Different calculation formulas for ideal body weight and actual/ideal body weight index estimation in post-traumatic stress disorder patients

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Introduction
An assessment of body weight (BW) is required for calculations of drug doses, tidal volumes in ventilated patients, patient safety (such as equipment load limits), estimation of renal function and nutritional status. In some patients, direct measurement of body weight is difficult because of immobility, trauma or burns, the lack of availability of measuring scales or intravascular lines that may easily become dislodged [1]. Estimation of body weights by medical and nursing staff have previously been shown to be inaccurate [2]. One of the oldest bioanthropological questions is what would be the preferable mass for a person to have regarding his/her height, constitution, gender, age and other relevant determinants. The aim of this study was to evaluate the most acceptable model for ideal body weight estimation and actual/ideal BW index using standard general pattern.

Subjects and Methods
This study included 78 male subjects, divided into two groups: PTSD – group (N=44) and control group (N=34). It is heterogenic group according to age and educational structure where third and fourth decade of life dominated, as well as, secondary high school education. Calculation of actual/ideal body weight index using general pattern was done, by using different methodology to obtain estimated ideal body weight (by Broca, Azerad, American Insurance Company, Demelov).

Actual/ideal BW index – is determined using standard general pattern (SGP), the most often: I = Ms/Mt; where Ms – Actual body weight (kg) and Mt – Estimated ideal body weight (kg).

Estimated ideal body weight was determined using different calculation formulas:
1. \( M:\bar{\nu} = h - 100 \)
   \( M:\bar{\mu} = h - 105 \)
   \( h \) – height (cm); Broca

2. \( M = h - 100 - \left( \frac{h - 150}{4} \right) \)
   \( h \) – height (cm); Azerad

3. \( M = 50 + 0.75 \times (h - 150) \)
   \( h \) – height (cm); American Insurance Company

4. \( M:\bar{\nu} = h - 100 - h - 100/20 \)
   \( M:\bar{\mu} = h - 100 - h - 100/10 \)

5. \( M:\bar{\nu} = h - 100 - h - 150/4 + A - 20/4 \)
   \( M:\bar{\mu} = h - 100 - h - 150/2.5 + A - 20/4 \)
   \( h \) – height (cm)
   \( A \) – age (yr.); Demolev’s pattern

### Statistical analysis

All statistical calculations were performed with the SPSS 16 software (version 16.0, SPSS Inc, Chicago, Illinois, USA). Each value was expressed as the mean±SD or as median and interquartile range. The distribution of variables was tested by Shapiro-Wilk test. The difference between two groups was analyzed by the Mann-Whitney test or t-test for the variables that followed normal distribution. The difference in ideal body weight index obtained by different formulas was tested using the The Wilcoxon signed-rank test. P values less than 0.05 were considered statistically significant.

### Results

Baseline characteristics of control and PTSD group are shown in Table 1. PTSD patients were significantly older compared to control group and had lower weight and height, but there were no significant differences in mean body mass index (BMI) in PTSD compared to control group (26.1±3.2 vs. 27.4±3.8, p=0.11) (Table 1).

<table>
<thead>
<tr>
<th>Table 1. Baseline characteristics of control subjects and PTSD patients.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
</tr>
<tr>
<td><strong>Gender (Male)</strong></td>
</tr>
<tr>
<td><strong>Height (cm)</strong></td>
</tr>
<tr>
<td><strong>Weight (kg)</strong></td>
</tr>
<tr>
<td><strong>BMI (kg/m²)</strong></td>
</tr>
</tbody>
</table>

Actual (measured) body weight was significantly higher compared to estimated ideal body weight obtained by different formulas which was observed both in control and PTSD group of patients.

In PTSD group there were significant differences in estimated ideal body weight values using Broca compared to Azarea (76.0±7.4 vs. 69.5±5.6 kg; p=0.001) and also between Azarea and Demolevs formula (69.5±5.6 vs. 74.9±6.4 kg; p=0.009).

In control group there were significant differences in estimated ideal body weight values using Broca compared to Azarea (81.8±7.7 vs 73.5±5.8 kg; p=0.016), Broca vs. American Insurance company formula (81.8±7.7 vs 73.8±5.8, p=0.002) and also between Azarea and Demolevs formula (73.5±5.8 vs 78.7±5.5; p=0.012).

### Table 2. Estimated ideal body weight in control subjects and PTSD patients using different formula

<table>
<thead>
<tr>
<th>Control group</th>
<th>PTSD group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measured weight (kg)</strong></td>
<td>90.4±13.7</td>
<td>80.8±11.0</td>
</tr>
<tr>
<td><strong>Estimated ideal body weight A (kg)</strong></td>
<td>81.8±7.7</td>
<td>76.0±7.4</td>
</tr>
<tr>
<td><strong>Estimated ideal body weight B (kg)</strong></td>
<td>73.5±5.8</td>
<td>69.5±5.6</td>
</tr>
<tr>
<td><strong>Estimated ideal body weight C (kg)</strong></td>
<td>73.8±5.8</td>
<td>69.5±5.6</td>
</tr>
<tr>
<td><strong>Estimated ideal body weight D (kg)</strong></td>
<td>78.0±7.8</td>
<td>72.1±7.1</td>
</tr>
<tr>
<td><strong>Estimated ideal body weight E (kg)</strong></td>
<td>78.7±5.5</td>
<td>74.9±6.4</td>
</tr>
</tbody>
</table>

There were no significant differences in median actual/estimated ideal body weight (IBW) index between control and PTSD group (Table 3).

### Table 3. Actual/estimated ideal body weight (IBW) index in control subjects and PTSD patients using different formula

<table>
<thead>
<tr>
<th>Actual/Estimated IBW index A</th>
<th>Control group</th>
<th>PTSD group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.07 (1.0-1.2)</td>
<td>1.06 (0.95-1.15)</td>
<td>0.38</td>
<td></td>
</tr>
</tbody>
</table>

| Actual/Estimated IBW index B | 1.2 (1.1-1.3) | 1.15 (1.04-1.24) | 0.47 |

| Actual/Estimated IBW index C | 1.2 (1.1-1.4) | 1.15 (1.04-1.24) | 0.15 |

| Actual/Estimated IBW index D | 1.1 (1.0-1.2) | 1.1 (1.0-1.2) | 0.97 |

| Actual/Estimated IBW index E | 1.1 (1.0-1.2) | 1.07 (0.97-1.2) | 0.25 |
However, in control group of subjects median ideal body weight index values as calculated using Demelovs formula was significantly lower compared to calculated IBW index values using Broca or Azaread formulas (Figure 1).

![Figure 1. Actual/estimated IBW index in control group of subjects using different calculation formula](image1)

In PTSD group, median IBW index values obtained with Demelovs formula were significantly lower 1.07 (0.97-1.2) compared to IBW index values obtained with other formulas (Figure 2). There were no significant differences in median IBW index values obtained with Demelovs compared to Broca formula (Figure 2)

![Figure 2. Actual/estimated IBW index in PTSD group using different calculation formula](image2)

**DISCUSSION**

A person during the first 25 years of life progressively gains the weight. After that, weight gain depends more and more upon un-biological factors. Total body mass is genetically less determined than body height, and more determined by socio-economic status, individual energetic consumption, nutrition culture and other exogenous factors. Coefficient of body mass variation is 3-4 times higher than one of body height. Actual body mass is the one that is registered by direct measuring, while the theoretical one (normal or „ideal“) is estimated by using certain patterns that usually consider gender, age, height or constitution.

Due to all facts named above, the aim of this study was to evaluate the most applicable model for actual/estimated BW index, since one of the oldest bioanthropological issues is what is ideal body mass a person should have based on his height, gender, age and other relevant determinants. Our results showed significant differences in estimated ideal body weight and in actual/estimated ideal BW index values calculated by different formulas both in PTSD group and control group. In PTSD group there were significant differences in estimated ideal body weight values using Broca compared to Azarea and also between Azarea and Demulevs formula.

Also, in control group there were significant differences in estimated ideal body weight values using Broca compared to Azarea and also between Azarea and Demulevs formula.

Both in patients with PTSP and in control subject's ideal body weight index values are lower using Demelovs formula compared to other formulas.

More and more attention is paid to study relationship between stress and overweight. In that sense, presupposition is that stress and environmental factors as caloric nutrition and reduced physical activity contribute to increased number of overweight persons. Overweight declines quality of life and presents health issue due to increased risk to diabetes development, metabolic syndrome development, hypertension, cardiovascular and malignant diseases [3]. In our study distribution of persons with ideal and increased BMI was equal within the group of war veterans with PTSD compared to the control group. Increased body mass was present in 75% veterans without PTSD and in 67% veterans with PTSD. Authors have shown that differences in nutrition habits, alcohol consumption and smoking habits should be considered [4].

Overweight becomes tremendous health issue and takes epidemic proportions among war veterans with diagnosis of PTSD. In a study by Maguen et al. [5] the authors have shown that the risk of overweight is higher in males with PTSD, while in females the risk for overweight is higher in group of females with depression. More extensive population prospective studies are needed to examine relation between PTSD, stress and overweight [6]. Many studies confirm that PTSD
could be the risk factor for overweight and obesity at war veterans [7]. Some studies reflect the light on gender dimorphism issue when the depression, PTSD, pain threshold and overweight in veterans are questions. Female veterans could show more or less vulnerability on those factors than males [8]. Studies which have examined relationship between PTSD, body mass index (BMI) and socio-economic status suggest that socio-economic status influences the overweight in PTSD veterans in negative sense. Lower socio-economic status might be a risk factor for overweight in PTSP patients [9].

**Conclusion**

Both in patients with PTSP and in control subjects ideal body weight index values are lower using Demelovs formula compared to other formulas used suggesting that it might have a superior role in ideal body weight estimation since it takes into account different determinants influencing a person’s body weight.

**References**


