Comparison of trunk-to-leg ratio as assessed by photographic imaging in shorter and taller preschool children of the western highlands of Guatemala: Implications regarding the biology of stunting

Joni Beintema1, Noel W. Solomons2, Rosario García2, Mónica Orozco2, Rebecca Gwaltney2 and Colleen Doak1

1 Health Science, VU University, Amsterdam, The Netherlands 2CeSSIAM, Guatemala City, Guatemala 3CeSSIAM, Quetzaltenango, Guatemala

Introduction

Linear growth is a consequence of the elongation of the trunk and the legs.

• The relative lengths of the trunk and leg body segments are explained by genetic, nutritional and environmental factors, with legs differentially more affected.

• The current evaluation of these body segments presents a number of challenges.

• Photographic imaging could help to improve accuracy and limit subject burden.

Objective

To apply photographic images to quantify body segments in preschool children in two geographic and socio-economic status (SES) settings in the Western Highlands of Guatemala.

Results

• Children from Quetzaltenango were 7.0 cm taller [median] than children from Sololá.

• Leg length explained 5.2 cm [median] of the difference in height.

• Sololá children were more stunted than in Quetzaltenango (46.1% vs. 5.9%).

• The median trunk-to-leg ratio was higher in Sololá (0.82) than in Quetzaltenango (0.76).

Table 1. Demographic and Anthropometric Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Sololá (n=102)</th>
<th>Quetzaltenango (n=102)</th>
<th>Difference [median]</th>
<th>p-value [mean]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs.)</td>
<td>Mean ± SD [Median]</td>
<td>6.0 ± 1.0 [6.0]</td>
<td>6.1±1.0 [6.2]</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>Mean ± SD [Median]</td>
<td>106.6±6.6 [107.0]</td>
<td>114.0±7.0 [114.0]</td>
<td>7.0 &lt;0.001</td>
</tr>
<tr>
<td>HAZ</td>
<td>Mean ± SD [Median]</td>
<td>-1.74±0.99 [-1.83]</td>
<td>-0.40±0.93 [-0.43]</td>
<td>1.4 &lt;0.001</td>
</tr>
<tr>
<td>Stunting</td>
<td>%</td>
<td>46.1</td>
<td>5.9</td>
<td>-</td>
</tr>
</tbody>
</table>

HAZ= height-for-age z-scores

Table 2. Body segment lengths and their ratio

<table>
<thead>
<tr>
<th></th>
<th>Sololá (n=102)</th>
<th>Quetzaltenango (n=102)</th>
<th>Difference [median]</th>
<th>p-value [mean]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunk length (cm)</td>
<td>Mean ± SD [Median]</td>
<td>47.9±2.8 [48.0]</td>
<td>49.1±2.9 [48.5]</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Leg length (cm)</td>
<td>Mean ± SD [Median]</td>
<td>58.7±5.0 [59.1]</td>
<td>64.9±5.8 [64.3]</td>
<td>5.2 &lt;0.001</td>
</tr>
<tr>
<td>Trunk-to-leg ratio</td>
<td>Mean ± SD [Median]</td>
<td>0.82±0.07 [0.82]</td>
<td>0.76±0.07 [0.76]</td>
<td>0.06 &lt;0.001</td>
</tr>
<tr>
<td>Trunk-to-stature ratio</td>
<td>Mean ± SD [Median]</td>
<td>0.45±0.02 [0.45]</td>
<td>0.43±0.02 [0.43]</td>
<td>0.02 &lt;0.001</td>
</tr>
</tbody>
</table>

Conclusion

Photographic imaging shows the contribution of leg length to key population differences in children’s height. In this setting, the relative shorter leg lengths in Sololá are consistent with their assumed higher prevalence of chronic stunting and their Mayan ethnicity.

Methods

• 102 children from Sololá (predominately Mayan, lower SES) were matched with 102 children from Quetzaltenango (n=102, largely from European ascent, higher SES) based on age and sex.

• Standing height was measured and used to identify stunting (≤-2 height-for-age z-scores).

• A standardized sagittal photograph, with the child standing in erect posture with the Frankfort plane gaze was taken with a digital camera from a 3-m distance.

• The length of the trunk and the legs was measured in mm from printed images and used to calculate individual trunk-to-leg ratios and to compare by group distributions across settings.

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Background: Current growth charts are the result of cross-sectional studies with sex- and age- specific measurements. This approach cannot be used in settings with limited resources for extensive anthropometric assessments. Photographic imaging could add important information in these settings and assess the contribution of different body segments to overall growth and its differences in shorter and taller populations.

Objective: Methods: We measured standing height in children, aged 0-3 years, from 252 rural communities in the Western Highlands of Guatemala. HAZ=height-for-age z-scores were calculated using the WHO Growth Standards.

Conclusion: Photographic imaging could help to improve accuracy and limit subject burden. This study aimed to apply photographic images to quantify body segments and to calculate relative leg lengths in shorter and taller populations in these settings.