardized age grouping.

We conclude that the deviations between these two large studies raise the question of the selection of the sampling technique. Even if the most appropriate technique is chosen, many factors can influence the success, such as financial background, the time of the sampling, the number of people on the staff, etc.

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