Journal of Nutrition and Food Security
Shahid Sadoughi University of Medical Sciences
School of Public Health
Department of Nutrition
Nutrition & Food Security Research Center

eISSN: 2476-7425 pISSN: 2476-7417 JNFS 2018; 3(4): 175-184 Website: jnfs.ssu.ac.ir

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

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ARTICLE INFO

ORIGINAL ARTICLE

Article history:
Received: 19 Jan 2017
Revised: 8 Apr2018
Accepted: 25 Jun 2018

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ABSTRACT

Background: Application of growth indicators taken from other countries can cause misdiagnosis of underweight and stunting. In this study we compared the trend of anthropometric growth indicators between the elementary school students of Yazd with the international standards. **Methods:** The study population of this retrospective cohort study consisted of 591 primary school children in Yazd (285 girls and 306 boys) who were selected by multistage random sampling. The studied indicators were physical growth height, weight and body mass index (BMI) recorded in the participants' health certificate within the five years of primary school education. Furthermore, we compared the results with the WHO standards. **Results:** The 3rd and 50th weight-for-age percentiles were roughly compatible with the WHO percentiles, but the 97th percentile was higher than it. All height-for-age percentiles for boys and girls, except for those who were 11 years, were higher than the WHO percentiles. The 3rd and 50th BMI percentiles for girls up to seven years of age were lower than the WHO percentiles; whereas, the 50th percentile for participants who aged seven years and older and the 97th percentile, except for those who aged 11 years, were higher than the WHO percentiles. The 3rd and 50th BMI percentiles for boys up to nine years of age were lower than the WHO percentiles, but the 50th percentile for those who aged nine years and over as well as the 97th percentile for all ages were higher than the WHO percentiles. **Conclusion:** The weight and BMI indicators obtained in this study were different from the WHO standards. This highlights the need for development and use of native reference curves regarding the anthropometric indicators for children in Iran.

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

This paper should be cited as: Vakili M, Mirzaei M, Arbabzadeh F, Amirheidari M. ***Anthropometric Indicators of the Elementary School Students in Yazd: A Comparison with WHO Standards.*** *Journal of Nutrition and Food Security (JNFS)*, 2018; 3 (4): 175-184.

[DOR: 20.1001.1.24767417.2018.3.4.1.8]
[DOI: 10.18502/jnfs.v3i4.161]

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, Kułaga *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

[DOR: 20.1001.1.24767417.2018.3.4.1.8]
[DOI: 10.18502/jnfs.v3i4.161]

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 the 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**.

[DOR: 20.1001.1.24767417.2018.3.4.1.8]
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Table 1. Mean of weight, height, and body mass index (BMI) regarding age and sex

Age (month)	N	Weight (kg)		Height (cm)		BMI (kg/m^2)	
		Mean (±SD)	95% CI	Mean (± SD)	95% CI	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 ± 678	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	29.72-3238	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

[DOR: 20.1001.1.24767417.2018.3.4.1.8]

[DOI: 10.18502/jnfs.v3i4.161]

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

	3rd percentile		25th percentile		50th percentile		75th percentile		97th percentile	
Age	Yazd	WHO	Yazd	WHO	Yazd	WHO	Yazd	WHO	Yazd	WHO
Boys										
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	14.25	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	15.90	16.42	20.08	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	16.50	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	15.78	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	19.90	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	16.4	17.07	19.07	18.52	26.16	22.23
Girls										
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	14.69	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	

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

	3rd percentile		25th percentile		50th percentile		75th percentile		97th percentile	
Age (month)	Yazd	WHO	Yazd	WHO	Yazd	WHO	Yazd	WHO	Yazd	WHO
Boys										
65	108.22	101.42	115	107.50	118	109.20	123	112.39	128.78	120.14
69	106.00	105.35	113	111.18	117	114.45	119	117.71	126.00	123.54
75	109.64	105.75	115	112.21	118	114.03	121	117.42	126.36	125.67
81	114.21	108.22	120	114.92	124	116.80	129	120.30	136.00	128.85
87	113.00	110.63	120	117.57	124	119.51	128	123.14	134.16	123.98
93	116.83	112.98	124	120.15	128	122.16	133	125.91	140.00	135.50
99	119.00	115.25	125	122.65	129	124.73	133	128.60	140.00	138.40
105	121.78	117.47	130	125.11	133	127.25	139	131.27	147.20	140.98
111	125.00	122.39	131	129.76	136	133.87	140	139.97	147.00	145.35
117	127.45	121.86	135.35	129.97	139.5	132.24	144	136.48	154.11	146.81
123	130.00	124.04	136.13	132.38	141	134.72	145	139.08	154.00	149.71

[DOR: 20.1001.1.24767417.2018.3.4.1.8]
[DOI: 10.18502/jnfs.v3i4.161]

129	132.00	126.28	138	134.85	143	137.25	146	141.73	145.60	152.66
135	131.36	128.66	141	137.45	144	139.92	148	144.52	158.00	155.74
Girls										
65	105.07	100.26	113	106.58	118	108.36	120	111.67	126.79	119.73
69	106.64	101.97	113	108.25	116	110.27	119	113.27	124.00	121.93
75	109.37	102.38	115	108.91	118	110.74	121	114.15	127.63	122.47
81	109.51	106.87	118	113.81	123	115.76	126	119.39	134.49	128.24
87	112.76	109.31	119	116.48	123	118.48	126	122.23	131.44	131.36
93	116.82	111.80	123	119.18	127	121.24	131	125.10	142.00	134.50
99	117.16	114.34	123	121.92	127	124.05	131	128.02	142.00	137.68
105	120.53	116.95	129	124.73	134	126.91	138	130.98	146.47	140.91
111	123.08	119.62	132	127.60	136	129.84	139	134.01	146.88	144.18
117	127.00	122.36	135	130.52	140	132.81	145	137.08	153.94	147.49
123	130.00	125.17	139	133.50	143	135.84	146	140.20	154.00	150.83
129	131.96	128.06	140	136.56	145	138.94	148	143.38	156.51	154.22
135	131.77	131.00	143	139.65	149	142.07	153	146.59	167.10	157.61

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

	3rd percentile		25th percentile		50th percentile		75th percentile		97th percentile	
Age (month)	**Yazd**	**WHO**	**Yazd**	**WHO**	**Yazd**	**WHO**	**Yazd**	**WHO**	**Yazd**	**WHO**
Boys										
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	14.25	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	16.42	20.08	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	15.78	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										
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	14.69	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

[DOR: 20.1001.1.24767417.2018.3.4.1.8]
[DOI: 10.18502/jnfs.v3i4.161]

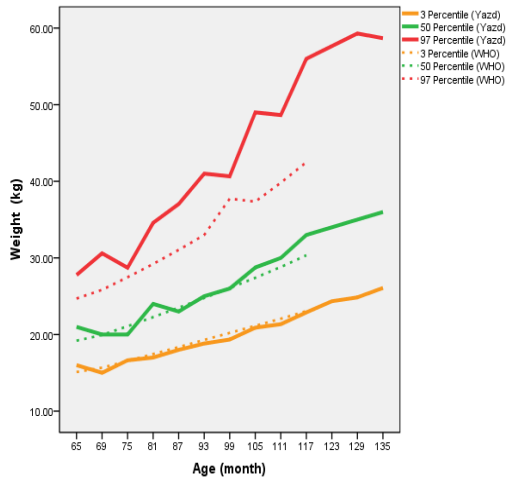

Figure 1. Comparison of weight-for-age percentiles for boys in Yazd with the WHO standards

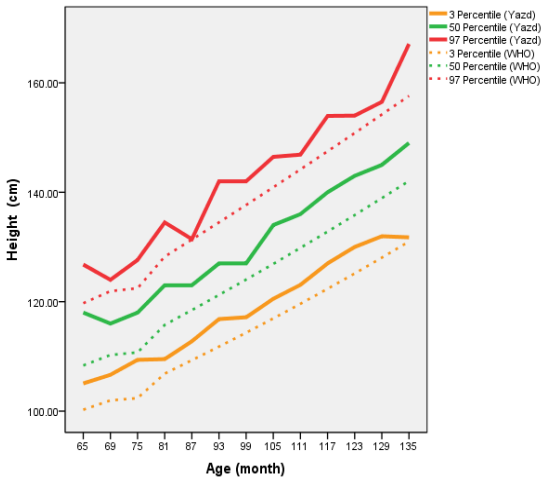

Figure 4. Comparison of height-for-age percentiles for girls in Yazd with the WHO standards

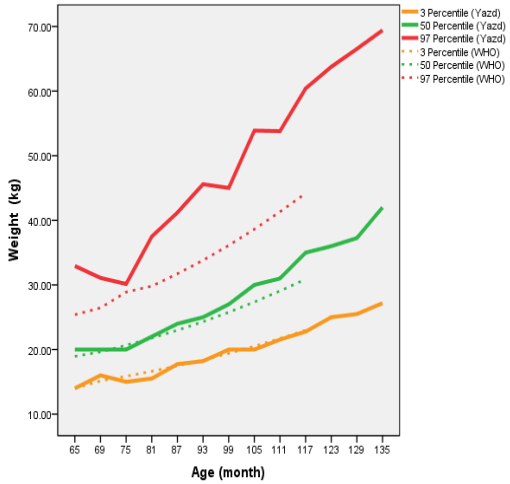

Figure 2. Comparison of weight-for-age percentiles for girls in Yazd with the WHO standards

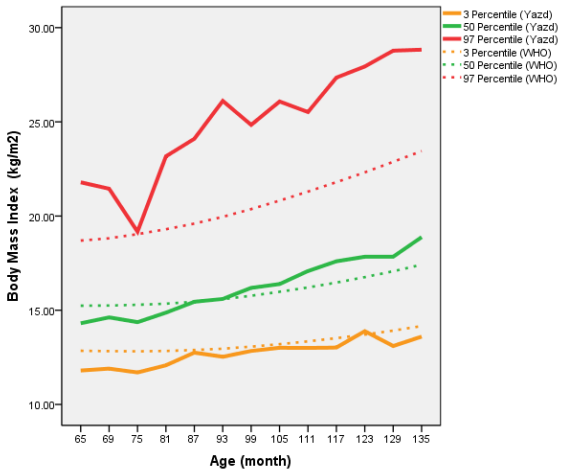

Figure 5. Comparison of body mass index-for-age percentiles for boys in Yazd with the WHO standards

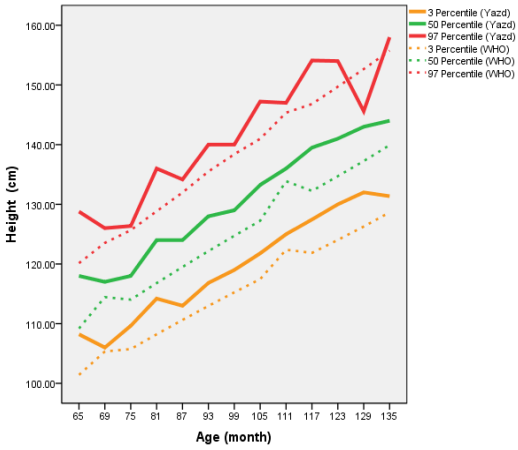

Figure 3. Comparison of height-for-age percentiles for boys in Yazd with the WHO standards

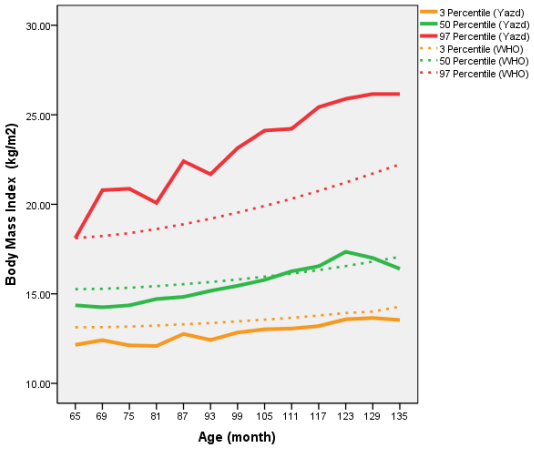

Figure 6. Comparison of body mass index-for-age percentiles for girls in Yazd with the WHO standards

[DOR: 20.1001.1.24767417.2018.3.4.1.8]
[DOI: 10.18502/jnfs.v3i4.161]

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 (Zararsız *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

[DOR: 20.1001.1.24767417.2018.3.4.1.8]
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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. Arbabzadeh 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.

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[DOI: 10.18502/jnfs.v3i4.161]