Stunted Child/Overweight Mother Pairs Represent a Statistical Artifact, Not a Distinct Entity\textsuperscript{1,2}

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Abstract

Stunted child/overweight mother (SCOWT) pairs have been viewed as a distinct phenomenon and much effort has been expended to characterize the environments that create these dual burden households. We hypothesized that the prevalence of SCOWT pairs is not independent of the prevalence of overweight mothers and stunted children in the general population. We analyzed data from the Demographic and Health Surveys (DHS) from 1991 to 2009. Datasets were included if the maternal BMI and the height-for-age Z-scores for children were reported. Mothers were included if they had a living child between 2 and 5 y old and were not currently pregnant. In 121 datasets from 54 countries, 339,202 households met the inclusion criteria. The median prevalences of maternal overweight, childhood stunting, and SCOWT pairs were 19.6\% (range 1.6–70.7\%), 27.3\% (range 6.65–50.8\%), and 3.3\% (range 0.5–16.0\%), respectively. The mean difference between the observed and expected prevalence of SCOWT pairs was \(-1.18\% (95\% CI \(-1.32\%, \ -1.04\%\)). Only two datasets had an observed prevalence of SCOWT pairs that was higher than the expected prevalence, but both were within the 95\% CI for the observed prevalence. SCOWT prevalence was more strongly associated with maternal overweight than with child stunting. SCOWT pairs are not independent and their prevalence depends primarily on the prevalence of maternal overweight. J. Nutr. 142: 771–773, 2012.

Introduction

Developing countries are experiencing an increased prevalence of overweight and obesity (1,2). Proposed explanations for this increase include the nutrition transition (3,4), epigenetic phenomena (5,6), and cultural changes (7,8). However, underlying challenges with poor nutrition still exist in many developing countries (9). This leads to a situation in which societies face a dual burden of undernutrition and overnutrition. This phenomenon is brought into sharp focus when undernutrition and overnutrition exist in the same household (3). Various combinations of underweight and overweight household members have been studied (10); a commonly described combination is that of the stunted child and overweight mother (SCOWT) (5). SCOWT pairs represent a conundrum because a mother and her child’s nutrition are more closely related than that of other household members (11). The prevalence of SCOWT pairs has been reported to be highest in lower-middle income countries, especially those in Latin America and the Middle East (10). The development of SCOWT pairs has been hypothesized to represent a distancing of the mother-child relationship (5).

There have been several investigations into the causes and risk factors for SCOWT pairs. Some public health researchers have questioned, however, if SCOWT pairs simply reflect societal patterns of nutrition status (7), or if there is an independent process that leads to the clustering of overweight mothers and stunted children in specific households. If SCOWT pairs are a distinct subset of the population of mothers and children in the developing world, their emergence would elicit several concerns. Nutrition programs aim to provide adequate amounts of high quality food to facilitate optimal child growth. In countries undergoing the nutrition transition, the quantity of food available may not be the problem, because increasing incomes allow families to buy more food. However, families may still not have enough money to buy nutrient-dense food, leading to a situation in which an adult consumes enough energy to gain weight, but a child cannot get enough nutrients to grow appropriately. As Garrett and Ruel (5) pointed out, “more food” is not going to be the solution in these situations. Thus, a high prevalence of SCOWT might suggest that public health professionals need to refine their strategies to consider the unique status of these mothers and children. Similarly, a casual observer might see a high prevalence of overweight adults in a society and assume that everyone has access to sufficient nutrition; however, as can be seen in these dual-burden households, there may still be large numbers of children who lack access to the right food to grow. Finally, there are long-term implications. It has been suggested that children who have stunted growth are more prone to develop obesity later in life when food is abundant (3). This may be contributing to the prevalence of SCOWT pairs that we observe today.

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\textsuperscript{2} Supplemental Table 1 and Supplemental Figure 1 are available from the “Online Supporting Material” link in the online posting of the article and from the same link in the online table of contents at http://jn.nutrition.org.
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In this analysis, we used data from the Demographic and Health Surveys (DHS) to estimate the prevalence of SCOWT pairs in lower- and middle-income countries over the past 20 y. We estimate the expected prevalence of SCOWT pairs based on the underlying population levels of maternal overweight and childhood stunting. By comparing the expected and observed prevalence of SCOWT pairs, we aim to determine if the existence of SCOWT pairs is a distinct entity.

Methods
We used data from the DHS from 1991 to 2009, which included waves DHS-II to DHS-V. The DHS is a cross-sectional survey, performed approximately every 5 y in lower- and middle-income countries around the world. Sample size ranged from 5000 to 30,000 households per survey. More details about the DHS are available elsewhere (12). We included all surveys that provided BMI data for the mother and height and weight data for children.

For each dataset, we excluded women with missing BMI data, women who had no children, and women who reported being currently pregnant. We included children 2–5 y of age in the survey, because height-for-age Z-scores are unstable prior to age 2 y (13,14) and the DHS does not collect anthropometric measurements for children over the age of 5 y. For women who had more than one child between 2 and 3 y old, we included only the youngest child in the analysis, because this child likely has the closest nutritional relationship with his or her mother (11). If this child was reported as nonliving, we removed the household from the analysis. We defined extremes of height and weight for both mothers and children as >5 SD above or below the mean and any observations with BMI or height-for-age scores outside these limits were treated as errors and deleted. In later DHS datasets, “de facto” members of the household were allowed to respond to the survey. When these members were responsible for the survey completion, we deleted these observations from the analysis. Finally, we removed any duplicates within the dataset.

We analyzed the data using SAS version 9.2. We calculated the prevalence of maternal overweight and childhood stunting. Maternal overweight was defined as BMI ≥25 kg/m² (15). BMI was calculated by dividing the mother’s weight in kilograms by her height in meters squared. Childhood stunting was defined as a height-for-age score ≥2 SD below the mean according to the WHO Child Growth Standards (16). SCOWT pairs were defined as mother/child pairs where both of the above were present. We calculated the expected number of SCOWT pairs within a dataset as the number of overweight mothers times the number of stunted children divided by the number of mother/child pairs. We calculated the difference between the observed and the expected prevalence of SCOWT pairs and calculated the adjusted Wald 95% CI for each dataset. We used linear regression to estimate the relationship between the prevalence of childhood stunting and SCOWT pairs and between the prevalence of maternal overweight and SCOWT pairs.

Results
There were 1,956,335 households in 131 datasets from 54 countries. A total of 789,432 households had no data for mother’s BMI, 46,804 households had no age-eligible children, 13,800 women reported being pregnant, 12,999 children were nonliving, and 9696 women and children had extreme BMI or height-for-age values. Many of the households removed from analysis fell into more than one of the above categories. The analytic sample included 121 datasets from 54 countries for a total of 394,644 households (Supplemental Table 1).

Across datasets, the median prevalence of each factor was: maternal overweight, 19.6% (range 1.6–70.7%); childhood stunting, 27.3% (range 6.65–50.8%); and SCOWT pairs, 3.3% (range 0.5–16.0%) (Supplemental Table 1). The differences between the observed and expected prevalence of SCOWT pairs ranged from −3.2 to 0.2%, with a mean of −1.18% (95% CI −1.32%, −1.04%). Regression analysis revealed that a higher observed prevalence of SCOWT was associated with a larger difference between the observed and expected prevalence of SCOWT pairs.

For 119 of the 121 datasets, the expected prevalence of SCOWT exceeded the observed prevalence. The exceptions were Egypt (2008), which had an observed prevalence of 16.0% (95% CI: 15.1%, 17.0%), and an expected prevalence of 15.9%, and Moldova (2005), which had an observed prevalence of 2.7% (95% CI: 1.9%, 3.9%) and an expected prevalence of 2.5%. Both of these expected prevalences were well within the 95% CI for the observed prevalences. There were several datasets in which the expected prevalence was greater than the upper bound of the 95% CI, around the observed prevalence of SCOWT pairs.

The number of SCOWT pairs steadily increased with prevalence of maternal overweight ($R^2 = 0.62$) (Fig. 1A) but was not related to prevalence of childhood stunting ($R^2 = 0.04$) (Fig. 1B).

**FIGURE 1** Associations among prevalence of SCOWT pairs and prevalence of maternal overweight (A), prevalence of SCOWT pairs and childhood stunting (B), and prevalence of maternal overweight and childhood stunting (C). Data are from 121 DHS from 54 countries. DHS, Demographic and Health Survey; SCOWT, stunted child/overweight mother.
Maternal overweight was inversely associated with childhood stunting ($R^2 = 0.47$ in a quadratic model) (Fig. 1C). Supplemental Figure 1 presents a 3-dimensional view of these relationships.

**Discussion**

Many countries face an increasing prevalence of adult overweight while still struggling with childhood stunting (3,5,10,17). It is important to determine if SCOWT pairs represent a separate entity from these trends. Our results, from a comprehensive and exhaustive analysis of multiple population-based datasets, provide strong evidence that SCOWT pairs are not statistically independent from the components of maternal overweight and childhood stunting and are dependent primarily on the prevalence of overweight women among the general population.

Our data show that as the prevalence of overweight mothers increases, the prevalence of childhood stunting decreases and the prevalence of SCOWT pairs increases. This supports the suggested etiology of the dual-burden household (2,7). As adults acquire more sedentary occupations and increased income, they experience a positive energy balance from less physical activity and higher energy food. More importantly, these energy-dense foods are not nutrient dense and thus provide suboptimal nutrition for children in the household. These results support the hypothesis of Jehn and Brewis (7), who suggested that a cause of SCOWT might be a rapidly increasing number of overweight women against a static background of childhood stunting. Our analysis confirms that the variation in prevalence of SCOWT pairs is driven by the prevalence of maternal overweight and is only weakly (and inversely) related to the prevalence of child stunting. This inverse association is driven by the inverse association of maternal overweight with child stunting. When maternal overweight is held constant, child stunting becomes a positive predictor of SCOWT prevalence (Supplemental Fig. 1).

The major limitation of our analysis is that we analyzed a secondary data source. Although the DHS uses well-validated survey methods, we lack direct control of how the variables of interest were collected and recorded. We minimized errors by deleting extreme values.

Although SCOWT pairs are not statistically independent from their components, this does not mean that the underlying economic, biologic, and social processes that contribute to their development should be ignored. Public health professionals do not need to design targeted interventions for these households. Rather, they should continue to intervene on the underlying problems that drive the prevalence of SCOWT pairs: childhood stunting and maternal overweight and obesity.

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**Literature Cited**