Adult weight measurement: decoding the terminology used in literature

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Abstract:
There are various types of names given to describe the adult weight measurement. The most commonly used terms (actual body weight, estimated body weight, ideal body weight and adjusted body weight) have been defined and summarized to assist in their application in therapeutic nutrition.


Introduction
Anthropometry requires a fundamental grasp of methodology. Weight and height are the most basic forms of anthropometry used in practice; however, clinicians may fail to fully understand the context of its application. In the case of weight, there are several terminologies that have been documented to describe the nature of the adjustment made to the original measurement value. When these terms are not clearly defined by the author, it may lead to confusion and/or incorrect calculations. Therefore, the purpose of this review is to summarise the most frequently used weight anthropometric terminology and abbreviations that are mentioned in the literature to date.

Actual body weight
Actual body weight (ABW), body weight (BW), or simply standardised as weight in the literature, is defined as the measurement taken when the subject is able to stand unassisted using a calibrated scale. The subject should wear minimal clothing, and should also remove shoes and socks. Before starting, the scale should be zeroed and then the subject must stand in the centre of the scale, without support and with equal distribution of weight between both feet. Measurements should be taken to the nearest 0.1 kilogram (kg). To account for diurnal variation, the most accurate measurement is taken in the morning after voiding. When measured correctly, ABW can be used to compare with other anthropometric measurements, for example with height to calculate body mass index (BMI = weight/height2).

In cases where non-ambulatory patients are unable to stand, specialised scales can be used such as a sitting scale or bed scale. However, the downside of using these types of equipment includes that they require training in order to obtain an accurate measurement, they are expensive and are uncommonly available for everyday use. But it is possible to estimate weight using other body measurements. This is known as estimated body weight (EBW).

Estimated body weight
When ABW is unable to be measured in non-ambulatory patients, EBW can be calculated using predictive equations. The most commonly used equations that could be used to calculate body weight in an adult have been summarised in Table 1. Adjustments made to the body weight measurement and is applicable to subjects with amputations, oedema, ascites or chronic kidney disease, as well as in obesity.

Adjusted body weight
Adjusted body weight (BW-adj), refers to the calculation adjustments made to the body weight measurement and is defined as the goal weight at which nutritional requirements are met. An IBW weight lies within the normal BMI range from 18.5 kg/m² to 24.9 kg/m². Ideal body weight can be calculated by using body weight as a function of height and a target BMI value (IBW (kg) = (BMI x Ht²)). If the subject is underweight then the lower limit of the normal BMI range is used in the IBW equation. However, if the subject is overweight then the upper limit of the normal BMI range is used in the IBW equation.

Adjusted for fluid: dry body weight
Dry body weight or oedema-free body weight (BWef), implies that the ABW has been adjusted to a figure that is minus the weight of excess bodily fluid. This alteration for positive fluid balance is commonly associated with peripheral oedema, ascites and chronic kidney disease (CKD).
Anthropometry requires a fundamental grasp of methodology.\(^1,2\) Weight and height are the most basic forms of anthropometry that are mentioned in the literature to date.\(^3-5\) Equations have not been validated for use in a South African setting,\(^6\) and the most fitting body measurements. This is known as estimated body weight (EBW).\(^7\) The most commonly used equations that could be used to calculate body weight are listed in Table 1.\(^8\)

### Adjustment for fluid in peripheral oedema

Peripheral oedema is a clinical finding, defined as the abnormal excessive accumulation of fluid in the body tissues, i.e. the retention of water and sodium in the extracellular spaces.\(^9\)

The causes of peripheral oedema include: (i) increased capillary hydrostatic pressure; (ii) regional venous hypertension, e.g. deep vein thrombosis; (iii) systemic venous hypertension, e.g. liver disease; (iv) increased plasma volume, e.g. congestive cardiac failure; (v) decreased plasma oncotic pressure; (vi) protein loss, e.g. malabsorption; (vii) reduced protein synthesis, e.g. malnutrition; (viii) increased capillary permeability, e.g. burns; and (ix) lymphatic obstruction or increased interstitial oncotic pressure, e.g. lymphoedema.\(^9\)

There are two types of peripheral oedema, pitting (PO) and non-pitting (NPO).\(^10\) NPO implies that pressure is applied to the affected area, no indentation is identified and therefore can be difficult to grade.\(^10\) The causes of NPO are commonly associated with lymphoedema, lipoedema (abnormal fat deposition in extremities) and myxoedema (severe hypothyroidism).\(^11\) PO is measured by pressing one's thumb down onto the affected area, holding for three seconds, and if an indent is left then it is classified as PO.\(^12\) The severity of PO can be classified according to the site of oedema, measurement of the indent, or the time taken for the skin to rebound (summarised in Table 2).\(^12,13\)

Table 2 describes the adjustment that can be made to ABW to calculate BWef, based on the grade of oedema identified.\(^14\)

### Table 1: Estimated body weight equations

<table>
<thead>
<tr>
<th>Gender</th>
<th>Approximation</th>
<th>Equation</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Body weight (kg) = (0.5759 x right arm circumference (cm) + 0.5263 x abdominal circumference (cm) + (1.2452 x right calf circumference) – (4.8689 x 2) – 32.9241)</td>
<td>Chumlea et al.(^7)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>Body weight (kg) = (0.98 x right calf circumference (cm)) + (1.16 x right knee height (cm)) + (1.73 x right arm circumference (cm)) + (0.37 x right subscapular skinfold thickness (mm)) – 81.69</td>
<td>Rabito et al.(^8)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2: Weight adjustment according to grading of peripheral oedema\(^12,13\)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Symbol</th>
<th>Indent measurement</th>
<th>Rebound time</th>
<th>Site of oedema</th>
<th>Weight adjustment equation (BWef)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>+</td>
<td>Barely detectable impression when finger is pressed onto skin, ≤ 2 mm</td>
<td>Immediate rebound</td>
<td>Both ankles and/or feet</td>
<td>BWef (kg) = ABW – 1.0</td>
</tr>
<tr>
<td>Moderate</td>
<td>++</td>
<td>3–4 mm</td>
<td>Slight indentation, takes ≤ 15 seconds to rebound</td>
<td>Both feet, hands, lower arms and lower legs</td>
<td>BWef (kg) = ABW – 5.0</td>
</tr>
<tr>
<td>Severe</td>
<td>+++</td>
<td>&gt; 4 mm</td>
<td>Deeper indentation, takes &gt; 15 seconds to rebound</td>
<td>Generalized bilateral pitting oedema, which includes both legs, arms, feet and face</td>
<td>BWef (kg) = ABW – 10.0</td>
</tr>
</tbody>
</table>

**Notes:** ABW = actual body weight, BWef = dry body weight.
Table 3: Weight adjustment according to grading of ascites

<table>
<thead>
<tr>
<th>Grade</th>
<th>Symbol</th>
<th>Definition</th>
<th>Weight Adjustment equation (BWef)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>+</td>
<td>Ascites is only detectable by ultrasound examination</td>
<td>BWef (kg) = ABW – 2.2</td>
</tr>
<tr>
<td>Moderate</td>
<td>++</td>
<td>Ascites causing moderate symmetrical distention of the abdomen</td>
<td>BWef (kg) = ABW – 6.0</td>
</tr>
<tr>
<td>Severe</td>
<td>+++</td>
<td>Ascites causing marked abdominal distension</td>
<td>BWef (kg) = ABW – 14.0</td>
</tr>
</tbody>
</table>

Notes: ABW = actual body weight, BWef = dry body weight.

Adjustment for fluid in ascites

Ascites is defined as the accumulation of fluid in the peritoneal cavity, causing abdominal swelling. Potential causes of ascites include: (i) liver disease; (ii) cirrhosis; (iii) cardiac failure; (iv) nephrotic syndrome; (v) malignancy; (vi) pancreatitis; and (vii) infection such as tuberculosis. The grade of uncomplicated ascites can be categorised according to clinical findings, which are summarised in Table 3.

Table 3 describes how to calculate BWef in overweight/obesity (Adj-IBW). The WTBP can be added to ABW to obtain BW-adj, and then BW-adj can be used to work out the BMI of the subject.

Adjustment for obesity

It has been recommended that BW-adj be used in the calculation of nutritional requirements in obese patients. Adjusted body weight in the context of obesity is defined as the weight that represents the metabolically active lean body tissue and therefore prevents over- or underestimation of nutritional requirements in the obese subject. In obese subjects BW-adj, sometimes known as adjusted ideal body weight (Adj-IBW), is determined by applying a correction factor to the ABW (see Table 5).

Table 5 explains how to calculate BW-adj in overweight/obesity and when its application is relevant for use in clinical practice. If a subject’s ABW falls below IBW x 1.25, then ABW can be used in the calculation of nutritional requirements. However, if the ABW falls between (and including) 25% and 29% more than the IBW, then BW-adj type 1 (BW-adj1) can be calculated. Furthermore, if the ABW is calculated to be ≥ 30% more than the IBW, then BW-adj type 2 (BW-adj2) can be calculated. The equations are recommended to prevent overfeeding in the obese critically ill patient and can be used when permissive hypo-caloric feeding is warranted.

The BW-adj can be used with the Harris–Benedict equation or simplistic calorific equations, e.g. kcal/kg.

Conclusion

The anthropometric terminology and abbreviations used in the literature can leave the reader confused, unless they have been fully explained. In the context of adult weight measurement, the most common terms that are used have been defined and decoded to aid in its application in therapeutic nutrition.

Disclosure statement - No potential conflict of interest was reported by the author.

References


Table 4: Weight of individual body parts

<table>
<thead>
<tr>
<th>Body part</th>
<th>% Contribution of total body weight</th>
<th>Weight of body part (WTBP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand</td>
<td>0.7</td>
<td>WtBP (kg) = (0.7 /100) x ABW</td>
</tr>
<tr>
<td>Lower arm and hand</td>
<td>2.3</td>
<td>WtBP (kg) = (2.3 /100) x ABW</td>
</tr>
<tr>
<td>Entire arm</td>
<td>5.0</td>
<td>WtBP (kg) = (5.0 /100) x ABW</td>
</tr>
<tr>
<td>Foot</td>
<td>1.5</td>
<td>WtBP (kg) = (1.5 /100) x ABW</td>
</tr>
<tr>
<td>Lower leg and foot</td>
<td>5.9</td>
<td>WtBP (kg) = (5.9 /100) x ABW</td>
</tr>
<tr>
<td>Entire leg</td>
<td>16</td>
<td>WtBP (kg) = (16 /100) x ABW</td>
</tr>
</tbody>
</table>

Notes: ABW = actual body weight, WTBP = weight of body part.
and height. If the CKD patient's percentage SBW (%SBW = weight / SBW). Standard body weight is defined as the median standard body weight of these body parts has been summarised in Table 4.

Adjustment for fluid in chronic kidney disease

This weight measurement should not be used. Rather, the ((BWef/SBW) x100)) falls outside the range of 95% to 115%, then adjustment for fluid in chronic kidney disease can be calculated, based on the grade of ascites identified.

Table 3 describes the adjustment that can be made to ABW to calculate BWef, based on the grade of ascites identified.

Table 3: Weight adjustment according to grading of ascites

<table>
<thead>
<tr>
<th>Grade</th>
<th>Symbol</th>
<th>Definition</th>
<th>Weight Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
<td>Normal</td>
<td>ABW</td>
</tr>
<tr>
<td>Mild</td>
<td>+</td>
<td>Ate symmetrical distention</td>
<td>ABW – 1.0 x (ABW / IBW)</td>
</tr>
<tr>
<td>Moderate</td>
<td>++</td>
<td>Abdominal distention</td>
<td>ABW – 1.5 x (ABW / IBW)</td>
</tr>
<tr>
<td>Severe</td>
<td>+++</td>
<td>Ascites causing marked abdominal distention</td>
<td>ABW – 2.0 x (ABW / IBW)</td>
</tr>
</tbody>
</table>

Application Equations for the adjustment

<table>
<thead>
<tr>
<th>Grade</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>BWef = ABW</td>
</tr>
<tr>
<td>Mild</td>
<td>BWef = ABW – 1.0 x (ABW / IBW)</td>
</tr>
<tr>
<td>Moderate</td>
<td>BWef = ABW – 1.5 x (ABW / IBW)</td>
</tr>
<tr>
<td>Severe</td>
<td>BWef = ABW – 2.0 x (ABW / IBW)</td>
</tr>
</tbody>
</table>


Correction factors for obesity

If ABW is ≥ 25% of IBW, then BW-adj type 1 (BW-adj1) can be calculated. Furthermore, if the ABW is calculated to be ≥ 30% more than the IBW, then BW-adj type 2 (BW-adj2) can be calculated. The equations are:

- BW-adj1 = ((ABW – IBW) x 0.25) + IBW
- BW-adj2 = ((ABW – IBW) x 0.50) + IBW
- BW-adj3 = ((ABW – IBW) x 1.00) + IBW

The most common terms that are used have been defined and reported by the author.

Disclosure statement

The anthropometric terminology and abbreviations used in the advancement of kinanthropometry; 2006. p. 9–59.

References


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