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Original article

Prevalence of Thinness in Adolescent Girls in Low- and Middle-Income Countries and Associations With Wealth, Food Security, and Inequality

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 A B S T R A C T

Purpose: Adequate nutrition during adolescence is important for optimal physical and cognitive development and for pregnancy either during adolescence or later life. Thinness among adolescent girls in low- and middle-income countries has been little studied.

Methods: We used body mass index data from 40 countries from the Global School Health Survey to estimate the prevalence of moderate and severe thinness in 12- to 18-year-olds using the World Health Organization 2007 growth reference. Self-report data on going to bed hungry were used as a proxy for household food insecurity. We used multilevel models to assess whether national wealth (gross domestic product), income inequality (Gini index), national gender inequality (Gender Inequality Index), and food security (Global Food Security Index) were associated with undernutrition.

Results: Prevalence rates of moderate and severe thinness across 61,603 girls from 40 countries were 6.30% (95% confidence interval [CI]: 5.71–6.95) and 1.34% (1.12–1.59), respectively, with higher rates in Asia. Combined moderate/severe thinness was more common among early (12–14 years) than later adolescents (15–18 years). Going to bed hungry sometimes was associated with increased risk of moderate/severe thinness (odds ratio [OR]: 1.102; 95% CI: 1.007–1.206). A significant inverse relationship was found between thinness and gross domestic product (OR: .94; 95% CI: .88–.99) and Global Food Security Index (OR: .96; 95% CI: .93–.99) but not Gini or Gender Inequality Index.

Conclusion: Thinness remains prevalent in adolescent schoolgirls in low- and middle-income countries and poses a significant threat to their health and that of the next generation. Further research is needed to assess potential interventions for this group.

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 IMPLICATIONS AND CONTRIBUTION

These data show that undernutrition remains a global threat to the health of adolescents and the next generation; the prevalence of moderate/severe thinness averaged 7.6% among adolescent girls across low- and middle-income countries.

Malnutrition, including undernutrition, stunting, and thinness, is a major cause of mortality and morbidity among children globally [1] and has important consequences for healthy development and the economic productivity of

individuals and societies [2]. Maternal undernutrition is also a major contributor to childhood mortality as well as maternal mortality and a range of other poor outcomes [2]. Yet undernutrition and thinness among adolescents, who are both children emerging into adulthood as well as frequently mothers themselves, has been little studied. This is despite emerging international recognition of the importance of adolescence for global health and that improving the health of

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adolescent girls may impact not only on the individual but also on future generations.

Globally, 1.2 billion young people are aged 10–19 years, 90% of whom live in low- and middle-income countries (LMICs) [3]. Adolescence is a period of rapid maturation in all organ systems, with higher nutritional demands which place adolescents at greater risk of malnutrition. As in childhood, adequate nutrition during rapid brain development in adolescence is important for achieving optimal cognitive outcomes and to place young people on a trajectory toward being productive adults [4]. Furthermore, adolescence has been shown to be an important time for catch up growth, when previous effects of poor childhood nutrition may be reversed or ameliorated [5]. Childbearing during adolescence places an additional nutritional burden on the mother and may explain some of the additional risk [6] that pregnancy in adolescence poses to the 16 million teenagers who give birth annually [7] and to their offspring.

Although the global prevalence and patterns of undernutrition among children is well documented [1] and routinely included in population-health benchmarks provided by various United Nations agencies, there has been no systematic study of the prevalence of thinness among adolescents. Younger adolescents (i.e., <15 years) are not included in routine data collection systems, such as the demographic health survey [3].

Available data for LMIC come largely from within-country analyses, with the most comprehensive data from a study of 10 countries [2]. Country-level studies suggest that the prevalence of undernutrition among adolescent girls varies widely between LMICs with much of the data originating from Africa [8,9], Southeast Asia [10–12], and India [13,14] with fewer studies from South America [15]. There is notable variability in age ranges, definitions of underweight, and recruitment and making international comparison challenging. Data from Indian studies suggest that between 39.4% and 42.6% of adolescent girls are underweight [13,14], with much lower prevalences reported by studies from Turkey (5.0% of 14- to 18-year-old schoolgirls were underweight) [16] and Brazil, where only 2.5% of 12- to 18-year-old girls were underweight [15].

We aimed to estimate the prevalence of thinness among adolescent girls in LMIC globally, using data from the World Health Organization (WHO) Global School Health Survey (GSHS) and from established WHO definitions of thinness. The WHO defines thinness as body mass index (BMI)-for-age Z-score <–2 standard deviation (SD) and severe thinness as BMI-for-age Z-score <–3 SD [17,18]. Furthermore, given evidence that childhood malnutrition is influenced by national wealth and food availability [19] and by gender inequality [20], we hypothesized that a country's levels of thinness among adolescent girls would be influenced by that country's macroeconomic context such as national wealth and the distribution of income as well as by gender equality and the security of a country's food supply. We therefore additionally examined whether indicators of national wealth, income or gender inequality, hunger, and national food security were associated with the prevalence of thinness. Understanding the patterns of adolescent thinness across LMIC will provide valuable information for policy makers about where best to target nutritional interventions in this age group.

Methods

Our cross-sectional study examined associations between individual-level data (BMI and demographic data) collected in a

clustered sample design from 40 countries and aggregated country-level data (indices of food security, gender inequity, income, and income inequality).

Data were obtained from the GSHS, an international survey of young people aged 11 to 17/18 years in LMIC sponsored by the WHO; see details published previously [21]. The survey provides self-reported data from young people in schools relating to a range of health outcomes together with measured height and weight. Publicly available data deposited by the WHO were accessed on November 11, 2013. Data were available for 66 countries collected between 2003 and 2011 (see Appendix). Participants reported being aged 11 years or younger; 12, 13, 14, or 15 years; or 16 years or older. We excluded those aged 11 years or younger as these may have included small numbers of children aged 10 years. Most of the included countries were originally classified as LMIC when the GSHS began, with the exclusion of the United Arab Emirates which has been excluded from these analyses.

In each country, survey administrators were given one-day training in aspects of delivery of the survey including anthropometry. All participating schools were given a portable height/length training board, weighing scales, and data entry sheet [22]. Young people were measured by survey staff without shoes on, with the measurement given to students on a slip of paper who then entered their height and weight onto the GSHS answer sheet during survey administration.

We excluded biologically implausible values using standardized rules. BMI Z-scores were calculated according to the WHO 2007 growth references [17]. Individuals were then categorized as having moderate thinness if BMI Z-score was between –2.01 and –3.00, or severe thinness if Z-score was <–3 [18]. We report prevalence rates of combined moderate and severe thinness and of severe thinness alone.

Of the 66 countries with available survey data, 61 provided BMI data on a total of 144,057 participants (82,838 girls [57.5%]). Many countries had high rates of missing BMI data, due to either the participant not being measured in certain schools or individual participants not entering their measurement data. To minimize bias, for these analyses, we included only countries where >67% of the cohort had height and weight data; 40 countries met this requirement (see Appendix for details of included countries). The sample therefore comprised 61,603 girls across 40 countries aged 12 years or older (74.4% of those with BMI data). Year of data collection varied from 2003 to 2011, with most collected between 2007 and 2010 (see Appendix). Where a country repeated data collection during this time, we used the most recent year of data.

Young people's reports of going to bed hungry were included as a marker of family-level household food security, a proxy for household deprivation. Young people were asked "During the past 30 days, did you go hungry because there was not enough food in your home?", with responses being never, rarely, sometimes, most of the time, or always. We collapsed the responses into three categories: never/rarely, sometimes, or most of the time/always. The GSHS provided no measures of nutritional intake or physical activity collected across all countries.

Country-level data

National wealth was assessed using the gross domestic product (GDP) per capita based on purchasing power parity in

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