The prevalence of obesity and its relevant factors in high-school students in Jahrom in 2014

Haydari Seyed Taghi¹, Emamgorashi Fatemeh², Sarikhani Yaser*³, Mirhadi Maryam², Tabrizi R¹

Abstract

Introduction:
Obesity is recognized as a major threat to human health in all societies and is identified as the abnormal accumulation of fat in the limbs associated with various factors, such as hereditary, dietary and many other demographic and physiological factors. The present study was conducted to investigate the prevalence of obesity and to analyze its relevant factors in high-school students in Jahrom in 2014.

Materials & Methods:
This study was conducted on 992 high-school students in Jahrom. For diagnosing obesity, participants’ body mass index and anthropometric indices were recorded based on the World Health Organization’s standard classification and their demographic details were also collected. The one-way ANOVA was used to compare the mean of obesity in the different groups and the Chi-square test was used to compare the percentage of obesity.

Results:
The results of the ANOVA showed that the students with a family history of obesity had a significantly higher body fat percentage and BMI (P=0.001). The combined results of the ANOVA and Duncan’s post-hoc test also showed that the students whose mothers had higher levels of education had a higher body fat percentage and BMI (P<0.05).

Conclusion:
In line with the results of other domestic studies, the present study also found a relatively high prevalence of obesity among high-school students. Conducting further studies on the factors affecting obesity can help gain a more precise knowledge of the target population and thus adopt effective preventive interventions such as educational programs as well as better medical approaches.

Keywords: Obesity, Overweight, Adolescents, Prevalence, Students

Introduction
Today, obesity has turned into a serious health problem in Iran and throughout the world and has significantly increased compared to previous years (1 & 2). In recent decades, the sudden increase in the global prevalence of obesity has attracted much attention (3), such that it has been introduced as an epidemic in a report by...
The prevalence of obesity and its related factors among adolescent students in the city of Jahrom: A case study

Haydari S.T et al

Materials & Methods

The present analytical cross-sectional study was conducted on a population of 14-18 year-old high school students from the city of Jahrom. The participants were all healthy and had no known congenital or acquired diseases and were not taking any medications.

The present study was conducted using a multi-stage sampling method, in which high schools were first selected as clusters, and then students from each school were randomly and alphabetically selected according to their grades. Given the prevalence of obesity of 18% obtained in Azerbajani et al. study, and considering the relative error of 0.03, type one error of 0.05, and test power of 0.8, the sample size for each sex was found 384 students, which was raised to 500 students, taking into account the effect size of 1.2. Verbal...
The prevalence of obesity and its consents were obtained from students prior to their participation.

**Anthropometric measurement method**
The students’ body fat percentage was measured by (OMRON-BF-50, Japan), using hand to foot method. To enhance accuracy, students were asked to fast for at least five hours, do no heavy exercises for 12 hours, and to drink no coffee 24 hours prior to the test. Anthropometric measurements including weight, height, BMI, hip, waist and arm circumferences, thickness of triceps, abdomen and clavicle muscles were measured by trained people. The circumferences of triceps abdomen and clavicle muscles were performed using a caliper with a precision of 0.5 mm; and hip, waist and arm circumferences were measured using a non-elastic tape measure. The participants’ heights and weights were measured using SECA stadiometer (Germany) and digital scales respectively - calibrated daily with a control weight- by trained people. BMI was calculated by dividing weight in kilograms over the height squared in meters. A control list was also prepared for each participant, which included demographic details (age, gender, average, parents’ education …). Obesity based on BMI was rated as follows: BMI<18.5 was classed as slim; 25<BMI<18.51 as normal; 30<BMI<25.01 as overweight; and BMI>30 as obese. Boys with fat percentage less than 25% were considered as normal and with fat more than 25% as obese, and girls with fat percentage less than 32% were considered as normal and with fat more than 32% as obese.

**Statistical methods**
Data were described using mean, standard deviation and percentage. Anthropometric values by gender for different academic years were compared using one-way variance analysis, and the obesity prevalence in different groups was compared using Chi-square test. The significance level was 0.05. The present study was approved by the ethics committee of Jahrom University of Medical Sciences.

**Results**
The present study was conducted on 992 high school students (500 boys and 492 girls). Mean age was 16.32±1.11 years in boys, and 15.98±1.18 years in girls. The prevalence of obesity and overweightness based on BMI was 4.1% in boys and 14.2% in girls. Obesity and overweightness were 4.2% and 16.1% in boys, and 3.9% and 12.2% in girls, with no significant difference between sexes. Based on body fat percentage, 31.7% of students were obese, which included 21.8% of boys and 40.7% of girls, with a significant difference between sexes (P<0.001). Anthropometric indices of different grade students from Jahrom high schools were compared using variance analysis test (Table 1). These results show a significant difference in mean anthropometric indices among boys in different grades. Duncan’s post hoc test suggests that the variations in anthropometric indices among boys in different grades do not follow a specific or analyzable pattern. Yet, a significant difference was observed in mean anthropometric indices of boys in the second and fourth grades and those in first and third grades. The variance analysis test showed a significant difference in only triceps measurement among girls in different grades. Duncan’s post hoc test showed that triceps mean measurement in the third and fourth grade female students was less than that in the first and second grades (Table 1). Table 2 compares obesity and BMI in students of different grades in Jahrom using Chi-square test. These results suggest a difference in boys’ obesity index of different grades; in fact, obesity is more
prevalent among first and third grade students than those in other grades. There was also a difference only in boys’ BMI of different grades. The results in this table show that like the obesity index, the mean BMI of the first and third grade students have been higher than normal.

A comparison of body fat index and BMI in boys and girls regarding their father’s education using variance analysis and Duncan’s post hoc tests showed that girls whose fathers held high school and university degrees had a higher BMI mean and fat percentage. These indices were not significantly different in boys (Table 3).

Table 3 presents body fat percentage and BMI in boys and girls regarding their mothers’ education. A comparison of the above-mentioned means with variance analysis and Duncan’s post hoc tests showed that students with more educated mothers had higher body fat percentage and BMI.

The present study results show a significant difference in body fat percentage and BMI among Jahrom students with regard to their family history of obesity, such that those with a family history of obesity had higher body fat percentage and BMI (Table 4).

Table 1: Mean anthropometric indices among Jahrom students by gender and grade

<table>
<thead>
<tr>
<th>Gender</th>
<th>Anthropometric index</th>
<th>First year mean (Confidence interval)</th>
<th>Second year mean (Confidence interval)</th>
<th>Third year mean (Confidence interval)</th>
<th>Pre-university mean (Confidence interval)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>% body fat</td>
<td>20.0 (18.2-21.8)</td>
<td>15.8 (14.4-17.1)</td>
<td>18.4 (17.9-19.8)</td>
<td>15.7 (14-17.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Triceps thickness</td>
<td>18.4 (16.7-20.0)</td>
<td>15.2 (14.2-16.2)</td>
<td>16.8 (15.7-17.9)</td>
<td>14.6 (13.2-15.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Abdominal muscle thickness</td>
<td>32.0 (28.0-36.0)</td>
<td>21.4 (19.3-23.5)</td>
<td>24.6 (22.2-26.9)</td>
<td>19.8 (17.0-22.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Clavicle muscle thickness</td>
<td>45.1 (40.0-50.2)</td>
<td>33.9 (31.2-36.5)</td>
<td>38.7 (35.8-41.7)</td>
<td>29.8 (27.2-32.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Weight</td>
<td>63.9 (61.1-66.7)</td>
<td>60.9 (59.1-62.8)</td>
<td>66.8 (64.6-68.9)</td>
<td>62.4 (60.1-64.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Height</td>
<td>167.6 (166.2-169.1)</td>
<td>169.2 (168.2-170.2)</td>
<td>171.9 (171.1-172.8)</td>
<td>171.0 (169.8-172.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Hip circumference</td>
<td>90.2 (88.5-92.0)</td>
<td>87.1 (85.6-88.7)</td>
<td>90.7 (89.4-92.0)</td>
<td>87.6 (86.0-89.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Waist circumference</td>
<td>79.1 (76.8-81.5)</td>
<td>75.1 (73.6-76.6)</td>
<td>77.8 (76.1-79.5)</td>
<td>74.1 (72.1-76.0)</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Arm circumference</td>
<td>24.8 (24.2-25.5)</td>
<td>24.0 (23.6-24.5)</td>
<td>25.3 (24.9-25.8)</td>
<td>24.4 (23.7-25.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>BMI</td>
<td>22.8 (21.8-23.7)</td>
<td>21.2 (20.7-21.8)</td>
<td>22.5 (21.9-23.2)</td>
<td>21.3 (20.6-22.1)</td>
<td>0.004</td>
</tr>
<tr>
<td>Girls</td>
<td>% body fat</td>
<td>29.8 (28.6-31.1)</td>
<td>31.8 (29.9-33.6)</td>
<td>30.0 (28.4-31.6)</td>
<td>30.1 (28.2-31.9)</td>
<td>0.309</td>
</tr>
<tr>
<td></td>
<td>Triceps thickness</td>
<td>18.8 (17.7-19.8)</td>
<td>19.0 (17.5-20.6)</td>
<td>16.8 (15.4-18.2)</td>
<td>15.4 (13.9-16.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Abdominal muscle thickness</td>
<td>17.0 (16.0-18.0)</td>
<td>17.6 (16.1-19.0)</td>
<td>16.2 (15.0-17.3)</td>
<td>15.9 (14.6-17.2)</td>
<td>0.245</td>
</tr>
<tr>
<td></td>
<td>Collarbone muscle thickness</td>
<td>33.6 (31.7-35.4)</td>
<td>37.0 (34.0-40.1)</td>
<td>34.2 (31.4-36.9)</td>
<td>34.8 (31.9-37.7)</td>
<td>0.243</td>
</tr>
<tr>
<td></td>
<td>Weight</td>
<td>54.2 (52.6-55.8)</td>
<td>56.7 (54.1-59.2)</td>
<td>55.1 (52.7-57.4)</td>
<td>53.7 (51.1-56.3)</td>
<td>0.281</td>
</tr>
<tr>
<td></td>
<td>Height</td>
<td>160.0 (159.2-160.8)</td>
<td>159.9 (158.8-161.0)</td>
<td>161.0 (160.0-161.9)</td>
<td>159.6 (158.3-160.8)</td>
<td>0.316</td>
</tr>
<tr>
<td></td>
<td>Hip circumference</td>
<td>91.3 (90.1-92.4)</td>
<td>93.6 (91.5-95.8)</td>
<td>92.8 (91.2-94.5)</td>
<td>92.1 (90.6-93.7)</td>
<td>0.149</td>
</tr>
<tr>
<td></td>
<td>Waist circumference</td>
<td>74.8 (73.4-76.2)</td>
<td>75.3 (73.0-77.6)</td>
<td>75.1 (73.2-77.1)</td>
<td>74.4 (72.3-76.6)</td>
<td>0.938</td>
</tr>
<tr>
<td></td>
<td>Arm circumference</td>
<td>23.8 (23.3-24.2)</td>
<td>24.2 (23.5-24.9)</td>
<td>24.1 (23.4-24.8)</td>
<td>23.8 (23.1-24.5)</td>
<td>0.694</td>
</tr>
<tr>
<td></td>
<td>BMI</td>
<td>21.1 (20.6-21.7)</td>
<td>22.1 (21.2-23.1)</td>
<td>21.2 (20.4-22.1)</td>
<td>21.0 (20.1-21.9)</td>
<td>0.211</td>
</tr>
</tbody>
</table>
The prevalence of obesity and its variations in anthropometric indices among students for identifying high-risk people and their treatment should be based on scientific evidence such as studies showing the prevalence of obesity among these groups (19-22).

The present study results show that variations in anthropometric indices among boys and girls in different grades do not follow a specific and analyzable pattern. These results may be explained by the fact that the effect of environmental and behavioral factors on the prevalence of obesity among students is greater than other risk factors (23-25). Moreover, the prevalence of obesity and overweightness among students was found 4.1% and 14.2% respectively. These results somewhat agree with those obtained in studies conducted by Sodaee-Zenozeq et al. in Marand city (overweight=25.6%, and...

Table 2: Mean body fat percentage and BMI in Jahrom students by gender and grade

<table>
<thead>
<tr>
<th>Gender</th>
<th>Anthropometric index</th>
<th>First grade</th>
<th>Second grade</th>
<th>Third grade</th>
<th>Pre-university</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obesity</td>
<td>Number</td>
<td>%</td>
<td>Number</td>
<td>%</td>
<td>Number</td>
</tr>
<tr>
<td>Boys</td>
<td>Obese</td>
<td>20</td>
<td>26</td>
<td>28</td>
<td>20</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>57</td>
<td>74</td>
<td>112</td>
<td>80</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>BMI &lt;20</td>
<td>14</td>
<td>16.7</td>
<td>41</td>
<td>25.9</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>20-25</td>
<td>44</td>
<td>52.4</td>
<td>89</td>
<td>56.3</td>
<td>106</td>
</tr>
<tr>
<td></td>
<td>25-30</td>
<td>22</td>
<td>26.2</td>
<td>27</td>
<td>17.1</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>&gt;30</td>
<td>4</td>
<td>4.8</td>
<td>1</td>
<td>0.6</td>
<td>15</td>
</tr>
<tr>
<td>Girls</td>
<td>Obesity</td>
<td>70</td>
<td>38</td>
<td>50</td>
<td>47.2</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>114</td>
<td>62</td>
<td>56</td>
<td>52.8</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>BMI &lt;20</td>
<td>43</td>
<td>23.4</td>
<td>28</td>
<td>26.4</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>20-25</td>
<td>111</td>
<td>60.3</td>
<td>56</td>
<td>52.8</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>25-30</td>
<td>28</td>
<td>15.2</td>
<td>12</td>
<td>11.3</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>&gt;30</td>
<td>2</td>
<td>1.1</td>
<td>10</td>
<td>9.4</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 3: Mean body fat percentage and BMI in Jahrom students by gender and parents education

<table>
<thead>
<tr>
<th>Parents</th>
<th>Gender</th>
<th>Anthropometric index</th>
<th>Illiterate</th>
<th>Below high school diploma</th>
<th>High school diploma</th>
<th>University</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Standard deviation</td>
<td>Mean</td>
<td>Standard deviation</td>
<td>Mean</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>Father</td>
<td>Boy</td>
<td>% body fat BMI</td>
<td>14.93</td>
<td>7.21</td>
<td>17.46</td>
<td>8.30</td>
<td>18.64</td>
</tr>
<tr>
<td></td>
<td>Girl</td>
<td>% body fat BMI</td>
<td>29.01</td>
<td>8.40</td>
<td>29.28</td>
<td>8.13</td>
<td>30.42</td>
</tr>
<tr>
<td>Mother</td>
<td>Boy</td>
<td>% body fat BMI</td>
<td>20.77</td>
<td>3.13</td>
<td>20.75</td>
<td>3.72</td>
<td>21.45</td>
</tr>
<tr>
<td></td>
<td>Girl</td>
<td>% body fat BMI</td>
<td>12.84</td>
<td>7.02</td>
<td>16.74</td>
<td>7.99</td>
<td>18.12</td>
</tr>
</tbody>
</table>

Table 4: Mean body fat percentage and BMI in Jahrom students by gender and family history of obesity

<table>
<thead>
<tr>
<th>Gender</th>
<th>Anthropometric index</th>
<th>Family history of obesity</th>
<th>No family history of obesity</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Standard deviation</td>
<td>Mean</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>Boy</td>
<td>% body fat BMI</td>
<td>20.27</td>
<td>8.89</td>
<td>16.03</td>
</tr>
<tr>
<td></td>
<td>23.32</td>
<td>4.66</td>
<td>21.34</td>
<td>3.57</td>
</tr>
<tr>
<td>Girl</td>
<td>% body fat BMI</td>
<td>32.06</td>
<td>8.75</td>
<td>27.32</td>
</tr>
<tr>
<td></td>
<td>22.13</td>
<td>4.59</td>
<td>19.59</td>
<td>3.34</td>
</tr>
</tbody>
</table>

Discussion

Obesity is currently a major health problem in most countries, yet no accurate new data on this phenomenon are available in Iran. Meanwhile, the implementation of screening of different population groups, especially children, adolescents, and students for identifying high-risk people and their treatment should be based on scientific evidence such as studies showing the prevalence of obesity among these groups (19-22).
The prevalence of obesity and its
Haydari S.T et al

obesity=5.3%) (26), Ahmadi et al. in
Sanandaj (overweight=11.62%, and
obesity=3.2%) (27), and Jalilvand et al. in
North Khorasan (8). However, studies
conducted in the cities of Birjand and
Yazd reported lower and higher results
compared to those of the present study. In
interpreting differences in the prevalence
of obesity and overweightness among
students, climate and geographical
conditions should not be overlooked (28-
31).
In agreement with studies conducted on
students in Marand (boys=3.6%, and
girls=2.5%) and in Sanandaj (boys=18%
and girls=10%), the present study results
showed a higher prevalence of
overweightness and obesity among boys
compared to girls (26 & 27). The
difference between sexes in the prevalence
of this phenomenon may be explained by
physical, genetic, physiological, and
psychological differences (23 & 25).
In line with the results obtained in a study
conducted in Iran by Jalilvand et al.
(P<0.05) and some foreign studies, the
present study results showed a significant
relationship between parents’ education
and the prevalence of obesity and
overweightness (8 & 27), which reflects
the effect of socioeconomic status of
families on the obesity of students (26).
However, the relationship between higher
parental education and the higher
prevalence of obesity is direct in
developing countries such as Iran unlike
that in developed countries. It is worth
noting that higher education does not
necessarily mean higher health literacy. In
other words, higher parental education
does not always mean higher knowledge
of proper dietary habits, proper nutrition,
or risks of obesity and factors affecting it
(16). According to the present study
results, the prevalence of obesity is higher
among students with family history of
obesity. In agreement with these results,
Jalilvand et al. study also showed that
parental obesity is a major factor in the
emergence of obesity in adolescence. This
probably shows the effects of hereditary
background in etiology of obesity, which
requires further studies (8).

Conclusion
In line with other studies conducted in
Iran, the present study results indicate the
high prevalence of obesity among students. Given the high-risk, but
preventable implications of obesity, preventive and treatment measures,
especially in adolescents are essential. Since in many cases prevention is more
effective than treatment, and given that the
obesity treatment is often difficult and
costly, the development and
implementation of obesity prevention and
control in adolescents is vitally important.
Particular attention should be given to
schools as the best place and students as
the most appropriate population for obesity
control and necessary interventions.
Accordingly, further studies determining
factors affecting the prevalence of obesity
among adolescents are necessary for the
adoption of evidence-based policies.
Moreover, the development and
implementing improvement programs for
community health literacy and dealing
with proper nutrition in families and in
schools, and adolescents’ lifestyle reform
program are recommended.

Acknowledgements
This article is the result of dissertation
thesis for the award of PhD in General
Practice from Jahrom University of
Medical Sciences. The authors wish to
express their gratitude to all participants.

Conflict of interest
Authors had no conflict of interest in
conducting this study.
References:


22. shaghholian n, aein f, deris f. 90th percentile of body mass index (BMI) and some obesity risk factors among 7-12 years old school children, Chaharmahal&amp; Bakhtiary, 2002. JUMS 2004; 5(4):42-8.


