Body Mass Index and its Relationship with Hematological Indices in Iranian Women

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Abstract: Obesity is an important risk factor for many chronic diseases. BMI is an indicator for total body fat determination. Reports in Iran indicate that nearly 20% of middle age persons are obese and 40% are overweight. Other studies also reported iron deficiency anemia in women. Obese women appear to have greater iron stores than nonobese women. This cross-sectional survey consisted of 1049 non-pregnant-non-lactating 15-49 years old women living in East Azerbaijan (Iran) which selected as random clustering suggested. Demographic Data was collected by questionnaire. Body weight and height was measured. Hb, Hct and MCV were measured in the fasting state. Means of age, parity was 28.8 and 3.94 respectively. The subjects were divided into quartiles of age, weight, BMI and childbearing number. Analysis of these classifications showed that means of Hb and Hct were significantly different between BMI quartiles and only Hct was significantly different between weight quartiles (p < 0.05). Discussion: Policy implications might include the development and implementation of programs to prevent excessive gestational weight gain and promote postpartum weight loss via dietary change and physical activity, concomitant with exclusive breast feeding. Because iron deficiency and excess are both probably undesirable, it would be of great help to identify more precisely populations at risk of iron deficiency; iron supplementation could then be more personalized.

Key words: Body mass index, women, Iron deficiency and anemia

Introduction
Obesity is an important risk factor for many chronic diseases, for example regional distribution of body fat in the abdominal area has a significant relation with cardiovascular risk factors (Perry et al., 1997). Changes in life style and low physical activity even in developing societies is a predisposing factor for adult weight increasing and prevention of obesity is an important subject in health programming.

BMI (Body Mass Index) is a an important anthropometric index that is usually used for body fat storage status assessment. BMI is an indicator for total body fat determination.

Reports in Iran indicate that nearly 20% of middle age persons are obese and 40% are overweight. In urban society the prevalence of overweight is significaantly higher than rural (Research in Micronutrients in Iran, 2001). At the other hand Menstruating women constitute a group at risk for iron deficiency surveys done in France and in North America (Fricker et al., 1990) reported iron deficiency in nearly 20% of menstruating. This high prevalence was explained by inadequate dietary iron intake to compensate for iron losses in the menses (Fricker et al., 1990). In Iran many reports indicating that 7.6% of middle age women are iron deficient, and 6.2% of them are anemic (Research in Micronutrients in Iran, 2001). Other studies also reported iron deficiency anemia in Iran (Jazayeri et al., 2001). Obese women appear to have greater iron stores than nonobese women (Fricker et al., 1990). Women have lower iron stores than men because of iron loss during their reproductive years.

Iron is an essential element and, although deficiency leads to anaemia, iron overload is also associated with many health problems (John et al., 2003). It has been hypothesized that adiposity might be an important mediator in the relationship of iron and CVD (Cardiovascular Disease) risk (Earle et al., 2006). So we assessed the BMI staus in premenopausal women in Marand and its relationship with iron biochemical indices. The data presented in this article are based on subsamples from the East Azerbaijan Province National Nutrition Research in Iran.

Materials and Methods
This cross-sectional survey consisted of 1049 non-pregnant-non-lactating 15-49 years old women living in urban and rural regions of East Azerbaijan (Iran). Subjects were excluded if not currently menstruating or current infection, also subjects who had taken iron or drugs likely to modify their iron status during the 3 months preceding the survey were excluded. The
sample was selected as random clustering suggested by EMRO* (Bennet et al., 1991).
Data collection done was in 3 steps:
1. Demographic Data was collected by questionnaire.
2. Anthropometric data: Body weight was measured to
the nearest 0.1 kg with the subjects dressed in light
clothing and no shoes. Body height was measured
to the nearest 0.5 cm with a wall-mounted
stadiometer. Measurements were taken while
subjects were relaxed, were standing erect and had
their arms at their sides and feet together. Body
mass index (BMI) was computed using the formula:
BMI = weight (kg) / (height m\(^2\)).
3. Biochemical Data by collecting fasting blood
sample: Blood samples were collected by
venipuncture in the fasting state. Hb, Hct and MCV
were measured by Autoanalyzer.

Data were analyzed by ANOVA, t-test and pearson
correlation by SPSS\(_{10}\) software.

Results
Means of age, parity was 28.8 and 3.94 respectively.
More than 60% (66.5%) were housewife and had low
literacy (73.5%). General characteristics of them is
shown at Table 1.

Table 2 demonstrates that there was a trend toward a
positive between BMI and age. ANOVA shows
significantly difference between different age groups
\(p=51.21699, \ p<0.0001\).

As Fig. 1 shows the most subjects have BMI 20-25,
however higher prevalence of obesity and overweight
among urban women and higher prevalence of
underweight among rural women is important.
The subjects were divided into quartiles of age, weight,
BMI and childbearing number. Analysis of these
classifications showed that means of Hb and Hct were
significantly different between BMI quartiles (Table 3)
and only Hct was significantly different between weight
quantiles. Comparison of Hb, Hct and MCV between
obese* normal, underweight and overweight groups did
not show any significant difference about them.

Pearson correlation showed significant correlation
between BMI and child bearing number \(r=0.01, \ p=0.006\) but after adjusting for age, there was not
significant relation between them. ANOVA showed
significantly difference about BMI between different child
bearing number groups \(p = 0.005\).

Discussion
In the presence study mean of Age was 28.83 and 24.49
respectively.
The majority of women had BMI (20-24). Our finding is
corruptant to Pon et al. (2006) study among Malaysian
women that most of premenopausal women were
overweight / Obese.

Fig. 1: Distribution of body mass index among Rural
and urban districts.

Mean BMI reported by Taylor etal for 96 NewZealand
women was 25.1±4.4 and suggested BMI as a Sensitive
indicator for Total adiposity assessment (Taylor et al.,
1997). However our results is different from Perry etal
findings that 115 Premenopause and 46 Postmenopausal
women were Compared, they had found that premenopausal women had a mean BMI of
37.06±6.01 and post menopausal women had
38.75±6.9.

They found a relation Between Central adiposity and
increase in Cardiovascular risk factors (2B). our results is
similar to Paknahad et al. (1997) findings that 1159
women and 334 men at rural Region of Isfahan (IRAN)
were studied, women had mean age of 31 and men had
mean age of 37, mean BMI of 23.38 for women was
reported that is lower than our finding, but at both study
subjects had mean of normal range
Boshtam et al. (1997) study among 1000 men and
12000 women (Isfahan-Iran) showed that mean BMI of
them was 26.1 and 27.8 respectively.

Gholamzadeh and Pishdad (1993) study showed that
20.66% of men and 12.66% of women living at north
region of Iran were overweight and 2.7% of men and
5.3% of women living in Iran at south region had BMI
higher than 30.

In our study mean of BMI at urban Region was
significantly higher than Rural (Fig. 1).

We can describe that changing to industrialized Urban
communities led to decrease women's physical activity
and increasing weight gain in compared with Rural
women.

Mean of Hb at our study was 14 g/dl which is higher than
other study in Greenland (13.2 ± 96) (Milman et al.,
2001).

At our study although at BMI quartile Hb and Hb were
significantly different, but comparing obese and non
obese women did not show significant difference about
Hb and Hct. Similar to our finding in Micozzi studies
(Micozzi et al., 1989) hemoglobin and Hct were not
significantly different among short-light with obese and
Table 1: Physiological characteristics of premenopausal women

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1030</td>
<td>28.5 ± 8.888</td>
</tr>
<tr>
<td>Weight</td>
<td>1032</td>
<td>59.3 ± 11.26</td>
</tr>
<tr>
<td>Height</td>
<td>1031</td>
<td>155.6 ± 7.37</td>
</tr>
<tr>
<td>BMI</td>
<td>1030</td>
<td>24.48 ± 4.75</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>678</td>
<td>14.08 ± 1.37</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>680</td>
<td>42.06 ± 3.96</td>
</tr>
<tr>
<td>MCV</td>
<td>690</td>
<td>87.56 ± 7.90</td>
</tr>
<tr>
<td>Parity</td>
<td>719</td>
<td>3.96 ± 2.840</td>
</tr>
<tr>
<td>Child Birth</td>
<td>712</td>
<td>3.93 ± 2.870</td>
</tr>
<tr>
<td>Abortion</td>
<td>702</td>
<td>0.52 ± 0.930</td>
</tr>
</tbody>
</table>


Table 2: Body mass index among different age groups

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 19</td>
<td>165</td>
<td>21.69 ± 3.32</td>
</tr>
<tr>
<td>20-25</td>
<td>278</td>
<td>23.13 ± 4.2</td>
</tr>
<tr>
<td>25-35</td>
<td>343</td>
<td>25.77 ± 5.06</td>
</tr>
<tr>
<td>35-49</td>
<td>233</td>
<td>26.19 ± 4.43</td>
</tr>
</tbody>
</table>

Table 3: Iron biochemical indices** by anthropometric and height-bearing quartiles.

<table>
<thead>
<tr>
<th>Quartile</th>
<th>Hemoglobin (g/dl)</th>
<th>Hematocrit (%)</th>
<th>MCV (fL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;22</td>
<td>14.18 ± 3.44</td>
<td>42.77 ± 3.44</td>
<td>87.29 ± 8.57</td>
</tr>
<tr>
<td>22-27</td>
<td>14.21 ± 3.16</td>
<td>42.35 ± 3.23</td>
<td>87.27 ± 8.12</td>
</tr>
<tr>
<td>27-35</td>
<td>14.01 ± 4.11</td>
<td>41.94 ± 4.70</td>
<td>87.40 ± 6.93</td>
</tr>
<tr>
<td>35-49</td>
<td>13.93 ± 1.58</td>
<td>41.78 ± 4.20</td>
<td>87.29 ± 8.06</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;21.196</td>
<td>13.93 ± 1.58</td>
<td>41.54 ± 3.68</td>
<td>87.11 ± 9.90</td>
</tr>
<tr>
<td>21.18-23.956</td>
<td>14.02 ± 1.48</td>
<td>41.88 ± 3.91</td>
<td>87.74 ± 6.30</td>
</tr>
<tr>
<td>23.86-26.845</td>
<td>14.27 ± 1.18</td>
<td>42.58 ± 3.27</td>
<td>88.3 ± 6.60</td>
</tr>
<tr>
<td>&gt;26.846</td>
<td>14.17 ± 1.39</td>
<td>42.44 ± 4.80</td>
<td>87.29 ± 8.06</td>
</tr>
<tr>
<td>p &lt; 0.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p &lt; 0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;51</td>
<td>13.8 ± 1.36</td>
<td>41.71 ± 3.64</td>
<td>87.62 ± 8.91</td>
</tr>
<tr>
<td>51-61.5</td>
<td>13.98 ± 1.50</td>
<td>41.74 ± 4.03</td>
<td>88.1 ± 8.34</td>
</tr>
<tr>
<td>61.5-66.5</td>
<td>14.24 ± 2.17</td>
<td>42.69 ± 3.49</td>
<td>88.8 ± 7.69</td>
</tr>
<tr>
<td>&gt;66.6</td>
<td>14.18 ± 1.33</td>
<td>42.34 ± 3.68</td>
<td>87.4 ± 7.60</td>
</tr>
<tr>
<td>p = 0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;152</td>
<td>13.09 ± 1.36</td>
<td>42.15 ± 4.57</td>
<td>87.87 ± 7.96</td>
</tr>
<tr>
<td>152.1-156</td>
<td>14.11 ± 1.42</td>
<td>42.13 ± 3.79</td>
<td>87.97 ± 7.05</td>
</tr>
<tr>
<td>156.1-160</td>
<td>14.31 ± 1.34</td>
<td>41.95 ± 3.72</td>
<td>87.43 ± 8.59</td>
</tr>
<tr>
<td>&gt;160.1</td>
<td>14.51 ± 1.36</td>
<td>42.23 ± 3.64</td>
<td>87.14 ± 8.36</td>
</tr>
<tr>
<td>p = 0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child bearing number:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤2</td>
<td>14.17 ± 1.27</td>
<td>42.4 ± 3.40</td>
<td>87.9 ± 7.010</td>
</tr>
<tr>
<td>3</td>
<td>13.89 ± 1.57</td>
<td>41.71 ± 5.02</td>
<td>87.84 ± 7.24</td>
</tr>
<tr>
<td>4-6</td>
<td>13.94 ± 1.43</td>
<td>41.54 ± 3.74</td>
<td>87.98 ± 7.71</td>
</tr>
<tr>
<td>&gt;7</td>
<td>13.98 ± 1.48</td>
<td>41.39 ± 3.93</td>
<td>87.41 ± 7.94</td>
</tr>
</tbody>
</table>

** Mean ± SD. over weight: 25 < BMI < 29.9 obese: BMI ≥ 30.

It is suggested that obese women appear to have greater iron stores than nonobese women, in terms of serum ferritin, hemoglobin and hematocrit concentrations. It is suggested that a high body mass index implies a high energy intake. As nutritional iron intake is proportional to the energy intake, subjects with a high body mass index have a high iron intake, which in turn influences body iron stores and serum ferritin (Milman and Kirchhoff, 1999).

Association between BMI and Bearing child number in this study was significant, it would be suggested that Parity is associated with overweight and obesity. However, the literature from developing countries is limited and may not represent current stages of development.

The importance of parity as a predictor of overweight increases with national economic development and health. Policy implications might include the development and implementation of programs to prevent excessive gestational weight gain and promote postpartum weight loss via dietary change and physical activity, concomitant with exclusive breastfeeding. (Kim and Stein, 2008).

Because iron deficiency and excess are both probably undesirable, it would be of great help to identify more precisely populations at risk of iron deficiency; iron supplementation could then be more personalized.

References

Simplified general methods for cluster sample surveys in developing countries: World Health Quart., 44: 89-106.


