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Running title: Height of Iranian Children Age 7-18 in Comparison with Global Standards

Height of Iranian Children Age 7-18 in Comparison with WHO (2007), CDC (2000) and NCHS (1977) Global Standards: A Systematic Review and Meta-Analysis

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Abstract

Background: Growth assessment based on standardized height and weight tables and charts is an essential part of healthcare monitoring and services for children and adolescents. The present systematic and meta-analysis study aimed to determine the height of Iranian children aged 7 to 18 years and compare it with the global standards.

Methods: A meta-analysis was performed on all relevant studies published until November 2018. The databases Iranmedex, Magiran, SID, IranDoc, Medline, Scopus, PubMed, Science Direct, Web of Knowledge, Cochrane and Google Scholar were searched using mesh and non-mesh keywords. Findings of the reviewed studies were compiled using the random effects model. Data heterogeneity was calculated using the Q statistic and the I^2 index.

Results: 37 articles were found eligible for inclusion in the meta-analysis. The total sample size in these studies was 395,210, consisting of 189,985 males and 205,372 females. The mean height of 18-year-old Iranian girls ($\bar{X} = 157.75$, %95CI: 156.79 to 158.71) was, respectively, 5.30, 5.38, 5.37 cm lower than the reference figures given by WHO ($\bar{X} = 163.05$), CDC ($\bar{X} = 163.13$), and NCHS ($\bar{X} = 163.12$). Similarly, the mean height of 18-year-old Iranian boys ($\bar{X} = 171.09$, %95CI: 169.72 to 172.47) was, respectively, 5.05, 5.09, 5.07 cm lower than the WHO ($\bar{X} = 176.14$), CDC ($\bar{X} = 176.18$), and NCHS ($\bar{X} = 176.16$) standards.

Conclusions: Given the slightly different growth pattern and low mean height of Iranian girls and boys compared to the global standards, it is imperative to develop and provide more generalizable growth charts for Iranian children in order to improve the quality of growth assessment undertaken for these age groups.

Keywords: *Stunting; Height; Growing Child; School Age; NCHS*

Background

Growth assessments are an essential part of healthcare monitoring and services for children and adolescents (1-3). Height and weight measurements are highly valued because of the wealth of information they provide for studies on the growth, diet and nutrition, and health of younger people as they develop (4). Growth pattern assessments are excellent measures for multidimensional analysis of growth variations over successive generations and their relationship with the environmental factors. Such assessments are typically performed by the use of standardized height and weight charts and tables developed by the World Health Organization (WHO), United States Centers for Disease Control and Prevention (CDC), United States National Center for Health Statistics (NCHS), and other internationally accredited organizations based on the anthropometric indicators of healthy children (8).

In Iran, as in many other countries, the lack of local standards has led to the use of standardized charts and tables of NCHS as references. Since 1978, WHO has recognized these charts, including the latest version published in 2007, as the global growth standard (11). Considering the variety of genetic, racial, geographic, economic, and social factors involved in the growth process and the fact that reference figures and natural growth patterns vary with the population, these reference charts can lead to erroneous conclusions (13). For example, various studies have shown that the average height of many countries has increased over time (19, 20). In Europe, the average height of adults has been on an increase since the middle of the nineteenth century, but while this increase has been about one centimeter per decade in northern Europe (20), it has been three centimeters per decade in southern and eastern Europe (13). In the Netherlands, the average height has increased from 165cm in 1860 to 181cm in 1990, making the Dutch the tallest nation in the world (20). This trend has also occurred in the United States, which has the world's most racially diverse population, but the increase in height-for-age has been about 7 centimeters or 4% less than in northern Europe (19). Several anthropometric studies conducted in different parts of Iran show major discrepancies in terms of height percentiles with each other and with the global standards (2, 27-29). Therefore, a closer examination of the issue is necessary, firstly because of the role of growth factors as major metrics for long-term improvement in the public health, and secondly to illustrate the various dimensions of generational changes in growth indices (34, 35).

The growth trends in Iranian students aged 7 to 18 years have been the subject of multiple studies, most

of which have reported some differences from the global standards. However, this is the first comprehensive meta-analysis of all studies carried out so far on this subject. In this systematic review and meta-analysis, the authors screened and compiled the existing reports on the average height of 7 to 18-year-old Iranian boys and girls and compared the findings with the global standards so as to contribute to the development of a clear and explicit local measure for the growth pattern assessment of Iranian children and adolescents.

Methods

Search strategy

The review study was designed in accordance with the protocols of Systematic Review and Meta-Analysis (PRISMA) (38). The target material was all studies published in Persian or English until November 2018. The search was performed in national and international electronic databases including Iranmedex, Magiran, SID, IranDoc, Medline, Scopus, PubMed, Science Direct, Web of Knowledge, Cochrane and Google Scholar search engine. The search was conducted by two researchers (S.Sh and A.Y) independently using identical keywords. Any disagreement was settled by the third researcher (S.Sh) and the final consensus was reached through group discussion. For Persian databases, the searched keywords were the Persian equivalents of height, students aged 7 to 18 years, and Iran. For English databases, the search was performed with mesh terms: Growth Disorders, Stunting, Body Height, Height, Length, Child, Growing Child, School Age OR 7 to 18 Years, and Iran. To expand the search, it was repeated with a combination of mesh and non-mesh terms and AND and OR functions. The reference list of articles was also reviewed. In the event of any ambiguity, inaccuracy, or missing data, one of the researchers (R.N) contacted the authors via email up to two times. The bibliography of the found articles was also manually searched to identify more possibly relevant articles (A.Y).

Screening

Inclusion and exclusion criteria

Two of the researchers (AY, KS) screened the articles based on the following inclusion criteria: 1) descriptive design, 2) the studied population being 7 to 18 years old, 3) provision of (mean $\pm$ standard deviation) or (mean $\pm$ standard error of the mean) for the studied population, and 4) being focused on

Iran. The exclusion criteria were: 1) non-random sampling, 2) irrelevance to the subject, 3) and article's lack of sufficient data for meta-analysis.

Data extraction

The quality of the articles was evaluated using the STROBE checklist (43). The authors adopted a simple procedure for quality scoring. In this procedure, two of the researchers (S.Sh and A.Y), working independently, gave each part of the checklist a score between 0 and 2, and the articles with total scores of 1-15, 16-30, and 31-44 were classified as poor, moderate and high quality respectively. The articles that earned a score of less than 16 (poor quality) were excluded from the meta-analysis process. Out of the 37 works reviewed, 33 articles, which all had a cross-sectional-observational design, were found eligible for data extraction. The required data were extracted by one of the researchers (A. Y) with the help of a prepared checklist. This checklist was designed to facilitate the organized collection of the data pertaining to the year of publication, age, gender, place of study, sample size, and mean and standard deviation (SD) for all subjects. In the cases where the standard error of the mean (SEM) was reported, the researchers converted it to the standard deviation. Stunting was defined as height-for-age shorter than 3rd percentile or 2 SD below the median of NCHS/WHO growth reference (45). Height reports of all studies were compared with the 50th percentile of the global height reference.

Statistical analysis

Data analysis was performed using STATA version 14.2. The results of the studies were combined using the random effects model. Data heterogeneity was measured with Q statistic and I^2 index. The level of significance was considered to be $P < 0.05$. The analysis was performed in subgroups based on the year of publication, age, gender, study area, sample size, and mean and SD or SEM of the height. A meta-regression was also performed to determine the relationship of the reported heights with the date of report and sample size. Since the effect size was being analyzed for a normally distributed quantitative variable, the mean and standard deviation of the heights were used and the standard error of the study was obtained from the equation $\frac{\sigma^2}{n}$.

The total mean height was calculated by two methods. The first method is the weighted averaging using

1 the equation $weighted\ mean = \frac{\sum w_i \hat{y}_i}{\sum w_i}$, where $\hat{y}_i$ is the effect size of study i, and W_i is the
2 weight of that study, which here is proportional to the size of the studied population, that is, the
3 population of the province where the study has been conducted. The second method is the meta-analysis
4 of fixed and random effects based on data heterogeneity. In this method, instead of the population of the
5 province, the weights are calculated based on the sample size and the mean error of samples. In this
6 method, the 95% confidence interval is calculated using the equation $\bar{Y} \pm z_{\frac{\alpha}{2}} \times \frac{S_y}{\sqrt{n}}$.

7 With these explanations, the mathematical formulation of the fixed and random models can be written
8 as follows:

9
$$\hat{y} = \frac{\sum \hat{y}_i w_i}{\sum w_i} \text{ with } w_i \approx \frac{1}{v_i}$$

10 where

11 $\hat{y}_i$ = value of the parameter in study i

12 v_i = variance of the parameter in study i

13 $\hat{y}$ = point estimate of the parameter after combining the results of all studies

14 According to the above formula, the parameter estimate is equal to the weighted sum of parameter values
15 reported in different studies. In this formula, the weight of each study is inversely proportional to the
16 variance of the parameter in that study. In case of using the inverse variance, the weight of each study
17 will be directly proportional to the inverse variance.

18 In the fixed model, it is assumed that $\hat{y}_i$ follows a normal distribution, or:

19
$$\hat{y}_i \approx N(y, v_i)$$

20 This means that the observations made in the studies have a normal distribution with a fixed mean (y
21 for the entire population) and a variance of v_i . In the random model, it is assumed that:

22
$$\hat{y}_i \approx N(y, v_i) \quad \text{and} \quad y_i \approx N(y, v_i)$$

23 This means that the observations made in each study follow a normal distribution with a mean equal to

the mean in the same population (y_i), and the parameters in different populations have a normal distribution with a mean equal to that parameter in all populations (μ) and a variance of τ^2 . Hence, the observed differences have two origins (τ^2, ν). Heterogeneity across studies was evaluated by using the Q statistics at the $P < 0.10$ level of significance. We also calculated the I^2 statistic, which describes the total variation across studies attributable to heterogeneity rather than chance; an I^2 value greater than 50% indicates at least moderate heterogeneity and potential publication bias was assessed by visual inspection of Begg's funnel plots.

Results

In the initial systematic search, a total of 528 articles were identified. Of these, 215 articles were duplicates and 191 were irrelevant, hence leaving 122 articles eligible for full-text review. After this review, 37 of these articles were excluded because of inconsistency in terms of target population, 28 were excluded because of missing data, and 17 were excluded because of not meeting the inclusion/exclusion criteria. The remaining 40 articles were subjected to quality evaluation and 37 of them were found eligible for inclusion in the final analysis (Figure 1).

The total sample size of the 37 articles included in the meta-analysis was 395,210, of which 189,985 were male and 205,372 were female. These studies were published in Iran between 1991 and 2017. The profile of the studies included in the meta-analysis is presented in Table 1

As shown in Figure 2, the mean height of 18-year-old Iranian girls was 157.75 cm (95% confidence interval: 156.156 – 158.72) and for boys, this figure was 171.09 (95% confidence interval: 169.72-172.47). The lowest and highest heights reported for 18-year-old Iranian girls were related to, respectively, the study of Mostafa Hosseini (1991) (5), which reported an average height of 153 cm (confidence interval: 152.89-153.10) for Iranian girls across the country, and the study of Akhi (2007) (34), which reported an average height of 161 cm (confidence interval: 160.72-161.26) for the city of Sari, Mazandaran (A). For 18-year-old Iranian boys, The lowest and highest reported heights were in,

1 respectively, the study of Mohsen Hosseini (2017)(49), which reported an average height of 164 cm
2 (confidence interval: 163.89-164.10) for Isfahan , and the study of Mehporvar (2015) (47), which
3 reported an average of 174.44 cm (confidence interval: 174-174.87) for Yazd (B).

4
5 According to the results presented in Figure 3, the mean height of Iranian girls and boys is lower than
6 the global standards. The results also show that Iranian girls and boys in the age group of 7 to 12 years
7 are only slightly shorter than the global references, but this difference widens from the age of 14 in girls
8 and 13 in boys. For example, Table 2 shows that at the age of 12, Iranian girls are 4.00, 4.25, and 3.96
9 cm shorter than the WHO, NCHS and CDC standards, but at the age of 16, this difference widens to
10 5.11, 5.10, and 5.14 cm, respectively, and remains the same at least until the age of 18 years. For Iranian
11 boys, the difference from the WHO, NCHS and CDC standards is 5.40, 5.76, and 5.44 cm at the age of
12 13, slightly changes to 5.20, 5.74, and 5.63 cm at the age of 16 and remains the same at least until the
13 age of 18. In other words, these differences from the global standards vary with the gender. For girls,
14 the difference starts at the age of 12 and reaches a maximum of about 5 cm at the age of 18. But for
15 boys, the difference from the global standards remains almost constant as they go through childhood
16 and adolescence.

17 According to the results of meta-regression analysis, the final height of 18-year-old Iranian girls and
18 boys has not significantly changed with the year of the study. No statistically significant difference was
19 observed in this regard for boys ($P = 0.20$) or girls ($P = 0.11$) (Table 3). Figure 4 shows meta-regression
20 analysis of random effects model of the mean height of 18-year-old Iranian girls and boys

21
22 The results of Table 4 show that among 18-year-old girls of different ethnicities, those belonging to
23 Kurd and Baluch ethnicities have respectively the highest (159.27 cm) and lowest (155.33 cm) mean
24 height. Similarly, among 18-year-old boys, those belonging to Kurd and Baluch ethnicities have the
25 highest (173.72 cm) and lowest (170.03 cm) mean height.

26
27 Although the funnel plot was slightly asymmetric, after using the trim-and-fill method, visual inspection
28 of Begg's funnel plot did not identify substantial asymmetry for WD studies. Figures not presented here

to save the limited space.

Discussion

To the best of our knowledge, this is the first systematic review and meta-analysis on the height of Iranians aged 7 to 18 years in comparison with WHO, NCHS, and CDC standards. In this study, the growth patterns of Iranian girls and boys were found to be different from the reference patterns. Meta-analysis of studies conducted on 398,758 male and female students showed that Iranian girls of age 10 to 13 are averagely taller than Iranian boys of the same age, but this relation reverses at higher ages. The same trend is present in the WHO standard, but in CDC and NCHS, it starts from the age of 11 instead of 10. In the previous studies, this trend has been attributed to the earlier onset of puberty in girls (50). Research has shown that the mean age of menarche in Iran is lower than in developed countries (51). For example, the mean age of menarche is 12.43 in the United States (52), 13.1 in Norway (53), 12.27 in Indonesia (54), 12.6 in Colombia (55) and 12.4 in Mexico (56). It is widely known that there are major differences in the age of menarche in different countries and different races, but the specific reasons for these differences are still not well understood (57). Besides race, multiple factors including biological, social, nutritional, geographical and lifestyle conditions may affect the age of menarche, but overall, early or late onset of menarche cannot be attributed to any one factor (58, 59).

Since the meta-analysis showed that the average height of Iranian girls and boys exhibit an almost uniform pattern from the age of 16 to 18, the mean height at the age of 18 was chosen for the final comparison with the global standards. In this comparison, it was found that the mean height of 18-year-old Iranian girls is, respectively, 4.67, 4.75, and 4.74 cm lower than the WHO, CDC, and NCHS standards. For 18-year-old Iranian boys, the mean height is 4.58, 4.62, and 4.60 cm lower than the WHO, CDC and NCHS standards. In these findings, the mean heights of Iranian girls and boys of all ages were closer to the WHO figures than to other standards. The results also showed a 13.18 cm difference in the mean height of Iranian boys and girls at the age of 18, whereas this difference is respectively 13.09, 13.05 and 13.04 cm in WHO, CDC, and NCHS standards.

According to the results of the meta-analysis, the weighted means of the height of Iranian girls and boys of all ages were also lower than the reference standards. All meta-analyses are based on the assumption

1 that sampling has been random and not stratified. For example, if a study has taken a sample of 500
 2 people from Ilam province, which has a population of 600,000 people, and another study has taken a
 3 sample of 500 people from Tehran province, which has a population of 12 million people, then In meta-
 4 analysis ,weighting to studies is based on inverse variance and sample size we do not give weight to
 5 studies base of province population of studies, when we pooled studies we give same weight to all of
 6 provinces. But in weighting mean method we use of structure, stratify sampling and population of
 7 provinces and sample size of studies accounted in the total mean. As a result, this weighted mean is
 8 more accurate than the other mean discussed above. The weighted mean height of 18-year-old Iranian
 9 girls was found to be 3.40, 3.48, 3.47 cm lower than the WHO, CDC and NCHS standards. For 18-year-
 10 old Iranian boys, the weighted mean of the height was 3.76, 3.80, 3.78 cm lower than the WHO, CDC
 11 and NCHS standards, respectively. The weighted mean height of girls and boys at the age of 18 was
 12 closer to the WHO reference values than to other standards, nevertheless, there is a substantial difference
 13 between the growth trends of Iranian girls and boys and those of the global standards.
 14 The above findings are consistent with the results of Ulijaszek et al. (2001), which after studying the
 15 mean height of 7-year-old students in numerous studies, reported that the mean height of Asian
 16 populations is approximately 1.0-1.7 cm lower than that of other demographic groups in Europe, Africa,
 17 North America, and South America (60). A study conducted on students aged 6 to 16 in Sagamu,
 18 Nigeria, showed that the mean height of these students was lower than the WHO and CDC references
 19 and generally closer to the former than the latter (61). The findings of the present work are also in
 20 agreement with the reports of studies conducted in Italy, Turkey and Saudi Arabia, which showed that,
 21 for most ages, stature growths were lower than the reference figures (62-64). A study on the growth of
 22 Nigerians aged 1 to 20 also showed that the 50th percentile of children growth chart was lower than that
 23 of WHO/FAO standard (65). On the other hand, these findings were inconsistent with the results of a
 24 study by Razzaghy et al. (2006), which reported that the height of Iranian boys aged 6 to 15 are
 25 comparable to the CDC figures and local standards are only needed for girls of 6 to 17 years old (6).
 26 The results are also inconsistent with the findings of Bener et al. (2005) and Fuiano et al. (2005) (66,
 27 67).
 28 These inconsistencies can be attributed to the populations studied in those works. For example, the study

of Razzaghy was conducted on the children of school age in Tehran, which can be hardly generalized to the entire population of Iranian children and adolescents. It should also be noted that the growth rate of girls and boys in different regions is a function of numerous factors. In this regard, some studies have suggested that children who enjoy a better social and economic status are taller than others (45, 68). In another study, race was highlighted as a key factor for the height of children and statistically significant differences were shown between the growth curves of black and white people (69). However, several studies have questioned the role of race in growth indices. For example, Droomers et al. (1995) showed that Indonesian children with high socioeconomic status had higher height and weight than American children (70). Also, the results of a systematic study showed that in low-income and middle-income countries, children living in urban areas are taller than their rural peers (70). The role of health services, education level, and nutritional diet on the height is also well recognized (68). A number of studies have also underscored the role of genetic and environmental factors such as malnutrition, growth retardation, and infection as factors influencing the anthropometric indices in developing countries (71, 72). The comparison of height indices of Iranian boys and girls with their European and American peers shows significant discrepancies, which can be attributed to differences in environmental, socio-economic, educational, lifestyle, and diet factors. Considering the significant difference between the mean heights of Iranian girls and boys and the global standards, it can be stated that these standards, which are based on the population of American children, are ill-suited for the population of Iranian children and adolescents (71). Because of genetic, economic, social and cultural differences, the existing criteria, which are mostly based on the population of people living in advanced Western nations, cannot be valid for all countries across the world. In addition, relying on the growth indicators designed based on non-local populations may lead to false diagnoses of underweight and short stature (49). The use of global standards can also have secondary effects such as the promotion of ill-fitting ergonomic designs for chairs and tables, which may increase the prevalence of musculoskeletal problems in the local population (73). The results of this study provide evidence in support of the notion that regional growth standards should be developed according to racial, genetic, and geographical specification of each country so that they could be relied upon for use in local studies on health or growth disorders.

The main limitation of this study was the skewed geographical distribution of the reviewed studies, which was reflected in the fact that some provinces had multiple representatives while others had no representative in the analyzed data. The main strength of this work is the large size of the compiled sample, which makes the findings more generalizable for the broader population of Iranian children and adolescents. The findings of this research are based on a sample of about 398,000 people living in different cities across Iran, and considering that height is a quantitative variable, this sample can be considered large enough for reasonable generalization of the results to the whole country. Hence, this is the most accurate estimate of the height status of Iranian girls and boys in different age groups from 7 to 18. The results of this meta-analysis are also consistent with the findings of a study conducted in 2015 by Mehrparvar (46, 47), which is currently the largest nation-wide anthropometry study carried out on six major ethnicities of Iran (Kurd, Lor, Turk, Arab, Persian, and Baluch).

Conclusion

Given the different growth pattern and low mean height of Iranian girls and boys compared to the global standards, the use of these reference charts for Iranian children and adolescents may lead to erroneous conclusions. Therefore, development and promotion of regional growth charts for Iranian children and adolescents seem necessary for reliable evaluation of growth trends and more effective health policy planning in relation to these age groups.

Abbreviations

World Health Organization (WHO), United States Centers for Disease Control and Prevention (CDC), United States National Center for Health Statistics (NCHS), protocols of Systematic Review and Meta-Analysis (PRISMA), standard deviation (SD), standard error of the mean (SEM).

Declarations

Ethics approval and consent to participate

The research proposal was approved by the Ethics Committee affiliated with Ilam University of Medical Sciences. This is a systematic review study then no ethical approval or consent to

1 participate is applicable to this study.

2 **Consent for publication**

3 Not applicable

4 **Availability of data and materials**

5 The datasets used and analyzed during the current study are available from the corresponding
6 author on reasonable request.

7 **Competing interests**

8 The authors stated no conflict of interest.

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11 **Authors' contributions**

12 All authors contributed extensively to the work presented in this paper. AY and MD designed
13 the study. SS, RN, and KS conceived the study. MM, AY, and SS created and performed the
14 literature search strategy, AY built the data extraction file, AY and SS performed the data extraction
15 and MD and KS supervised the process. MD and KS performed the statistical analyses, and all
16 authors interpreted the data. MM and RN drafted and revised the manuscript, and all the other
17 authors contributed substantially to the writing and revising of the manuscript. All authors have
18 read and approved the final version of the manuscript.

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References:

1. Ebrahimzadeh S. Determining The Standards Of Height And Weight In Iranian Children Of 6-12 Years Of Age And Comparing It With International Standards. 2002.
2. Mohamm K, Hosseini M, Noorbala A. Secular Trends In Growth (Weight And Height) Of Children In Iran Over A Decade (1990-1 To 1999). Hakim Research Journal. 2006;9(1):1-8.
3. Taheri F, Fouad Am. Growth Normogram In 11-14 Year Old Female Students In Birjand And Its Comparison With National Center For Health Statistic (Nchs) Standard. 2006.
4. The State Of The World's Children 1998: A Unicef Report. Malnutrition: Causes, Consequences, And Solutions. Nutr Rev. 1998;56(4 Pt 1):115-23.
5. Hosseini M, Taslimi S, Dinarvand P, Jones M, Mohammad K. Trends In Weights, Heights, Bmi And Comparison Of Their Differences In Urban And Rural Areas For Iranian Children And Adolescents 2–18-Year-Old Between 1990–1991 And 1999. Child: Care, Health And Development. 2010;36(6):858-67.
6. Razzaghy Azar M, Moghimi A, Montazer M, Sadeghi Hm, Golnari P, Sadigh N, Et Al. Cross-Sectional Reference Values For Height, Weight And Body Mass Index Of Schoolchildren Living In Tehran, Iran. Annals Of Human Biology. 2006;33(4):471-9.
7. Ayatollahi S. Age-Related Weight-For-Height Charts For South Iranian School Children. Journal Of Tropical Pediatrics. 1995;41(3):181-5.
8. Mei Z, Yip R, Grummer-Strawn Lm, Trowbridge Fl. Development Of A Research Child Growth Reference And Its Comparison With The Current International Growth Reference. Archives Of Pediatrics & Adolescent Medicine. 1998;152(5):471-9.
9. A Nb. Studying Height And Weight Of Male Students Aged 7-19 Years In Ardabil And Comparing It With Nchs Standard And Similar Studies In Iran. . Journal Of Science And Technology. 2005.
10. Langerodi M. Study Of Height And Weight Of Children Under Age 10 In Qazvin. Journal Of Qazvin University Of Medical Sciences & Health Services. 1998.
11. Frongillo E, Hanson K. Determinants Of Variability Among Nations In Child Growth. Annals Of Human Biology. 1995;22(5):395-411.
12. Taghavi N.S Em Ka, Porheydari M. Studying The Height And Weight Of Children Aged 7-11 Years In Shahrood During Academic Years 2003-2004 And Comparing It With The Global Standard. Journal Of Science Islamic Azad University. 2007;17(2):95-101.
13. Cole Tj. The Secular Trend In Human Physical Growth: A Biological View. Economics & Human Biology. 2003;1(2):161-8.
14. Ah Tb. Anthropometric Characteristics Of Students Aged 11-17 Years In Urmia And Comparison With Nchs Standard. Research In Sport Sciences. 2005.
15. Aminorroaya A, Amini M, Mosavi Af, Sanaat Z. Increased Heights And Weights Of Isfahani Female Children And Adolescents In Iran. Journal Of Tropical Pediatrics. 2002;48(6):377-9.
16. Aminorroaya A, Amini M, Naghdi H, Zadeh Ah. Growth Charts Of Heights And Weights Of Male Children And Adolescents Of Isfahan, Iran. Journal Of Health, Population And Nutrition. 2003;341-6.
17. Ershadi A. Statistical Indexes And Weight And Height Curves In 6-18 Years Old Students Of Kashan In 2000. 2000.

- 1 18. Ayatollahi S, Pour-Ahmad S, Shayan Z. Secular Trends In Growth Among School Children
2 Of Shiraz (Southern Iran) Born In The Post-War Period. Medical Journal Of The Islamic Republic
3 Of Iran (Mjiri). 2006;20(3):141-6.
- 4 19. Kuczmarski Rj. Cdc Growth Charts; United States. 2000.
- 5 20. Hauspie R, Vercauteren M, Susanne C. Secular Changes In Growth And Maturation: An
6 Update. Acta Paediatrica. 1997;86(S423):20-7.
- 7 21. Ahmadi A Va. A Survey Of Height And Weight Of Children And Adolescents In Kerman,
8 Iran, In 1997. Journal Of Kerman University Of Medical Sciences. 2014.
- 9 22. Sohrabi A, Karajibani M, Vahedi R. Comparison Of Mean Weight And Height Growth Of
10 Governmental And Private Students Of Primary Schools Of Zahedan District, Iran. 2006.
- 11 23. Akhi O Tm Kz, Kavsarian M. Studying The Height And Weight Of Female Students Aged
12 6-18years Old In Sari, Iran. Journal Of Mazandaran University Of Medical Sciences 2007.
- 13 24. Shidfar F Mm Am, Azizi H.R. Study Of Height, Weight And Body Mass Index Of Female
14 Students Aged 6-15 Years Old In Babol City In The Years 1374-81 And Their Comparison
15 With Reference To The United States Centers For Disease Control And Prevention (Cdc2000).
16 Iranian Journal Of Nutrition Sciences And Food Technology. 2007;2(3):13-22.
- 17 25. K H. Physical Growth Status Of Elementary School Students In Babol 1998. Journal Of
18 Babol University Of Medical Sciences.9-43.
- 19 26. Nemati A Na Dmh. Anthropometrics Factors Of Girls Of Ardabil Aged 7-19 Years And
20 Comparison Of Them With Nchs Standard. Journal Of Research Medical Sciences, Ardabil
21 University Of Medical Sciences. 2008;8(2):202-8.
- 22 27. Nemati A Nba. Anthropometrics Factors Of Girls Of Ardabil Aged 7-19 Years And
23 Comparison Of Them With Nchs Standard. Journal Of Ardabil University Of Medical Sciences.
24 2009;8(2).
- 25 28. Baghianimoghadam B, Karbasi Sa, Golestan M, Kamran M. Determination Of Growth
26 Pattern Of 7-12 Years Old Children In Yazd City And Comparison Of It With Who Standards. J
27 Pak Med Assoc. 2012;62(12):1289-293.
- 28 29. Bayat P-D, Khazaei M, Ghorbani R, Ayubian M, Sohoul P, Ghanbari A. Growth Pattern
29 In 7-12 Years Old Arak Children (Central Iran) In Comparison With Other Ethnic Subgroups Of
30 Iran. Italian Journal Of Anatomy And Embryology. 2012;117(1):1-7.
- 31 30. Montazerifar F Km Sm. Study Of Growth Pattern In 19-19 Year-Old Girls In Zahedan
32 City. Journal Of Medical Sciences University Of Medical Sciences Shahid Sadoghi Of Yazd.
- 33 31. Habibi E, Hoseini M, Asaad Z. Match Between School Furniture Dimensions And
34 Children's Anthropometry In Isfahan Schools. Iran Occup Health. 2009;6(2):51-61.
- 35 32. Ebrahimzadeh S. Determining The Sandards Of Height And Weight For 6-12-Year-Old
36 Kids Of Mashad And Comparing It With International Standards. 2002.
- 37 33. Hafezi R, Mirmohammadi S, Mehrparvar A, Akbari H, Akbari H. An Analysis Of
38 Anthropometric Data On Iranian Primary School Children. Iranian Journal Of Public Health.
39 2010;39(4):78.
- 40 34. Tanner Jm. Growth As A Measure Of The Nutritional And Hygienic Status Of A
41 Population. Hormone Research In Paediatrics. 1992;38(Suppl. 1):106-15.
- 42 35. James Cole T. Assessment Of Growth2002. 383-98 P.

- 1 36. Mozaffari Kh, Nabizade Al, Akbari M, Ahadi Z, Talaei B. Standardized Of Height, Weight
2 And Body Mass Index (Bmi) In Healthy 6-11-Year-Old Schoolgirls And Schoolboys, Yazd City
3 2010-2011. 2014.
- 4 37. Saffari F, Jalilolghadr S, Esmailzadehha N, Shariatinejad K. Anthropometric Indices In 6-
5 14 Year-Old Girls In Qazvin, Iran. *Journal Of Isfahan Medical School*. 2012;29(165).
- 6 38. Moher D, Liberati A, Tetzlaff J, Altman Dg. Preferred Reporting Items For Systematic
7 Reviews And Meta-Analyses: The Prisma Statement. *Ann Intern Med*. 2009;151(4):264-9, W64.
- 8 39. Fakharzadeh L, Javaherizadeh H, Sabeti F, Cheraghian B. Are Growth Curves For Iranian
9 School-Aged Children Different From The Nchs Standards? *The Journal Of The Egyptian Public*
10 *Health Association*. 2011;86(5 And 6):90-4.
- 11 40. Mirmohammadi S-J, Hafezi R, Mehrparvar Ah, Rezaeian B, Akbari H. Prevalence Of
12 Overweight And Obesity Among Iranian School Children In Different Ethnicities. *Iranian Journal*
13 *Of Pediatrics*. 2011;21(4):514.
- 14 41. Mirmohammadi Sj, Hafezi R, Mehrparvar Ah, Gerdfarmarzi Rs, Mostaghaci M,
15 Nodoushan Rj, Et Al. An Epidemiologic Study On Anthropometric Dimensions Of 7–11-Year-Old
16 Iranian Children: Considering Ethnic Differences. *Ergonomics*. 2013;56(1):90-102.
- 17 42. Shahin M, Afzalpour Me, Fallah Z. Construction Of Height-Weight Growth Charts For 2-
18 18 Year Old Boys In Qayenat City In Iran: A Comparison With Nchs. *Annals Of Biological*
19 *Research*. 2012;3(5):2162-7.
- 20 43. Von Elm E, Altman Dg, Egger M, Pocock Sj, Gotzsche Pc, Vandenbroucke Jp. The
21 Strengthening The Reporting Of Observational Studies In Epidemiology (Strobe) Statement:
22 Guidelines For Reporting Observational Studies. *Lancet*. 2007;370(9596):1453-7.
- 23 44. Taghi Hs, Fatemeh E, Yaser S, Maryam M. The Prevalence Of Obesity And Its Relevant
24 Factors In High-School Students In Jahrom In 2014.
- 25 45. Fatemi Mj, Fararouei M, Moravej H, Dianatinasab M. Stunting And Its Associated Factors
26 Among 6–7-Year-Old Children In Southern Iran: A Nested Case–Control Study. *Public Health*
27 *Nutrition*. 2019;22(1):55-62.
- 28 46. Mehrparvar Ah, Hafezi R, Mirmohammadi Sj, Mostaghaci M, Davari Mh. Anthropometry
29 Of Iranian Guidance School Students With Different Ethnicities: A Comparative Study. *Scientifica*.
30 2015;2015.
- 31 47. Mehrparvar Ah, Mirmohammadi Sj, Hafezi R, Mostaghaci M, Davari Mh. Static
32 Anthropometric Dimensions In A Population Of Iranian High School Students: Considering Ethnic
33 Differences. *Human Factors*. 2015;57(3):447-60.
- 34 48. Hosseini M, Kelishadi R, Yousefifard M, Qorbani M, Bazargani B, Heshmat R, Et Al.
35 Height-Adjusted Percentiles Evaluated Central Obesity In Children And Adolescents More
36 Effectively Than Just Waist Circumference. *Acta Paediatrica*. 2017;106(1):112-9.
- 37 49. Hosseini S, Afshari Safavi A, Esmaeil Zade A, Beig Rezaei S. Comparison Of
38 Anthropometric Indices Of The Children Aged 5-18 Years In Isfahan With Nchs Values. *Iranian*
39 *Journal Of Epidemiology*. 2017;13(2):119-27.
- 40 50. Lin-Su K, Vogiatzi Mg, New Mi. Body Mass Index And Age At Menarche In An
41 Adolescent Clinic Population. *Clinical Pediatrics*. 2002;41(7):501-7.
- 42 51. Bahrami N, Soleimani Ma, Chan Yh, Ghojzadeh M, Mirmiran P. Menarche Age In Iran:
43 A Meta-Analysis. *Iranian Journal Of Nursing And Midwifery Research*. 2014;19(5):444.
- 44 52. Chumlea Wc, Schubert Cm, Roche Af, Kulin He, Lee Pa, Himes Jh, Et Al. Age At
45 Menarche And Racial Comparisons In Us Girls. *Pediatrics-Springfield-*. 2003;111(1):110-3.

- 1 53. Bratke H, Bruserud Is, Brannsether B, Aßmus J, Bjerknes R, Roelants M, Et Al. Timing
2 Of Menarche In Norwegian Girls: Associations With Body Mass Index, Waist Circumference And
3 Skinfold Thickness. *Bmc Pediatrics*. 2017;17(1):138.
- 4 54. Aryani I, Rachma Up, Rokhayati E, Moelyo Ag. Menstrual Cycle Patterns Of Indonesian
5 Adolescents. *Paediatrica Indonesiana*. 2018;58(3):101-5.
- 6 55. Jansen Ec, Herrán Of, Villamor E. Trends And Correlates Of Age At Menarche In
7 Colombia: Results From A Nationally Representative Survey. *Economics & Human Biology*.
8 2015;19:138-44.
- 9 56. Thomas F, Renaud F, Benefice E, De Meeus T, Guegan J-F. International Variability Of
10 Ages At Menarche And Menopause: Patterns And Main Determinants. *Human Biology*.
11 2001;73(2):271-90.
- 12 57. Ong Kk, Ahmed Ml, Dunger Db. Lessons From Large Population Studies On Timing And
13 Tempo Of Puberty (Secular Trends And Relation To Body Size): The European Trend. *Molecular
14 And Cellular Endocrinology*. 2006;254:8-12.
- 15 58. Villamor E, Marin C, Mora-Plazas M, Baylin A. Vitamin D Deficiency And Age At
16 Menarche: A Prospective Study. *The American Journal Of Clinical Nutrition*. 2011;94(4):1020-5.
- 17 59. Karapanou O, Papadimitriou A. Determinants Of Menarche. *Reproductive Biology And
18 Endocrinology*. 2010;8(1):115.
- 19 60. Ulijaszek S. Ethnic Differences In Patterns Of Human Growth In Stature. In: Reynaldo M,
20 Ferdinand H, Editors.: Nestec Ltd.; 2001. P. 1-20.
- 21 61. Fetuga M, Ogunlesi T, Adekanmbi A, Alabi A. Growth Pattern Of Schoolchildren In
22 Sagamu, Nigeria Using The Cdc Standards And 2007 Who Standards. *Indian Pediatrics*.
23 2011;48(7):523-8.
- 24 62. Cacciari E, Milani S, Balsamo A, Spada E, Bona G, Cavallo L, Et Al. Italian Cross-
25 Sectional Growth Charts For Height, Weight And Bmi (2 To 20 Yr). *Journal Of Endocrinological
26 Investigation*. 2006;29(7):581-93.
- 27 63. El-Mouzan Mi, Al-Herbish As, Al-Salloum Aa, Qurachi Mm, Al-Omar Aa. Growth Charts
28 For Saudi Children And Adolescents. *Saudi Medical Journal*. 2007;28(10):1555-68.
- 29 64. Neyzi O, Furman A, Bundak R, Gunoz H, Darendeliler F, Bas F. Growth References For
30 Turkish Children Aged 6 To 18 Years. *Acta Paediatrica*. 2006;95(12):1635-41.
- 31 65. Nwokoro So, Ifada K, Onochie O, Olomu J. Anthropometric Assessment Of Nutritional
32 Status And Growth Of 10 Individuals In Benin City (Nigeria) Metropolis. *Pakistan Journal Of
33 Nutrition*. 2006;5(2):117-21.
- 34 66. Bener A, Kamal Aa. Growth Patterns Of Qatari School Children And Adolescents Aged 6-
35 18 Years. *Journal Of Health, Population And Nutrition*. 2005:250-8.
- 36 67. Fuiano N, Tucci A, Pietrobelli A. Growth Curves In Pediatrics. Pilot Study In A City Of
37 South Of Italy. *Minerva Pediatrica*. 2005;57(5):297-303.
- 38 68. Delemarre-Van De Waal Ha. Environmental Factors Influencing Growth And Pubertal
39 Development. *Environmental Health Perspectives*. 1993;101(Suppl 2):39-44.
- 40 69. Saha C, Eckert Gj, Pratt Jh, Shankar Rr. Onset Of Overweight During Childhood And
41 Adolescence In Relation To Race And Sex. *The Journal Of Clinical Endocrinology & Metabolism*.
42 2005;90(5):2648-52.
- 43 70. Droomers M, Gross R, Schultink W, Sastroamidjojo S. High Socioeconomic Class
44 Preschool Children From Jakarta, Indonesia Are Taller And Heavier Than Nchs Reference
45 Population. *European Journal Of Clinical Nutrition (United Kingdom)*. 1995.

- 1 71. Tanner Jm. 1 Normal Growth And Techniques Of Growth Assessment. Clinics In
2 Endocrinology And Metabolism. 1986;15(3):411-51.
- 3 72. Anderson M, Dewey K, Frongillo E, Garza C, Haschke F, Kramer M, Et Al. An Evaluation
4 Of Infant Growth-The Use And Interpretation Of Anthropometry In Infants. Bulletin Of The World
5 Health Organization. 1995;73(2):165-74.
- 6 73. Choobineh A, Rahimi Fard H, Jahangiri M, Mahmood Khani S. Musculoskeletal Injuries
7 And Their Associated Risk Factors. Iran Occupational Health. 2012;8(4):70-81.
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1 **Table 1:** Profile of the studies included in the quantitative meta-analysis.

ROW	Study	Year	Area	N		
				Male	Female	Total
1	Mohammad K. (2)	1991	Iran	7872	7896	15768
2	Hosseini M.(5)	1991	Iran	11175	11174	22349
			(Rural, Urban)			
3	Ayaatollahi S M T A.(7)	1989	Shiraz	642	565	1207
4	Motie Langarodi H. (10)	1992	Ghazvin	1103	1113	2236
5	Aminorroaya M.(15, 16)	1997	Esfahan	4150	4386	8536
6	Ershadi A.(17)	1998	Kashan	-	8093	8093
7	Ahmadi A. (21)	1998	Kerman	3287	3419	6706
8	Mohammad K. (2)	1999	Iran	8904	8880	17784
9	Hosseini M. (5)	1999	Iran	12598	12598	25196
			(Rural,Urban)			
10	Hajian K.(25)	2000	Babol	498	500	994
11	Montazerifar F.(30)	2000	Zahedan	-	1404	1404
12	Ebrahimzadeh S. (32)	2000	Mashahd	334	338	672

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Table 1: Continued ...

13	Ebrahimzadeh S.	2001	Shiraz			
	(1)		Mashhad	5808	5657	11465
			Uromieh			
14	Taheri F.(3)	2004	Birjand	-	1020	1020
15	Razaghi Azar M. (6)	2003	Tehran	1512	1407	2919
16	Naghizadeh A. (9)	2005	Ardabil	3998	-	3998
17	Taghavi N. (12)	2005	Shahrood	1234	990	2224
18	Tartibian B. (14)	2005	Uromieh	-	1522	1522
19	S.M.T A.(18)	2006	Shiraz	1141	1064	2205
20	Sohrabi A.(22)	2007	Zahedan	34229	29551	63780
21	Akhi O.(23)	2007	Sari	-	1233	1233
22	Shidfâr F. (24)	2007	Babol	-	609	609
23	Nemati A. (26)	2008	Ardabil	-	3741	3741
24	Habibi E. (31)	2009	Esfahan	493	489	982
25	Hafezi R.(33)	2010	Iran	1015	1015	2030
26	Mozafari H.(36)	2011	Yazd	1080	1080	2160
27	Safari F. (37)	2011	Ghazvin	-	2181	2181
28	Fakharzadeh L. (39)	2011	Abadan	1064	1076	2140
29	Mirmohammadi S.J.(40)	2011	Iran	14924	14964	30092
30	Mirmohammadi S.J.(41)	2012	Iran	6471	6287	12731
31	Shahin M.(42)	2012	Ghaenat	3200	-	3200
32	Baghianimoghadam.(28)	2012	Yazd	960	961	1921
33	Heydari ST.(44)	2014	Jahrom	492	500	992
34	Mehrpavar AH. (46)	2015	Iran	3590	3884	7410
35	Mehrpavar AH. (47)	2015	Iran	4703	4773	9476
36	Hosseini M. (48)	2016	Iran	6669	6451	13120
37	Hosseini S M.(49)	2017	Esfahan	23070	30751	53839

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1 **Table 2:** Comparison of the mean height of Iranian girls and boys aged 7 to 18 years with the global standards

Age (Year)	Gender	Height length (cm)			Weight	$\bar{X}$		
		Children and adolescents 7 to			*Mean	Height length (cm)		
		12 years old in Iran			(cm)			
		% 95 CI						
		$\bar{X}$	Lower	Upper	$\bar{X}$	WHO	CDC	NCHS
7	Male	119.30	117.33	121.27	119.36	121.73	122.03	121.76
	Female	118.86	115.92	121.80	118.54	120.81	121.76	121.49
8	Male	124.63	122.71	126.55	124.96	127.26	128.12	127.87
	Female	124.24	121.50	126.99	123.80	126.55	127.82	127.58
9	Male	130.90	127.08	132.10	130.11	132.56	133.73	133.51
	Female	129.84	127.11	132.57	129.36	132.49	133.13	132.92
10	Male	135.05	133.21	136.90	135.40	137.77	138.82	138.61
	Female	135.59	132.93	138.25	134.91	138.63	138.21	137.98
11	Male	139.96	138.01	141.90	139.54	143.11	143.73	143.52
	Female	141.72	138.99	144.45	140.98	144.99	144.26	143.97
12	Male	144.73	142.24	147.22	143.75	149.08	149.30	149.04
	Female	147.23	143.95	150.50	146.40	151.23	151.48	151.19
13	Male	150.64	147.52	153.75	149.02	156.04	156.40	156.08
	Female	151.74	148.57	154.92	151.31	156.37	157.34	157.15
14	Male	157.29	153.87	160.70	155.84	163.18	164.14	163.84
	Female	154.93	152.39	157.47	154.68	159.78	160.47	160.39
15	Male	163.53	160.21	166.85	162.50	168.95	170.13	169.94
	Female	156.45	154.39	158.52	156.21	161.66	161.89	161.85
16	Male	167.87	165.18	170.55	167.56	172.89	173.61	173.50
	Female	157.40	155.83	158.97	157.05	162.51	162.50	162.54

17	Male	170.68	168.54	172.82	170.06	175.16	175.34	175.29
	Female	157.87	156.75	158.98	157.41	162.85	162.92	162.91
18	Male	171.09	169.72	172.47	171.12	176.14	176.18	176.16
	Female	157.75	156.79	158.71	157.59	163.05	163.13	163.12

1 * Calculated based on weighted mean in Iran

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Table 3: Meta-regression analysis of random effects of the mean height of 18-year-old Iranian girls and boys

Variables		Year	Cons
Mean height of 18 years old boys	Coef.	0.084	1.066
	Std.Err.	0.064	129.322
	t	1.310	0.010
	P> t	0.205	0.994
Mean height of 18 years old girl	Coef.	0.812	-5.298
	Std.Err.	0.048	98.224
	t	1.660	-0.050
	P> t	0.113	0.958

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16 **Table 4:** Comparison of the mean height of 18-year-old Iranian girls and boys based on ethnicity

Mean height length (cm) in difference ethnic									Mean	
									Height length (cm)	
Age (Year)	Gender	Persian	Kurd	Turk	Lor	Arab	Balouch	Unknow	Maximum	Minimum
7	Male	119.29	118.94	119.79	118.57	123.11	119.09	118.63	123.11	118.63
	Female	118.86	119.36	118.68	118.81	120.95	119.03	118.52	120.95	118.52
8	Male	124.77	124.67	124.63	123.90	128.29	124.10	123.84	128.29	123.84
	Female	124.60	124.00	123.96	123.55	127.55	124.93	122.72	127.55	122.72
9	Male	129.71	130.61	130.31	129.56	134.78	130.48	129.33	134.78	129.33
	Female	129.86	129.99	130.50	128.77	133.11	130.91	128.61	133.11	128.61

10	Male	134.63	135.35	134.85	135.15	139.60	134.73	134.22	139.60	134.22
	Female	135.87	136.78	136.18	134.70	138.81	135.49	133.79	138.81	133.79
11	Male	139.46	140.44	143.00	139.61	143.46	138.60	139.03	143.46	139.03
	Female	141.77	143.16	143.92	140.54	144.54	140.46	140.15	144.54	140.15
12	Male	144.08	145.60	146.61	143.66	149.25	142.54	144.26	149.25	142.54
	Female	146.78	149.99	148.81	146.60	150.71	146.55	145.56	150.71	145.56
13	Male	149.48	152.44	153.09	150.79	156.39	151.60	149.76	156.39	149.76
	Female	151.55	154.37	153.12	152.08	153.74	150.04	150.72	154.37	150.04
14	Male	156.76	159.62	159.98	158.03	160.87	154.06	156.24	159.98	154.06
	Female	154.64	157.20	156.34	155.62	155.93	153.17	154.22	157.20	153.17
15	Male	162.79	165.95	165.78	163.16	166.11	160.82	163.51	166.11	160.82
	Female	156.10	158.45	157.38	157.11	156.60	154.31	156.66	158.45	154.31
16	Male	167.52	170.76	168.62	167.83	170.32	165.40	167.61	170.32	165.40
	Female	157.03	158.99	158.99	157.51	157.40	156.18	157.28	158.99	156.18
17	Male	170.30	172.77	171.05	170.75	173.55	168.05	170.66	173.55	168.05
	Female	157.88	159.44	159.24	157.46	157.57	156.02	157.73	159.44	156.02
18	Male	170.35	173.72	172.02	171.85	172.26	170.03	170.83	173.72	170.03
	Female	157.91	159.27	158.29	158.04	158.67	155.33	157.70	159.27	155.33

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Figures

Figure 1
Diagram of meta-analysis in accordance with PRISMA

Figure 2

Estimation of the mean height of 18-year-old Iranian girls and boys based on the date of the study

Figure 3

Comparison of the mean height of Iranian girls and boys during growth with the global standards

Figure 4

Random effects model of the mean height of 18-year-old Iranian girls and boys * Larger circles represent larger sample sizes. * Width of the diagram represents the distance.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [BPEDD2000015R1PRISMA2009checklist.doc](#)