Available online at www.sciencedirect.com

SciVerse ScienceDirect

www.nrjournal.com

Highland Guatemalan women are extremely short of stature, and no lactation duration effects on body composition are observed in a cross-sectional survey

Linda Oyesiku[a], *Noel W. Solomons*[a], *Colleen M. Doak*[b], *Marieke Vossenaar*[a,*]

[a] *Center for Studies of Sensory Impairment, Aging and Metabolism, Guatemala City, Guatemala*
[b] *Health Sciences, VU University, Amsterdam, the Netherlands*

ARTICLE INFO

Article history:
Received 6 June 2012
Revised 24 November 2012
Accepted 12 December 2012

Keywords:
Height
Stunting
BMI
Women
Guatemala

ABSTRACT

Early linear growth in Guatemala has historically been compromised, resulting in adults of short stature. We hypothesized that the rate of short stature among mothers in the Western Highlands would have tracked from their own childhood when younger than 5 years, and that maternal weight declines progressively from delivery through lactation. Maternal weight and height were collected in 542 lactating mothers of infant and toddlers, ranging in age from 15 to 48 years, with subsequent classification of mothers for short stature (relative to the 1977 World Health Organization/National Center for Health Statistics growth curves) and for underweight (body mass index [BMI], <18.5 kg/m^2), overweight (BMI, 25-30 kg/m^2), or obesity (BMI, ≥30 kg/m^2). The mean stature for the sample of adult women was 149.3 ± 5.9 cm, with a median of 149.0 cm. Women classified of Mayan descent were significantly ($P < .001$) shorter (147.0 ± 5.1 cm) than others (150.5 ± 6.0 cm). In terms of height percentiles for the age-specific female reference, 410 (76%) of mothers were below the fifth percentile and only 8 (1.5%) reached the median. Respective partition for underweight, normal weight, overweight, and obesity was as follows: 5%, 50%, 36%, and 9%. Variation in BMI with respect to the age of the offspring as the indicator of the duration of lactation was not significant, by analysis of variance or correlation analysis. Insofar as short stature is a risk factor for a series of adverse health consequences, including obesity and obstructed labor at childbirth, among others, it is time to direct public health attention toward resolving the causal factors for short stature in Guatemala.

1. Introduction

Human body composition is influenced by a host of generic, dietary, and environmental factors. The stature is the product of linear growth through the formative years from birth through puberty. It is the basic frame and fixing constraint of body composition. The other, more flexible element is body weight and the accumulation of lean and fat tissue. These components are more malleable and can increase and decrease, depending on conditioning of the muscle mass and the accumulation of energy stores. Given the historically problematic situation of nutrition in Guatemala [1,2], it is worthwhile to develop an updated description of the height, weight, and their interaction in body composition in this nation. This is of greatest public health relevance in the more vulnerable groups, and this includes

Abbreviations: BMI, body mass index; WHO, World Health Organization; NCHS, National Center for Health Statistics.

* *Corresponding author*. Tel.: +502 24733942; fax: +502 24733942.
E-mail addresses: mvossenaar@hotmail.com, cessiam@guate.net.gt (M. Vossenaar).

0271-5317/$ – see front matter © 2013 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.nutres.2012.12.001

lactating women with nutritional demands to maintain maternal functions and offer, through the breast milk, all or part of the needs of the child.

Short stature is a well-recognized public health problem in Guatemala, in which 54% of the population younger than 5 years is stunted using the World Health Organization (WHO) Child Growth Standard, and stunting prevalence can reach 80%, especially in the Western Highlands of the republic [3]. The adverse consequences of stunting on function and health have been outlined by Dewey and Begum [4] and include poorer cognitive performance, economic productivity, and women's reproductive health. With respect to reproduction, maternal short stature is a recognized risk factor for obstructed labor [5]. The total adult body mass, moreover, is constrained by the stature attained by adulthood. The taller an individual is, the more weight they can appropriately support within the normative boundaries. Short stature, however, predisposes to obesity [6] because adults tend to gain the expected weight of an adult without the corresponding linear frame to distribute it across.

This interplay of height and body mass would be expected to have interesting ramifications in situations in which normal growth in either of these dimensions is constrained either in childhood (height attainment) or during the reproductive cycle (weight gain or loss). The low-income population of Guatemala is an optimal setting to test this expectation, given the endemic short stature (stunting) for which this Central American republic is known [3] and the nutritional transition it is undergoing in terms of dietary practices and body composition [7,8]. We present here a perspective on contemporary height attainment and body composition from the cross-sectional enrollment of low-income lactating or postlactating mothers across 24 months of the offspring lifespan in 2 metropolitan clinic settings in the Western Highlands. We hypothesized that the rate of short stature among mothers in the Western Highlands would have tracked from their own childhood when younger than 5 years, and that maternal weight declines progressively from delivery through lactation.

2. Methods

2.1. Subject selection

This study was conducted in the highlands of Guatemala in Quetzaltenango, the second most important city of the country and the nearby suburb of La Esperanza. The population of interest was lactating mothers of young children aged between 0 and 24 months. Initially, 626 mother-child dyads visiting the local public health centers for various reasons such routine checkups, vaccinations, or illness were recruited in the study. The health centers are generally visited by the lower socioeconomic groups, but by those who have access, that is, they live at a reasonable distance from the center and have the opportunity to visit. Exclusion criteria included the following: (i) premature infant (defined as born >4 weeks preterm), (ii) having siblings who participated in the study, (iii) having congenital anomalies or chronic illness, or (iv) failure to sign the study consent form. Mothers who were not lactating at the time of interview were excluded from analysis. The study recruitment period was from February 2011 to February 2012. Most participants were interviewed once, but a small sample was invited a second or third time.

Ethical approval was obtained from the Human Subjects Committee of the Center for Studies of Sensory Impairment, Aging and Metabolism, and the study confirms to the provisions of the Declaration of Helsinki in 1995 (as revised in Edinburgh 2000). The procedures and privacy issues of the study were explained, and informed consent was obtained from all mothers.

2.2. Data collection

All participants were initially interviewed by means of a face-to-face interview with a structured questionnaire designed by our research team to examine child feeding practices and morbidity. In addition, sociodemographic data were collected. This included offspring sex and date of birth, place of birth (such as hospital or home), maternal date of birth, marital status, number of children, highest level of education attained, and current occupation. An observation of the clothing worn was made; it was noted as either modern western or traditional Guatemalan.

Anthropometric measurements of the mother were collected by trained researchers following standard procedures described by Lohman et al [9]. Mothers were weighed with a calibrated balance scale (Camry Electronic Co, Ltd, Zhongshan, China; model BR9709) to the nearest 0.1 kg without shoes and with minimal clothing. Standing height was measured with a stadiometer in centimeters to the nearest 0.5 cm.

2.3. Data analysis

Age of the infant was calculated based on the date of birth and date of interview. Age categories for the children were made as follows: 0 to 5, 6 to 11, 12 to 17, and 18 to 24 months. Age of the mother was calculated based on the date of birth and date of interview; when date of birth was unknown, reported age was used. The mothers were categorized as teenagers or adults with the cutoff point at 17 years because women reach their adult height at this age [10]. Parity was categorized as having a single child or more than 1 child. A mother's level of education was classified as "low" if she completed primary school or less and as "high" if she completed secondary school. The occupation of the mothers was categorized into 2 groups: (i) working outside the home or (ii) not working outside the home, which includes housewives. Ethnicity was determined by the clothes of the mother. If she was wearing traditional, Guatemalan clothing, she was classified as *Mayan indigenous*. If she was wearing modern, western clothing, she was classified as *Ladina*. The age of the infant, or time postpartum, was used as a proxy for lactation duration.

To classify mothers for low stature, the 1977 WHO/National Center for Health Statistics (NCHS) growth curves [10] were used as a reference for female stature. Age-specific median heights were 160.4, 161.8, 162.4, and 163.1 cm for teenaged mothers aged 14, 15, 16, and 17 years, respectively. Median height for mothers 18 years and older was 163.7 cm. The cutoff for short stature, defined as the fifth percentile, was 148.7,