Anthropometric Indicators of the Elementary School Students in Yazd: A Comparison with WHO Standards

Mahmood Vakili; MD, MPH\(^1\), Mohsen Mirzaei; MD, MPH\(^2\), Farhad Arbabzadeh; MD\(^3\) & Mahrouz Amirheidari; MD\(^3\)

\(^1\) Health Monitoring Research Center, School of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.
\(^2\) Yazd Cardiovascular Research Center, School of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.
\(^3\) School of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

**Article history:**
- Received: 19 Jan 2017
- Revised: 8 Apr 2018
- Accepted: 25 Jun 2018

**Corresponding author:**
farhad.arbabzadeh@yahoo.com
School of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran
Postal code: 89151-73149
Tel: +98 9010263106

**Keywords:** Anthropometric indicators; World Health Organization growth standards; Growth monitoring

**Introduction**

Growth and development are valuable benchmarks for assessing the health status of children that can be achieved by being aware of the standards and comparing the children's physical status with it.

The growth monitoring by the growth chart is a simple and inexpensive tool for screening and identifying children at the risk of growth disorders. In this regard, the health care providers compare and interpret the individual growth
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patterns with the existing growth diagrams to identify the abnormal ones (Bordom et al., 2008). As a result, they can recognize any deviations from the standard pattern on the spot and prevent from any negligence (Scherdel et al., 2016). Anthropometric indicators include the height for age, weight for age, height for weight, and body mass index (BMI).

Therefore, investigation of children in terms of specific growth indices of each region is of special importance to prevent from physical disorders (Kulaga et al., 2010). Factors such as genetics, age, gender, nutrition, environment, psychological factors, parasitic, and infectious diseases affect the growth.

Although the international charts show the differences among countries, the regional and national reference charts assess the local differences and examine the impact of environmental and genetic factors (Milani et al., 2012). In Iran, the growth chart designed by the National Center for Health Statistics (NCHS) is used to assess the weight and height of children (Akha et al., 2008, Hosseini et al., 2008, Pasdar et al., 2014). However, application of the growth charts taken from the developed countries' standards can cause a great number of children to be diagnosed with growth disorders.

According to the critique of some studies, although the world standard growth diagrams are helpful in the correct diagnosis of growth disorders for children of all countries, the reference charts in each region are required to study the trend of changes in child growth (Elusiyan et al., 2016, Kulaga et al., 2011, Voynov et al., 2017).

Limited studies tried to design the growth charts for Iranian children at different age groups and rare studies compared these charts with the standards of the World Health Organization (WHO). As reported in some studies, the growth mean and percentile were below and above the standard curve in various regions (Abasalti et al., 2010, Naghizadeh Baghi and Nemati, 2008, Taheri et al., 2000).

Although the cross-sectional study is a fast method to draw the growth chart of participants at different ages, it requires a large sample size to be accurate and is costly. However, in a prospective study it is possible to pursue a detailed growth chart by following the target population growth in successive years. In spite of the necessity for using the local standards for designing the growth charts, no study has ever designed growth charts for the Iranian population. Therefore, in the current research, we examined the anthropometric indicators of children during their five years of education in primary schools of Yazd province, Iran. Then, we compared the results with the global standard values.

Materials and Methods

Study design and population: The study population of this retrospective cohort study consisted of 591 primary school children (285 girls and 306 boys) in Yazd province. They were selected by multistage random sampling and evaluated for their anthropometric indicators.

Considering the similar studies and by taking into account the standard deviation of 3 for the school children's height, the measurement error of 0.4, 95 percent confidence level, and a cluster coefficient of 1.3, the sample size was estimated as 281 for each gender. In this study, seven boys and six girls studying at the primary school level were selected from 416 school children of public schools and 175 students of the private schools. The participants were selected from the two educational districts of Yazd city and non-Iranian schools were excluded. After referring to the selected schools, the participants were selected from all students of the fifth grade by convenience sampling.

Measurements: The studied indicators included the physical growth (height and weight) and BMI recorded in the participants’ health certificates within the five school years of primary education. The medical background of the students as well as their parents’ educational levels and occupations were also recorded.

Data analysis: Data were analyzed using descriptive statistics for anthropometric indicators
and then the information was compared with the WHO international standards in the SPSS version 16. Independent t-test was used to study the difference between the public and private schools.

**Ethical considerations:** The proposal of this research was reviewed and approved by the Ethics Committee in the School of Medicine, Shahid Sadoughi University of Medical Sciences (ethics code: IR.SSU.MEDICINE.REC.1394.144).

**Results**

In this study, the data on the height, weight, and BMI of the 591 primary school children (6 to 12 years) were collected during their five-year school period from two educational districts (1 and 2) of Yazd.

The total number of students was 591; 306 of whom were boys. We found that 415 (70.2%) students were studying in public schools and 176 (29.8%) in private schools. Furthermore, 266 (45%) students were selected from the schools located in educational district 1 and 325 (55%) were from the educational district 2.

The mean and confidence interval (CI) for height, weight, and BMI based on age for boys and girls are presented in Table 1.

According to the results, the 3rd and 50th weight-for-age percentiles for boys and girls were compatible with those recommended by the WHO, but the 97th percentile was higher than the one recommended by the WHO.

All height-for-age percentiles of girls and boys, except the 97th percentile for boys aged 127 months, were higher than those recommended by the WHO.

The 3rd and 50th BMI-for-age percentiles for girls up to 87 months were lower than the percentiles recommended by the WHO, but the 50th percentile for the students over 87 months and the 97th percentile, except for participants over 97 months, were higher than the percentiles recommended by the WHO.

The 3rd and 50th percentiles for boys up to 111 months were lower than those recommended by the WHO, but the 50th percentile for boys over 111 months and 97th percentile were higher than those recommended by the WHO.

The mean weight of boys aged 87, 93, 99, and 123 months who studied at private schools was significantly higher than those from public schools ($P < 0.05$). The mean weight of girls aged 65, 69, 81, 93, 99, 105, 111, and 117 months from private schools was significantly higher than those from public schools ($P < 0.05$).

The mean height of boys from public and private schools was not significantly different ($P > 0.05$). The mean height of girls aged 65, 81, 93, 105, and 117 months from private schools was significantly higher than those from public schools ($P < 0.05$).

The mean BMI of boys aged 65, 87, 93, 99, 105, 111, and 123 months from private schools was significantly higher than those from public schools ($P < 0.05$). The mean BMI of girls aged 65, 69, 81, 87, 93, 99, 105, 111, and 123 months from private schools was significantly higher than those from public schools ($P < 0.05$).

Height-, weight-, and BMI-for-age percentiles for girls and boys in comparison with the percentiles recommended by the WHO are shown in Tables 2, 3, and 4, respectively.

Percentiles for the growth of height, weight, and BMI of schoolchildren in comparison with the percentiles recommended by the WHO are illustrated in Figures 1-6.
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### Table 1. Mean of weight, height, and body mass index (BMI) regarding age and sex

| Age (month) | N  | Weight (kg) Mean (±SD) | 95% CI | Height (cm) Mean (± SD) | 95% CI | BMI (kg/m²) Mean (±SD) | 95% CI |
|-------------|----|------------------------|-------|-------------------------|-------|-------------------------|-------|
| **Boys**    |    |                        |       |                         |       |                         |       |
| 65          | 73 | 20.67 ± 3.12           | 19.94-21.40 | 118.58 ± 5.62 | 117.27-119.89 | 14.64 ± 1.44 | 14.30-14.98 |
| 69          | 111| 19.88 ± 3.55           | 19.22-20.55 | 116.18 ± 4.91  | 115.25-117.10 | 14.67 ± 1.96 | 14.30-15.03 |
| 75          | 87 | 20.58 ± 3.25           | 19.88-21.27 | 117.98 ± 4.48  | 117.03-118.94 | 14.76 ± 2.07 | 14.32-15.20 |
| 81          | 106| 23.62 ± 4.58           | 22.74-24.50 | 124.62 ± 6.08  | 123.45-125.79 | 15.10 ± 2.05 | 14.71-15.50 |
| 87          | 113| 23.89 ± 4.58           | 23.04-24.74 | 124.24 ± 5.45  | 123.22-125.25 | 15.40 ± 2.26 | 14.98-15.82 |
| 93          | 160| 26.15 ± 5.55           | 25.28-27.01 | 128.73 ± 6.32  | 127.74-129.71 | 15.67 ± 2.52 | 15.28-16.07 |
| 99          | 144| 27.01 ± 5.62           | 26.08-27.99 | 129.43 ± 5.60  | 128.50-130.35 | 16.00 ± 2.48 | 15.60-16.42 |
| 105         | 162| 29.92 ± 6.10           | 28.83-31.00 | 134.09 ± 6.67  | 133.05-135.12 | 16.48 ± 2.79 | 16.06-16.92 |
| 111         | 144| 31.05 ± 6.80           | 29.93-32.17 | 135.50 ± 6.06  | 134.50-136.50 | 16.78 ± 2.74 | 16.33-17.23 |
| 117         | 162| 34.17 ± 8.39           | 32.87-35.47 | 139.94 ± 6.78  | 138.89-140.99 | 17.28 ± 3.14 | 16.79-17.77 |
| 123         | 144| 35.91 ± 8.61           | 34.49-37.33 | 140.97 ± 6.38  | 139.92-142.02 | 17.89 ± 3.20 | 17.37-18.42 |
| 129         | 89 | 36.39 ± 8.14           | 34.67-38.10 | 142.62 ± 6.17  | 141.32-143.92 | 17.76 ± 3.13 | 17.11-18.43 |
| 135         | 35 | 37.42 ± 8.38           | 34.54-40.30 | 144.86 ± 6.26  | 142.70-147.01 | 17.75 ± 3.42 | 16.58-19.92 |
| **Girls**   |    |                        |       |                         |       |                         |       |
| 65          | 68 | 20.55 ± 4.57           | 19.44-21.66 | 116.74 ± 5.36  | 115.44-118.04 | 14.97 ± 2.54 | 14.36-15.58 |
| 69          | 87 | 20.29 ± 3.71           | 19.50-21.84 | 116.03 ± 4.69  | 115.04-117.03 | 15.01 ± 2.11 | 14.56-15.45 |
| 75          | 78 | 20.34 ± 3.26           | 19.60-21.08 | 117.90 ± 4.42  | 116.91-118.90 | 14.57 ± 1.70 | 14.19-14.96 |
| 81          | 116| 23.67 ± 5.86           | 22.59-24.75 | 122.75 ± 5.94  | 121.66-123.84 | 15.58 ± 2.97 | 15.03-16.12 |
| 87          | 91 | 24.48 ± 5.63           | 23.31-25.66 | 123.01 ± 4.83  | 122.00-124.02 | 16.07 ± 2.87 | 15.47-16.67 |
| 93          | 146| 26.89 ± 7.25           | 25.70-28.07 | 127.25 ± 6.22  | 126.23-128.27 | 16.42 ± 3.30 | 15.88-16.96 |
| 99          | 135| 28.42 ± 6.77           | 27.27-29.57 | 129.27 ± 6.02  | 128.25-130.30 | 16.86 ± 3.02 | 16.34-17.37 |
| 105         | 150| 31.05 ± 8.24           | 29.72-33.28 | 133.52 ± 6.70  | 132.44-134.60 | 17.23 ± 3.42 | 16.68-17.78 |
| 111         | 135| 32.85 ± 8.08           | 31.48-34.23 | 135.60 ± 5.95  | 134.58-136.61 | 17.70 ± 3.35 | 17.13-18.27 |
| 117         | 150| 35.94 ± 9.67           | 34.38-37.50 | 140.06 ± 7.08  | 138.92-141.20 | 18.15 ± 3.92 | 17.52-18.79 |
| 123         | 135| 38.19 ± 9.75           | 36.53-39.85 | 142.63 ± 6.46  | 141.53-143.73 | 18.60 ± 3.78 | 17.96-19.25 |
| 129         | 82 | 38.98 ± 9.51           | 36.90-41.08 | 144.65 ± 6.37  | 143.25-146.05 | 18.48 ± 3.56 | 17.70-19.26 |
| 135         | 52 | 43.46 ±               | 40.28-46.63 | 148.64 ± 7.88  | 146.45-150.84 | 19.47 ± 3.97 | 18.36-20.57 |
Table 2. Comparison of weight-for-age percentiles for boys and girls in Yazd with the WHO standards

| Age (month) | 3rd percentile | 25th percentile | 50th percentile | 75th percentile | 97th percentile |
|-------------|----------------|-----------------|-----------------|-----------------|----------------|
| Yanzd       | WHO            | Yanzd           | WHO             | Yanzd           | WHO            |
| Boys        |                |                 |                 |                 |                |
| 65          | 12.15          | 13.13           | 13.65           | 14.43           | 14.36          |
| 69          | 12.41          | 13.14           | 13.42           | 14.44           | 14.25          |
| 75          | 12.12          | 13.17           | 13.65           | 14.48           | 14.36          |
| 81          | 12.09          | 13.23           | 13.66           | 14.55           | 14.71          |
| 87          | 12.76          | 13.30           | 13.89           | 14.64           | 14.83          |
| 93          | 12.42          | 13.37           | 14.14           | 14.74           | 15.17          |
| 99          | 12.84          | 13.46           | 14.31           | 14.85           | 15.45          |
| 105         | 13.02          | 13.56           | 14.57           | 14.98           | 15.78          |
| 111         | 13.06          | 13.66           | 14.80           | 15.12           | 16.26          |
| 117         | 13.20          | 13.79           | 15.03           | 15.28           | 16.54          |
| 123         | 13.58          | 13.93           | 15.36           | 15.47           | 17.35          |
| 129         | 13.65          | 14.01           | 15.70           | 15.67           | 17.00          |
| 135         | 13.54          | 14.28           | 15.01           | 15.91           | 16.4           |
| Girls       |                |                 |                 |                 |                |
| 65          | 11.80          | 12.85           | 13.20           | 14.29           | 14.31          |
| 69          | 11.90          | 12.83           | 13.80           | 14.28           | 14.62          |
| 75          | 11.70          | 12.82           | 13.52           | 14.29           | 14.37          |
| 81          | 12.08          | 12.84           | 13.61           | 14.33           | 14.87          |
| 87          | 12.75          | 12.89           | 13.89           | 14.41           | 15.45          |
| 93          | 12.53          | 12.96           | 14.07           | 14.52           | 15.60          |
| 99          | 12.84          | 13.07           | 14.70           | 14.66           | 16.19          |
| 105         | 13.01          | 13.20           | 14.69           | 14.83           | 16.39          |
| 111         | 13.00          | 13.35           | 15.38           | 15.02           | 17.08          |
| 117         | 13.02          | 13.52           | 15.42           | 15.24           | 17.60          |
| 123         | 13.89          | 13.71           | 15.95           | 15.48           | 17.84          |
| 129         | 13.10          | 13.92           | 16.13           | 15.75           | 17.84          |
| 135         | 13.60          | 14.16           | 16.65           | 16.05           | 18.88          |

Table 3. Comparison of height-for-age percentiles for boys and girls in Yazd with the WHO standards

| Age (month) | 3rd percentile | 25th percentile | 50th percentile | 75th percentile | 97th percentile |
|-------------|----------------|-----------------|-----------------|-----------------|----------------|
| Yanzd       | WHO            | Yanzd           | WHO             | Yanzd           | WHO            |
| Boys        |                |                 |                 |                 |                |
| 65          | 108.22         | 101.42          | 115             | 107.50          | 118            |
| 69          | 106.00         | 105.35          | 113             | 111.18          | 117            |
| 75          | 109.64         | 105.75          | 115             | 112.21          | 118            |
| 81          | 114.21         | 108.22          | 120             | 114.92          | 124            |
| 87          | 113.00         | 110.63          | 120             | 117.57          | 124            |
| 93          | 116.83         | 112.98          | 124             | 120.15          | 128            |
| 99          | 119.00         | 115.25          | 125             | 122.65          | 129            |
| 105         | 121.78         | 117.47          | 130             | 125.11          | 133            |
| 111         | 125.00         | 122.39          | 131             | 129.76          | 136            |
| 117         | 127.45         | 121.86          | 135.35          | 129.97          | 139.5          |
| 123         | 130.00         | 124.04          | 136.13          | 132.38          | 141            |
### Anthropometric indicators of the school students in Yazd.

| Age (month) | Yazd  | WHO  |
|-------------|-------|------|
| 65          | 12.15 | 13.13 |
| 69          | 12.41 | 13.14 |
| 75          | 12.12 | 13.17 |
| 81          | 12.09 | 13.23 |
| 87          | 12.76 | 13.30 |
| 93          | 12.42 | 13.37 |
| 99          | 12.84 | 13.46 |
| 105         | 13.02 | 13.56 |
| 111         | 13.06 | 13.66 |
| 117         | 13.20 | 13.79 |
| 123         | 13.58 | 13.93 |
| 129         | 13.65 | 14.01 |
| 135         | 13.54 | 14.28 |

### Table 4. Comparison of BMI-for-age percentiles for boys and girls in Yazd with the WHO standards

| Age (month) | 3rd percentile | 25th percentile | 50th percentile | 75th percentile | 97th percentile |
|-------------|----------------|-----------------|-----------------|-----------------|----------------|
| Boys        | Yazd | WHO  | Yazd | WHO  | Yazd | WHO  | Yazd | WHO  | Yazd | WHO  |
| 65          | 12.15 | 13.13 | 13.65 | 14.43 | 14.36 | 15.26 | 15.69 | 16.18 | 18.11 | 18.11 |
| 69          | 12.41 | 13.14 | 13.42 | 14.44 | 14.24 | 15.28 | 15.34 | 16.23 | 20.79 | 18.23 |
| 75          | 12.12 | 13.17 | 13.65 | 14.48 | 14.36 | 15.34 | 15.34 | 16.30 | 20.87 | 18.39 |
| 81          | 12.09 | 13.23 | 13.66 | 14.55 | 14.71 | 15.43 | 15.9 | 16.2 | 20.88 | 18.62 |
| 87          | 12.76 | 13.30 | 13.89 | 14.64 | 14.83 | 15.54 | 16.65 | 16.57 | 22.41 | 18.89 |
| 93          | 12.42 | 13.37 | 14.14 | 14.74 | 15.17 | 15.66 | 16.5 | 16.74 | 21.68 | 19.20 |
| 99          | 12.84 | 13.46 | 14.31 | 14.85 | 15.45 | 15.80 | 17.05 | 16.93 | 23.14 | 19.54 |
| 105         | 13.02 | 13.56 | 14.57 | 14.98 | 15.98 | 15.96 | 17.43 | 17.13 | 24.12 | 19.91 |
| 111         | 13.06 | 13.66 | 14.80 | 15.12 | 16.26 | 16.13 | 18.04 | 17.35 | 24.22 | 20.31 |
| 117         | 13.20 | 13.79 | 15.03 | 15.28 | 16.54 | 16.33 | 18.74 | 17.60 | 25.43 | 20.75 |
| 123         | 13.58 | 13.93 | 15.36 | 15.47 | 17.35 | 16.55 | 19.9 | 17.88 | 25.89 | 21.22 |
| 129         | 13.65 | 14.01 | 15.70 | 15.67 | 17.00 | 16.80 | 19.06 | 18.19 | 29.16 | 21.72 |
| 135         | 13.54 | 14.28 | 15.01 | 15.91 | 16.40 | 17.07 | 19.07 | 18.52 | 26.16 | 22.23 |

| Girls       | Yazd  | WHO  | Yazd | WHO  | Yazd | WHO  | Yazd | WHO  | Yazd | WHO  |
|-------------|-------|------|------|------|------|------|------|------|------|------|
| 65          | 11.80 | 12.85 | 13.20 | 14.29 | 14.31 | 15.24 | 15.71 | 16.33 | 21.79 | 18.70 |
| 69          | 11.90 | 12.83 | 13.80 | 14.28 | 14.62 | 15.25 | 15.88 | 16.36 | 21.45 | 18.82 |
| 75          | 11.70 | 12.82 | 13.52 | 14.29 | 14.37 | 15.29 | 15.35 | 16.44 | 19.17 | 19.04 |
| 81          | 12.08 | 12.84 | 13.61 | 14.33 | 14.87 | 15.35 | 16.56 | 16.55 | 23.17 | 19.30 |
| 87          | 12.75 | 12.89 | 13.89 | 14.41 | 15.45 | 15.45 | 17.23 | 16.69 | 24.10 | 19.60 |
| 93          | 12.53 | 12.96 | 14.07 | 14.52 | 15.60 | 15.59 | 17.75 | 16.88 | 26.11 | 19.96 |
| 99          | 12.84 | 13.07 | 14.70 | 14.66 | 16.19 | 15.77 | 18.37 | 17.11 | 24.84 | 20.37 |
| 105         | 13.01 | 13.20 | 14.89 | 14.83 | 16.39 | 15.98 | 18.65 | 17.37 | 26.08 | 20.82 |
| 111         | 13.00 | 13.35 | 15.38 | 15.02 | 17.08 | 16.21 | 19.49 | 17.66 | 25.52 | 21.30 |
| 117         | 13.02 | 13.52 | 15.42 | 15.24 | 17.60 | 16.47 | 19.64 | 17.98 | 27.35 | 21.80 |
| 123         | 13.89 | 13.71 | 15.95 | 15.48 | 17.84 | 16.76 | 20.12 | 18.32 | 27.94 | 22.32 |
| 129         | 13.10 | 13.92 | 16.13 | 15.75 | 17.84 | 17.07 | 20.60 | 18.70 | 28.78 | 22.88 |
| 135         | 13.60 | 14.16 | 16.65 | 16.05 | 18.88 | 17.42 | 21.48 | 19.11 | 28.83 | 23.45 |
Figure 1. Comparison of weight-for-age percentiles for boys in Yazd with the WHO standards

Figure 2. Comparison of weight-for-age percentiles for girls in Yazd with the WHO standards

Figure 3. Comparison of height-for-age percentiles for boys in Yazd with the WHO standards

Figure 4. Comparison of height-for-age percentiles for girls in Yazd with the WHO standards

Figure 5. Comparison of body mass index-for-age percentiles for boys in Yazd with the WHO standards

Figure 6. Comparison of body mass index-for-age percentiles for girls in Yazd with the WHO standards
Discussion

The results from the comparison of the growth trends of height, weight, and BMI of students in Yazd for the 3rd, 50th, and 97th percentiles with the WHO growth curves showed that the growth patterns were different from the WHO growth curves.

For both genders, the 3rd and 50th weight-for-age percentiles were compatible with the WHO percentiles, but the 97th percentile was much higher than the WHO percentiles.

Studies conducted in other cities of Iran during the past 20 years have shown that the percentiles for Iranian children are less than the WHO indicators, but these indicators have been approaching the standards in recent years (Akha et al., 2008, Ershadi et al., 2001, Rrafati and Falah, Sohrabi et al., 2006, Tarahi and Goudini, 2001).

A study conducted in Turkey also showed that the weight indicators of students were less than the international standards and was different from Iranian students (Zararsuz et al., 2017).

In a study conducted by Mozaffari-khosravi et al. (2010) in Yazd, 2592 students aged 6-11 years were investigated. The results showed that the 5th and 15th weight percentiles for boys were lower than the international standard percentiles. However, for participants who were 8 years and older, the 50th percentile was compatible with the WHO standards and the 97th percentile was higher than the WHO standards (Mozaffari-Khosravi et al., 2014). These results are roughly similar to the findings of the current study.

Improvement of the weight indicator among Iranian children is resulted from enhancement of nutrition, economy, and health care. The 97th percentile in this study was higher than the corresponding international standards because of the poor and inappropriate nutrition in students.

In both genders, the height indicator for all percentiles was higher than the WHO indicators, but height percentiles were reported to be lower than the standards in some studies conducted in Iran (Akha et al., 2008, Ershadi et al., 2001, Rrafati and Falah, Sohrabi et al., 2006, Taheri et al., 2000, Tarahi and Goudini, 2001).

The results of a study in China (2009) showed that the height of male students aged less than 15 years and the height of female students aged less than 13 years were higher than the international standards (Li et al., 2009). These findings are similar to results of our study.

Mozaffari-khosravi et al. reported that the height percentiles for girls were almost equal to the WHO standards, but for 11-year old boys, the 50th and higher-than-50th percentiles were higher than the WHO standards, which is inconsistent with the findings of the present study (Mozaffari-Khosravi et al., 2014).

The BMI indicator in both genders was different from the WHO standards, so that the 3rd percentile for both genders was lower than the WHO standards. Moreover, the 50th percentiles for boys up to 111 months and girls up to 87 months were lower than the WHO standards. However, the higher-than-97th percentiles were much higher than the WHO standards.

A study conducted in Sari city, Iran (2010), showed that BMI of children had been improving and approaching the international standards compared to the observations of a previous study in 1998 (Akha et al., 2008).

In a study in Isfahan, the anthropometric indicators of male students in the age range of 6-18 years were almost consistent with the NCHS growth curves. Results indicated that boys were taller and heavier than their peers living in Isfahan 22 years age (Aminorroaya et al., 2003).

In the study of Mozaffari-khosravi et al., the 50th and lower-than-50th BMI percentiles for girls were approximately equal to the WHO standards, but the 75th and higher-than-75th percentiles were higher than the WHO standards. These findings are consistent with the findings of the present study on the 97th percentile.

The 75th and higher-than-75th BMI percentiles for 9-year boys were higher than the WHO standards (Mozaffari-Khosravi et al., 2014). This result is partly consistent with our results.

The results of studies conducted in Iran have shown improvement in the health and nutritional indicators. In addition, the physical growth
indicators have been growing compared to the past years. However, the weight and BMI percentiles, which were lower than the international standards in the past, are now improving. The increase of these indicators, especially for the 97th percentile warns about the prevalence of overweight and obesity in students, which is due to the decrease in physical activity and inappropriate diets. The height indicators were higher than the WHO standards, which may be due to the early onset of puberty.

Conclusion
Although the weight and BMI indicators obtained in this study are similar to those reported by a previous study in Yazd, certain observed differences are due to genetic differences, the participants' age at onset of puberty, as well as environmental factors such as nutrition, living environment, and economic-cultural factors. This in turn, highlights the use of reference curves and charts for height, weight, and BMI developed specifically for children in Iran.

Acknowledgements
Hereby, we gratefully thank the staff of the Education Organization of Yazd and the school teaching and boarding staffs who collaborated in the implementation of this study.

Authors’ contributions
Vakili M and Mirzaei M contributed in the design of the study. Arabzadeh F and Amirheidari M contributed in data collection and wrote the first draft of the manuscript. Data analysis was performed by Vakili M. All authors studied and approved the final version of the manuscript.

Conflict of interest
The authors declare no conflict of interest with respect to the design and composition of the manuscript.

References
Abasalti Z, et al. 2010. Standardized percentile curves of height versus the age of Iranian children aged 25 to 60 months living in the northeast of Iran. The horizon of medical sciences. 16 (1): 36-44.

Akha O, Teimoorzadeh M, Kashi Z & Kowsarian M 2008. A Study on 6-18 years-old girl students about weight and height in Sari. Journal of Mazandaran University of medical sciences. 18 (67): 50-57.

Aminorroaya A, Amini M, Naghdil H & Zadeh AH 2003. Growth charts of heights and weights of male children and adolescents of Isfahan, Iran. Journal of health, population and nutrition. 21 (4): 341-346.

Bordom J, Billot L, Gueguen R & Deschamps J 2008. New growth charts for Libyan preschool children. Eastern mediterranean health journal. 14 (6): 1400-1412.

Elusiyan JB, Ibekwe MU, Alkali YS & Agwu JC 2016. Growth characteristics of contemporary school-age Nigerian children. Journal of tropical pediatrics. 62 (5): 345-351.

Ershadi A, Mmtazmanesh N, Afzali H & Malekan R 2001. Heights and weights curves of children (less than tow years old) in Kashan in 1377. Medical journal of Mashhad University of medical sciences. 43 (70): 88-97.

Hosseini M, Mohammad K & Safari S 2008. Urban-rural difference in weight and height of children and its trend during two national health surveys (1991 and 1999). Journal of medical council of Islamic Republic of Iran 26 (4): 465-473.

Kulaga Z, et al. 2011. Polish 2010 growth references for school-aged children and adolescents. European journal of pediatrics. 170 (5): 599-609.

Kulaga Z, et al. 2010. The height-, weight-, and BMI-for-age of Polish school-aged children and adolescents relative to international and local growth references. BMC public health. 10 (1): 109.

Li H, Ji C, Zong X & Zhang Y 2009. Height and weight standardized growth charts for Chinese
children and adolescents aged 0 to 18 years. *Chinese journal of pediatrics.* 47 (7): 487-492.

Milani S, et al. 2012. The use of local reference growth charts for clinical use or a universal standard: a balanced appraisal. *Journal of endocrinological investigation.* 35 (2): 224-226.

Mozaffari-Khosravi H, NabizadaehAsl L, Akbari M, Ahadi Z & Talaei B 2014. Standardized of Height, Weight and Body Mass Index (BMI) in Healthy 6-11-year-old Schoolgirls and Schoolboys, Yazd City 2010-2011. *Toloo-e-behdasht.* 13 (3): 182-194.

Naghizadeh Baghi A & Nemati A 2008. A Survey of Height and Weight of Ardebilan boys aged 7-19 years and comparison of them with NCHS reference population and other Studies in Iran. *Journal of science and technology.* 8 (1-2): 118-128.

Pasdar Y, Mozafari HR, Darbandi M & Niazi P 2014. Educational achievement relationship with nutritional status and primary school children growth in suburb areas of Kermanshah (2012). *Koomesh.* 15 (4): 541-550.

Rafati S & Falah N Determination of normal percentiles of children height and weight in Tehran in 1997. *Daneshvar pezeshki.* 11 (48): 13-18.

Scherdel P, et al. 2016. Growth monitoring as an early detection tool: a systematic review. *The lancet diabetes & endocrinology.* 4 (5): 447-456.

Sohrabi A, Karajibani M & Vahedi R 2006. Comparison of mean weight and height growth of governmental and private students of primary schools of Zahedan district, Iran. *Tabib-e-shargh.* 8 (2): 151-159.

Taheri F, Fesharakinia A & Sadatjue S 2000. Determining the weight and height in 7-12 year old children in Birjand and its comparison with NCHS standard. *Journal of Birjand University of medical sciences.* 7 (1): 33038.

Tarahi M & Goudini H 2001. Study of weight and height percentiles in students of primary schools. *Yafteh.* 2 (7): 33-38.

Voynov V, Kulba S & Arapova YY 2017. Growth and development in school-age children from Rostov region, Russia: Comparison between urban and rural settings. *Journal of comparative human biology.* 68 (6): 465-478.

Zararsiz G, et al. 2017. Comparison of updated weight and height percentiles with previous references in 6-17-year-old children in Kayseri, Turkey. *Journal of clinical research in pediatric endocrinology.* 9 (1): 39.