

Background: Linear growth is very dependent on the differential elongation of the two major body components: trunk and legs. Photographic imaging could help to improve accuracy and limit subject burden. This study aimed to apply photographic images to quantify body segments in preschool children in 2 settings differing by socio-economic status (SES) in the Western Highlands of Guatemala.

Methods: We measured standing height in children, aged 4-7 y from a lower SES (predominately Mayan-ascendant) and a higher SES (largely European-ascendant) from Sololá and Quetzaltenango, respectively. Height for age z-scores were calculated using the WHO Growth Standards to identify stunting (≤ -2 height-for-age z-scores). A standard sagittal photograph with the child standing in erect posture with the Frankfort Gaze was taken from a 3-m distance with a digital camera. The length of the trunk and of the legs was measured in mm from printed images and used to calculate trunk-to-leg ratios and to compare between settings.

Results: The Quetzaltenango children were on average 7.0 cm taller than their Sololá-counterparts, 5.2 cm of the difference was attributed to leg length. Children in Sololá have a higher prevalence of stunting than children in Quetzaltenango (46.1% vs. 5.9%). The median trunk-to-leg ratio was higher in Sololá (0.82) than in Quetzaltenango (0.76).

Conclusion: Photographic imaging show the key population differences in these settings relates to the shorter relative leg lengths in Sololá. These findings are congruent with population differences in child stunting as well as ethnicity.

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*

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Introduction

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

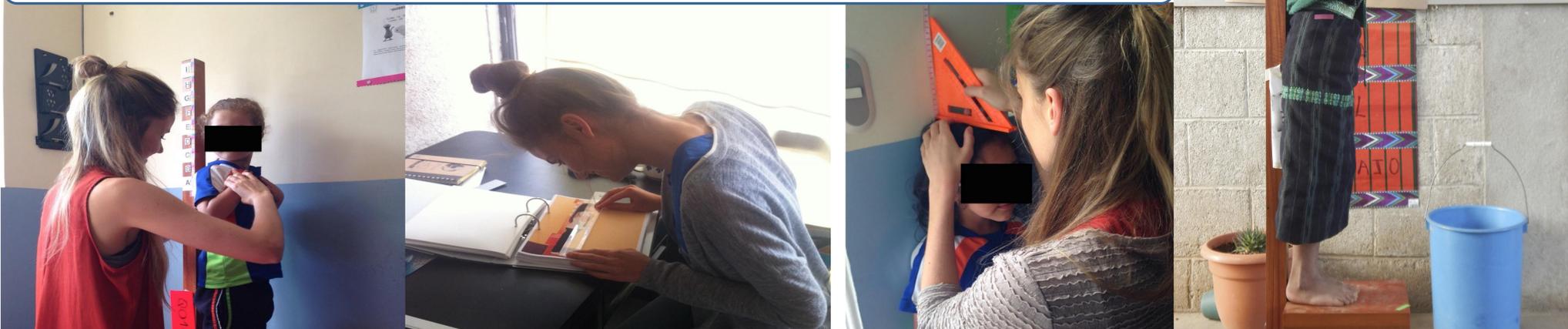
- The relative lengths of the trunk and leg body-segments are explained by genetic, nutritional and environmental factors, with legs differentially more affected
- The current evaluation of these body segments presents a number of challenges
- Photographic imaging could help to improve accuracy and limit 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.

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 of 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



Results

- Children from Quetzaltenango were **7.0 cm [median]** taller 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

		Sololá (n=102)	Quetzaltenango (n=102)	Difference [median]	p-value [mean]
Age (yrs.)	Mean ± SD [Median]	6.0 ± 1.0 [6.0]	6.1 ± 1.0 [6.2]	0.2	>0.05
Height (cm)	Mean ± SD [Median]	106.6 ± 6.6 [107.0]	114.0 ± 7.0 [114.0]	7.0	<0.001
HAZ	Mean ± SD [Median]	-1.74 ± 0.99 [-1.83]	-0.40 ± 0.93 [-0.43]	1.4	<0.001
Stunting	%	46.1	5.9	-	-

HAZ= height-for-age z-scores

Table 2. Body segment lengths and their ratio

		Sololá (n=102)	Quetzaltenango (n=102)	Difference [median]	p-value [mean]
Trunk length (cm)	Mean ± SD [Median]	47.9 ± 2.8 [48.0]	49.1 ± 2.9 [48.5]	0.5	<0.05
Leg length (cm)	Mean ± SD [Median]	58.7 ± 5.0 [59.1]	64.9 ± 5.8 [64.3]	5.2	<0.001
Trunk-to-leg ratio	Mean ± SD [Median]	0.82 ± 0.07 [0.82]	0.76 ± 0.07 [0.76]	0.06	<0.001
Trunk-to-stature ratio	Mean ± SD [Median]	0.45 ± 0.02 [0.45]	0.43 ± 0.02 [0.43]	0.02	<0.001

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

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