Stunted child–overweight mother pairs: Prevalence and association with economic development and urbanization

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Abstract

This paper explores the prevalence of the coexistence of a stunted child and an overweight mother in the same household (SCOWT), a somewhat paradoxical phenomenon when found in the developing world. It tests whether this phenomenon is associated with a country's level of economic development and urbanization and, by implication, the nutrition transition. It then highlights policy directions for public nutrition. Data from 42 Demographic and Health Surveys in Africa, Asia, and Latin America were used. Stunting was defined as height-for-age < –2 SD of the reference population, and maternal overweight as a body-mass index > 25 kg/m^2. World Bank and United Nations figures were used for gross domestic product (GDP) per capita (an indicator of economic development) and for level of urbanization. Descriptive statistics were derived, and regression analysis was used to model the association between economic development, urbanization, and the prevalence of pairs of stunted children and overweight mothers. The prevalence of this phenomenon is generally below 10%, except in four countries, three of them in Latin America. The phenomenon is generally more prevalent in Latin America than in Africa, though not necessarily more prevalent in urban than in rural areas. The analysis finds that the phenomenon is associated with economic development, but not urbanization, and that it does differ between urban and rural areas and regions. The association with GDP per capita supports the hypothesis that SCOWT increases with economic development, up to a point. SCOWT appears to be most prevalent, as expected, in those countries in the midst of the nutrition transition. Recognizing this phenomenon is important for delineating strategies that respond to the differential needs of individuals within the household and do not just affect the household as a whole. This may become especially important with future economic development and, potentially, urbanization.

Key words: DHS (Demographic and Health Surveys), economic development, malnutrition, nutrition transition, overweight, stunting, urbanization

Introduction

In cruel and ironic contrast to the deprivation associated with poverty, diseases more often associated with excess, such as diabetes, obesity, and heart disease, have also emerged as serious concerns in many developing countries [1, 2]. These countries now face the worst of two worlds: millions of infants, young children, and adults suffer from hunger and undernutrition at the same time as other millions contend with overnutrition and its consequences.

Traditional developing-country diets consist largely of unprocessed foods, and most households struggle to get enough food for everyone to eat. Yet with increased economic development and urbanization, populations in many developing countries are now consuming more energy, more processed foods, including more refined grains, and foods higher in saturated fat, sugar, and salt. National food and nutrition policies that affect the relative prices of foods may also encourage such changes. In the Middle East, for instance, some governments subsidize staple items such as oil, sugar, and wheat. The relatively lower prices of these foods can lead to their overconsumption at the cost

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of a more balanced diet. A decline in physical activity may accompany these dietary changes. City-dwellers, including rural migrants, take on more sedentary jobs, and firms and households adopt labor-saving technologies [3, 4]. Together these conditions are contributing to a rise in overweight and nutrition-related chronic diseases (NRCDs) among these populations [4, 5]. The situation appears especially acute in the middle-income nations of Latin America and the Near and Middle East [2, 6]. During this "nutrition transition," symptoms of under- and overnutrition logically coexist at the population level. Overnutrition emerges as a national problem, even as undernutrition remains high, with wealthier households exhibiting "diseases of affluence," including obesity, and poorer households exhibiting food insecurity and malnutrition.

The nutrition transition is often conceived of as a national phenomenon, a wave of change in diet, physical activity, and body composition patterns that a country goes through on the road to higher levels of economic development [4], but recent work indicates under- and overnutrition can also exist not only in the same population, but in the same household [3, 7]. As Popkin [5] notes, this is somewhat surprising, since in developing countries undernutrition is generally thought of as reflecting deprivation at the household level: lack of income, lack of food, poor sanitation, and low levels of education, among others. These factors affect all members of the household directly, or indirectly through their impact on care, feeding practices, and diet. Numerous economic studies confirm the association of undernutrition and food insecurity with low income in developing countries [8–14].

In the face of pan-household constraints (such as the very low household income found in many developing countries), it is not surprising that the nutritional status of household members is fairly well correlated. The joint probability of undernutrition for children and mothers in the same household, then, would not just occur as a simple function of respective prevalences. Using the data in this study, for example, and testing with a one-sided Fisher exact test of significance, we found associations with $p < .10$ between the prevalence of stunted children and of underweight mothers in 29 of the 42 countries. In 38 countries, using a two-sided Fisher exact test of significance, we found an association with $p < 0.10$ between the prevalence of stunted children and overweight mothers.

The coexistence of undernutrition and overweight among members of the same household thus represents a weakening of intrafamilial associations of nutritional status and raises questions about its cause and implications for programs and policies. One possibility is that in these households, pan-household constraints have become less severe. One might conceive of this situation occurring more often in more economically developed and more urbanized countries, with higher overall levels of household income and more widespread food availability. Individual-level and intrahousehold factors, such as food choices, caring behaviors, and individual diets, become relatively more important. The locus of the leading constraints to food insecurity and malnutrition may shift from the household to the individual level. In the case of overweight, the household may have reached a point where sufficient resources exist for at least some individuals to get "enough" food to eat, in terms of energy, even if it is of low quality. Some household members could remain undernourished due to deficiencies of energy and essential nutrients, and others become overweight from excess energy. A somewhat different possibility is that at these higher levels of economic development, energy is sufficient for both children and adults, but micronutrient intakes remain low, leading to stunting in children and overweight in adults.

In any case, the coexistence of under- and overnutrition in the same household has implications for food and nutrition programming. Many programs in developing countries implicitly assume that child undernutrition indicates household food insecurity. Programs then target more food or more income to households with malnourished children. Yet under- and overnutrition in the same household makes this sort of targeting less effective. In this case, food choices and distribution within the household may be more important factors than the household's overall food availability and level of resources. The challenge to public finances and to a public health system that must simultaneously address the causes of both under- and overnutrition in the population is difficult enough, but the presence of both inside the household complicates matters.

Objectives

This paper reports the prevalence of the phenomenon of under- and overweight members in the same household and investigates its relation to global factors associated with the nutrition transition, namely economic development and urbanization. The paper looks at a particular expression of under- and overnutrition, the occurrence of a stunted (undernourished) child in the same household as an overweight (overnourished) mother. We term this pairing of a stunted child and an overweight mother SCOWT. The paper will quantify the prevalence of SCOWT in a number of developing countries, explore the association of SCOWT with economic development and urbanization, and highlight policy directions for the public nutrition community.

Some studies have examined broad national trends of increasing levels of obesity or overweight in regions where child undernutrition continues to be a serious problem [2]. Others have looked at the coexistence of overweight and underweight among any member of

the same household in countries generally considered to be undergoing a nutrition transition [3, 15]. This study documents the coexistence within a household of childhood stunting and maternal overweight. It is the first to present data on the global prevalence of this phenomenon and on countries at higher and lower levels of economic development and urbanization. This allows for comparison of countries that are arguably farther along in the nutrition transition with those that have only barely started along this path.

The rationale for a focus on stunting rather than underweight or wasting as an indicator of child undernutrition is that stunting reflects the cumulative, long-term effects of the numerous insults experienced by children during their intrauterine and preschool years [16]. Programmatically, then, many researchers and development practitioners consider it indicative of long-term deprivations at the household level. Although the specific etiologies differ, the nature of stunting and BMI as indicators of longer-term nutritional status make it natural to pair them for this analysis.

As an ecological study, this paper does not seek to identify specific household- or individual-level determinants of undernutrition or overweight. However, it does explore whether SCOWT is associated with longer-term economic and social processes at the population level. In this study, we hypothesize that a higher prevalence of SCOWT is associated with higher levels of urbanization and economic development. We know diet, activity, and child-care patterns shift with urban living and with higher incomes, and so we expect to see higher levels of adult overweight and obesity. If not accompanied by similar rates of decline in stunting at the household level, we will see the emergence of these SCOWT pairs along with the rise in overweight that often signals the nutrition transition.

Methods

Data

To conduct this analysis, we used publicly available data sets from the Demographic and Health Surveys (DHS) for 42 countries (27 in Africa, 8 in Latin America, and 7 in Asia). The DHS are funded by the US Agency for International Development and coordinated by Macro International. Data collection is usually carried out in collaboration with country governments using population sampling frames. All data are nationally representative. The years of the data range from 1992 to 2001. Although predominantly from Africa, the data do come from all developing-country regions, so they provide at least some indication of the prevalence of the phenomenon around the world. These data sets are available from the DHS website (www.measuredhs.com).

We chose data sets that had anthropometric data for mothers and their children. Children 6 to 60 months old and their nonpregnant mothers aged 18 years or older were included in the analysis. In 29 of the datasets the maximum age of children was 60 months old; in the remaining 13 it was 36 months old. If a mother had more than one child in this age group, we selected one of the children randomly for analysis.

For children's nutritional status, we used height-for-age Z scores (HAZ). Stunting was defined as HAZ below –2 SD of the World Health Organization/National Center for Health Statistics/Centers for Disease Control (WHO/NCHS/CDC) reference standards [17]. Using the WHO guidelines, we considered mothers with a body-mass index (BMI) > 25kg/m^2 as overweight [18].

We used World Bank figures for Gross Domestic Product (GDP) per capita (in constant 1995 dollars) for the same years as the nutritional status data [19]. GDP per capita is the per capita value of final goods produced within the country and here serves as a proxy for a country's level of economic development. Use of Gross National Income (GNI) would have added net receipts of primary income from abroad, but was not available in constant-dollar per capita terms. GDP per capita calculated using purchasing power parity (PPP) rates, rather than exchange rates, might arguably be appropriate as well, but the comparability of estimates using PPP rates is subject to significant doubt and heated debate [20, 21]. We estimated the percentage of the population in urban areas in the year of the DHS using United Nations sources [22].

Statistical analysis

From these data we calculated the prevalences of stunted children, overweight mothers, and SCOWT pairs (as a percentage of total child-mother pairs) in each country. We used the Statistical Package for the Social Sciences (SPSS) for descriptive statistics.

Using STATA, we estimated a multivariate linear regression model to explore the independent association of the level of urbanization and economic development with SCOWT. It is important to note that this is a cross-country regression model. It is not an attempt to model the determinants of nutritional status at the household or individual level, nor to "explain" either stunting or BMI. This model provides a simple control to determine the association of national-level factors of urbanization and economic development (holding the other factor constant) with SCOWT. Initially squaring the urbanization and GDP per capita variables allowed for flexibility to account for possible nonlinear relationships.

We also developed and tested models that included interaction terms to see if these national-level factors exhibited any difference in their association with

SCOWT across regions or in urban and rural areas. Dummy variables were used to represent categorical variables for geographic regions (Asia, Africa, and Latin America) and urban-rural areas. Main effects were interacted with the urban dummy and the regional dummies, using a joint F-test to determine whether there were any significant differences of the main effects in urban versus rural areas, or in different regions. We considered coefficients with p values < .10 significant with regard to main effects and F-tests with p values < .10 significant for groups of interactions. The interactions of the main effects with the urban dummy revealed no significant differences. The interactions with regional dummies (Asia and Latin America, with Asia as the initial reference) revealed no significant difference between urban and rural Asia and rural Africa. Consequently, the final model excludes main-effect interactions with the urban dummy variable and includes only regional interactions for Africa (urban) and Latin America (urban and rural).

With 42 countries, using both rural and urban observations, we had a total of 84 observations. The relatively small number of observations means we must be careful in interpreting results because of the limited statistical power, particularly within the Asian and Latin American regions.

Results

Prevalence

Overweight is a serious problem in many developing countries, with prevalence appearing to be higher in higher-income and more urbanized countries (**table 1** and **figs. 1–3**) [2, 3]. The range of overweight mothers

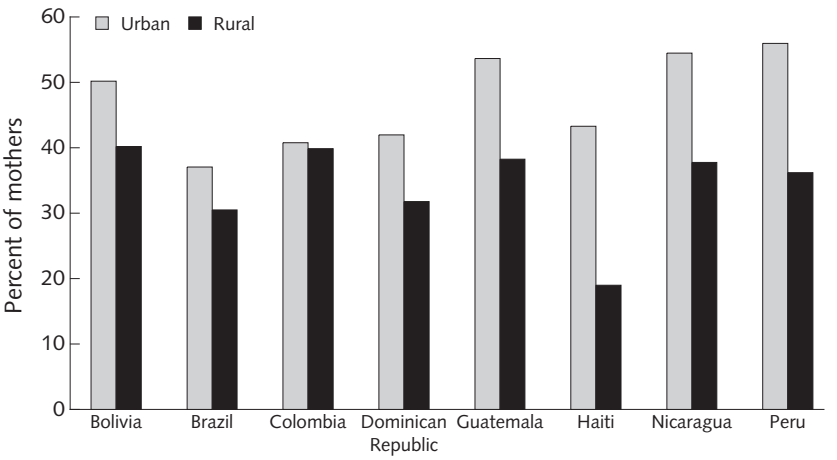

FIG. 1. Percentage of mothers overweight
Source: Demographic and Health Surveys from eight Latin American countries

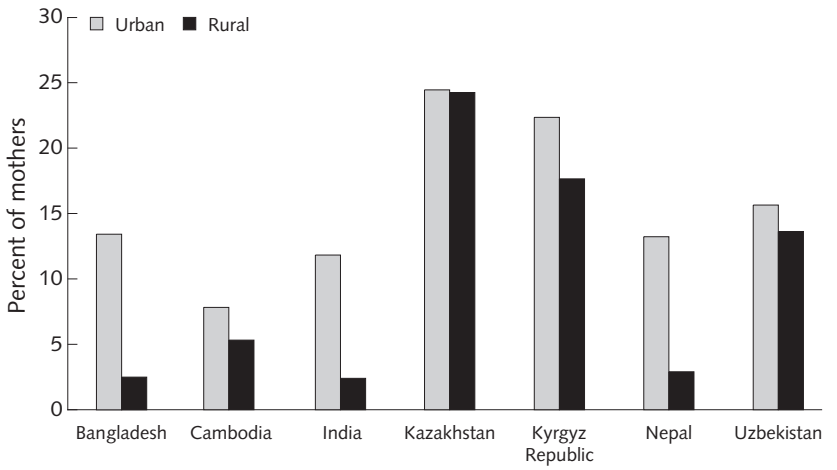

FIG. 2. Percentage of mothers overweight
Source: Demographic and Health Surveys from seven Asian countries

across African and Asian countries is particularly large. Among African countries in our sample, the percentage of overweight mothers ranges from a low of 2% in Ethiopia to a high of 71% in Egypt. In Asia, three of

TABLE 1. Descriptive statistics

Region and country	Year of survey	Children stunted (%)	Mothers overweight (%)	Children in SCOWT pairs (%)	Urban residence (%)	GDP per capita (1995 US$)
Africa						
Benin	2000	32.1	16.5	3.5	42.3	429
Burkina Faso	1999	41.9	5.8	1.9	16.7	272
Cameroon	1998	35.7	19.8	4.8	49.0	639
Central African Republic	1994	38.7	6.8	2.2	39.1	323
Chad	1996	46.0	5.2	1.8	22.2	212
Comoros	1996	37.2	19.6	5.6	30.4	453
Côte d'Ivoire	1998	25.4	17.3	2.5	43.6	870
Egypt	2000	19.4	70.8	12.4	42.1	1,217
Ethiopia	2000	55.1	2.0	0.9	14.9	116
Ghana	1998	27.2	16.1	2.7	43.9	390
Guinea	1999	30.4	13.4	2.9	32.6	613
Kenya	1998	34.8	11.9	2.4	35.9	340
Madagascar	1997	56.1	3.5	1.1	25.5	237
Malawi	2000	52.7	11.0	4.8	15.1	168
Mali	2001	43.9	13.8	4.0	30.2	303
Morocco	1992	25.0	32.8	5.8	48.4	1,293
Mozambique	1997	39.8	10.3	2.2	26.2	165
Namibia	1992	30.1	20.7	3.8	26.6	2,106
Niger	1998	47.5	7.6	2.1	20.6	220
Nigeria	1999	48.6	19.6	8.3	44.1	250
Rwanda	2000	45.5	13.5	5.6	13.6	267
Senegal	1992	26.2	17.3	2.5	40.0	547
Tanzania	1996	47.2	13.4	4.5	26.9	180
Togo	1998	24.8	11.5	1.8	33.4	344
Uganda	2000	40.7	11.2	3.1	12.0	339
Zambia	1996	46.4	12.8	4.5	37.3	409
Zimbabwe	1999	29.3	26.0	5.9	33.6	664
Asia						
Bangladesh	2000	46.8	4.4	1.0	23.2	373
Cambodia	2000	45.5	5.6	2.5	16.9	388
India	1998	50.1	4.6	1.2	27.7	430
Kazakhstan	1995	16.8	24.3	2.7	56.4	1,268
Kyrgyz Republic	1997	28.2	18.7	4.5	36.0	414
Nepal	2001	52.9	3.6	1.5	13.7	247
Uzbekistan	1996	33.2	14.2	5.5	38.4	585
Latin America						
Bolivia	1998	27.0	46.4	11.5	61.9	958
Brazil	1996	9.5	35.7	2.6	77.8	4,474
Colombia	2000	12.6	40.5	4.2	74.9	2,289
Dominican Republic	1996	8.9	38.0	2.2	56.6	1,726
Guatemala	2000	45.5	44.5	16.0	45.1	1,563
Haiti	2000	21.0	27.4	2.8	35.6	359
Nicaragua	2001	19.4	46.8	6.9	56.1	504
Peru	2000	24.4	47.8	9.6	72.8	2,334

GDP, Gross Domestic Product.

the seven countries are countries of the former Soviet Union (FSU). The percentages of overweight mothers in FSU countries are markedly higher than the figures for Bangladesh, Cambodia, India, and Nepal, where overweight mothers are practically nonexistent. In contrast, overweight mothers are quite prevalent in Latin America. In all Latin American countries, more than one-fourth of mothers are overweight, with figures ranging from 27% of mothers in Haiti to 48% in Peru.

Yet childhood stunting remains a serious problem in these countries as well, even in urban areas and even in countries with a high prevalence of overweight mothers (**table 1, figs. 4–6**). For instance, in Egypt and Peru, the

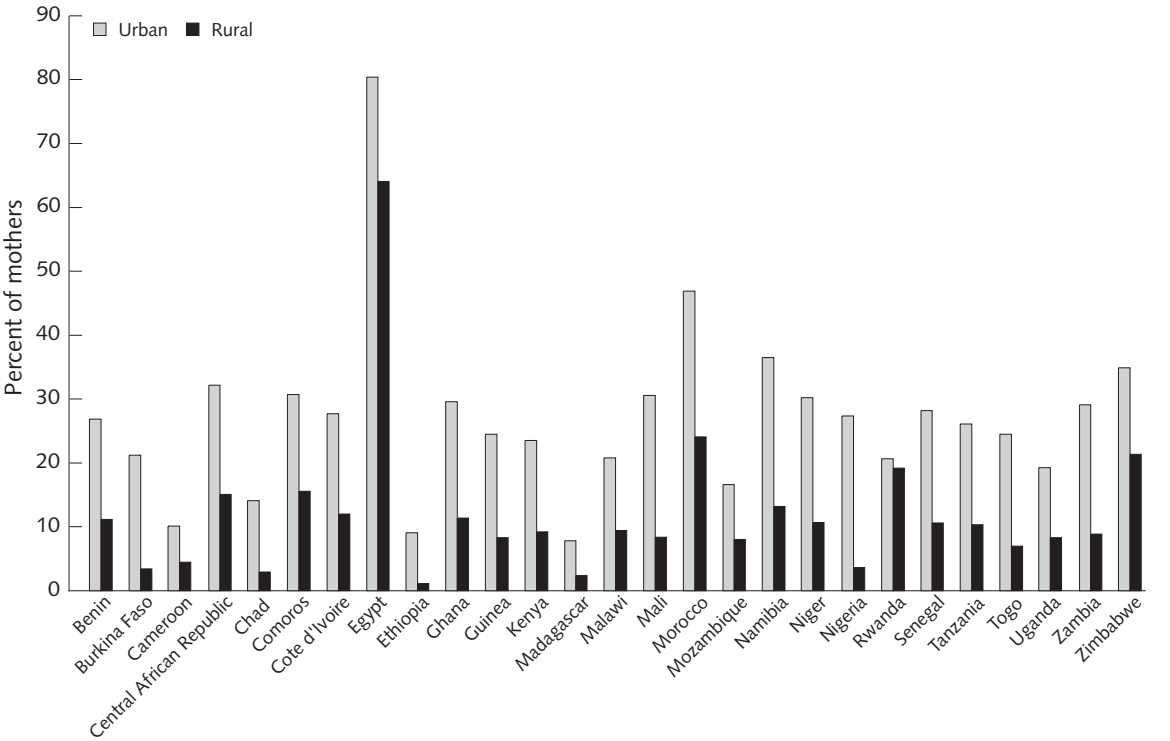

FIG. 3. Percentage of mothers overweight
Source: Demographic and Health Surveys from 27 African countries

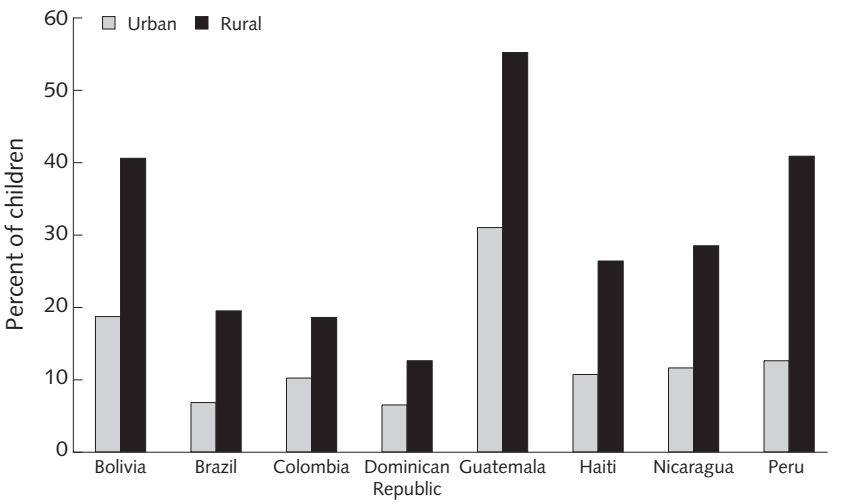

FIG. 4. Percentage of children stunted
Source: Demographic and Health Surveys from eight Latin American countries

countries with the highest prevalence of overweight mothers, 19% and 24%, respectively, of children 6 to 60 months old are stunted. More than 40% of preschoolers are stunted in many southern African countries and in Bangladesh, Cambodia, Guatemala, India, and Nepal. As documented previously, the prevalence of stunting is consistently higher in rural than in urban areas [23].

Overweight mothers and stunted children, of course, could occur in the population but not necessarily in the same household. **Figures 7, 8, and 9** present the prevalence of SCOWT pairs in the sample of countries studied. The prevalence of SCOWT is generally below 10%, except for four countries, of which three are in Latin America (Bolivia, Guatemala, and Peru). Egypt is the other country, with a prevalence of 12%. The level of SCOWT varies across countries and is related, as expected, to levels of both overweight and stunting. For instance, Bolivia and Guatemala have the highest prevalences of SCOWT in Latin America. Bolivia has

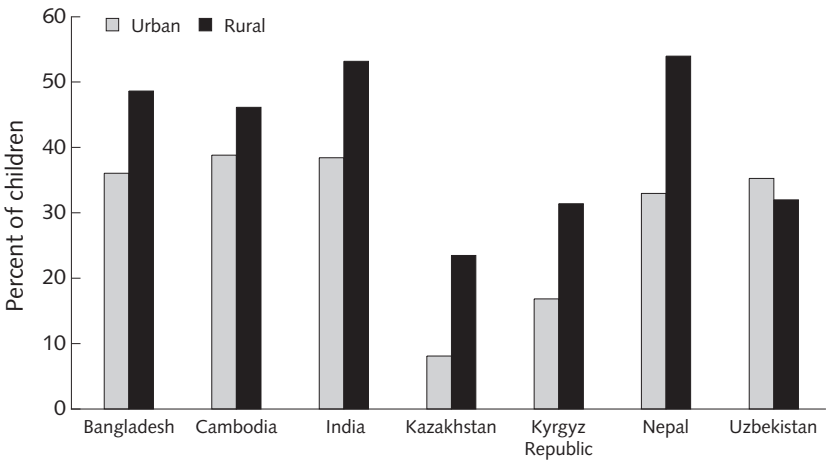

FIG. 5. Percentage of children stunted
Source: Demographic and Health Surveys from seven Asian countries

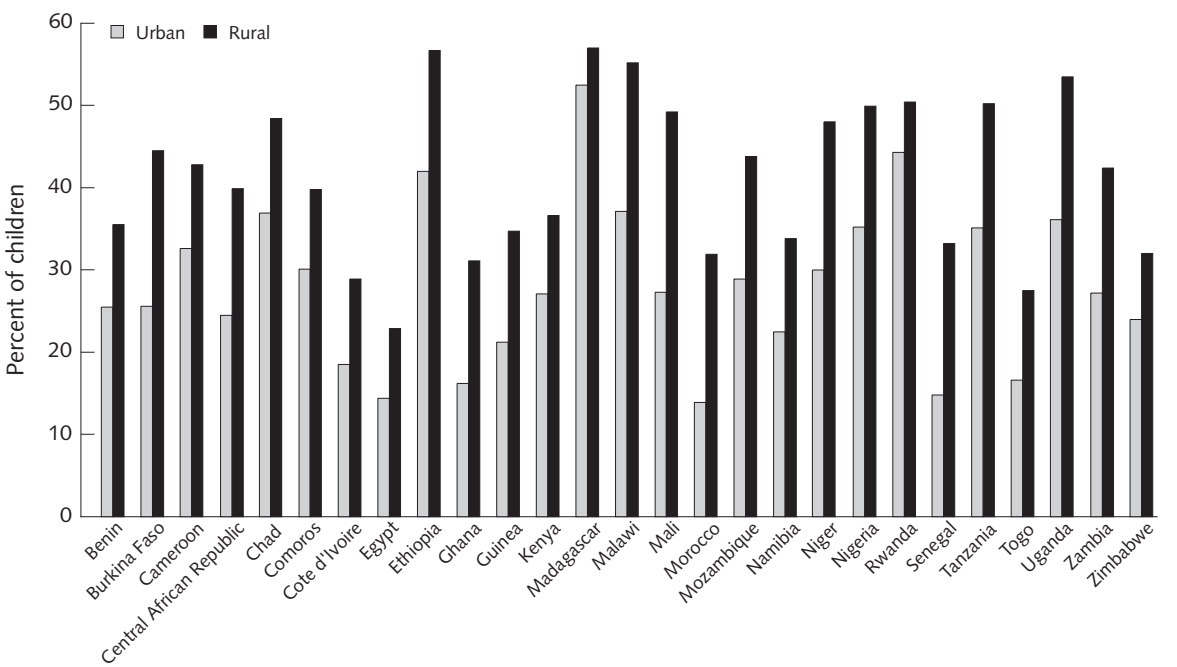

FIG. 6. Percentage of children stunted
Source: Demographic and Health Surveys from 27 African countries

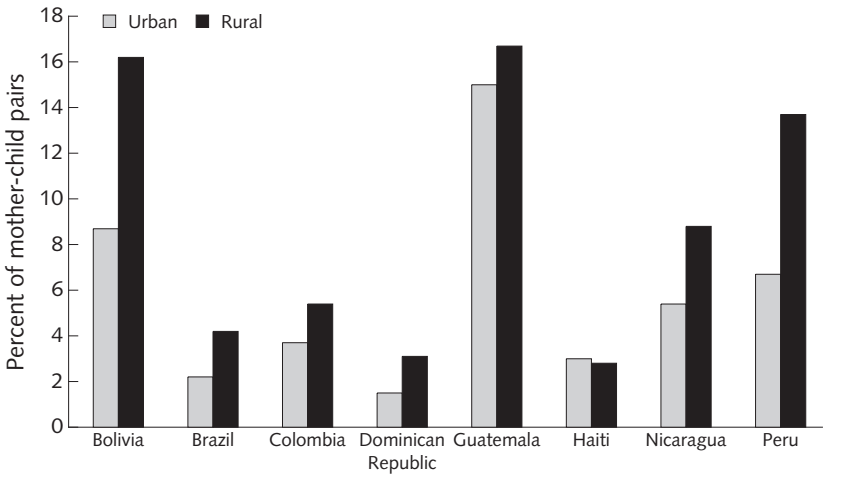

FIG. 7. Percentage of mother-child pairs consisting of stunted child and overweight mother.
Source: Demographic and Health Surveys from eight Latin American countries

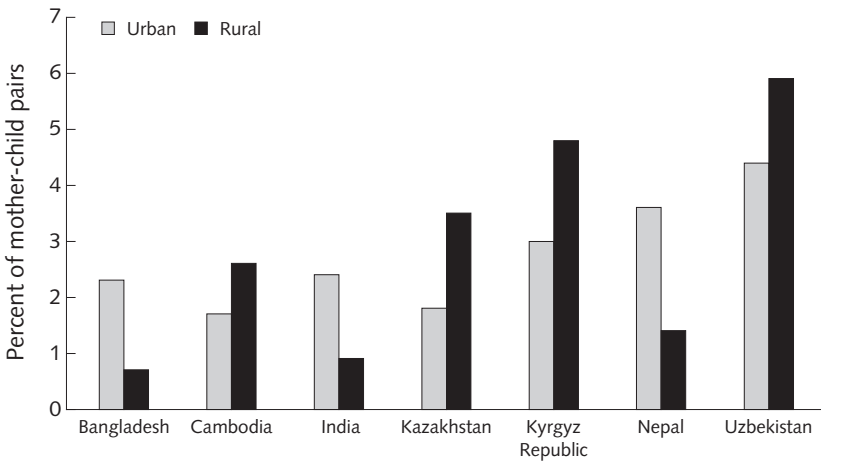

FIG. 8. Percentage of mother-child pairs consisting of stunted child and overweight mother
Source: Demographic and Health Surveys from seven Asian countries

the highest rate of overweight mothers in the region, at 47%, and Guatemala has the highest level of stunting, at 46%.

Surprisingly, SCOWT is not always more prevalent in urban than in rural areas (figs. 7–9). SCOWT, then, is not purely an urban phenomenon. This is because the prevalence of SCOWT is affected both by the rates of childhood stunting, which are consistently higher in rural than in urban areas, and by the prevalence of maternal overweight, which is almost always higher in urban areas.

In all Latin America countries except Haiti, the prevalence of SCOWT is actually higher in rural areas. In Asia, the prevalence of SCOWT is higher in the rural areas of four of seven countries, although prevalences are low in general and the urban-rural differences are small. In Africa, SCOWT prevalence is higher in rural areas in only three of 27 countries, but again, urban-rural differences are usually small. SCOWT primarily occurs in urban areas in Africa because fewer rural women than urban women are overweight (fig. 3), even though stunting levels are generally high in both rural and urban areas (fig. 6).

Association with economic development and urbanization

The regression results from the final model (**table 2**) show that economic development, as represented by GDP per capita, is associated with SCOWT but urbanization as such is not. Economic development is almost always positively associated with the prevalence of SCOWT across regions, though at a declining rate, as indicated by the negative coefficient on the squared term for GDP per capita. However, at GDP above US$1,691 per capita (a situation found in five of the

TABLE 2. Regression results[a,b]

Variable	Coefficient (standard error)	*p* value
Level of urbanization	.003 (0.032)	.94
GDP per capita	.003* (.001)	.01
GDP per capita squared	–8.87e–07* (2.79e–07)	.00
Africa dummy-urban	2.01* (1.36)	.01
Latin America dummy-rural	5.18* (1.43)	.00
Latin America dummy-urban	–3.09* (0.71)	.03
Intercept	1.87 (0.96)	.06

a. Dependent variable: SCOWT.
b. Adjusted $R^2 = 0.30$.
* Significant at $p < .10$. Asia-rural is the omitted dummy variable. Asia-urban and Africa-rural were not significantly different from Asia-rural and so are not included in this model. The coefficients on the Africa-urban and the Latin America-urban and -rural dummy variables are relative to Asia-rural.

study countries), the association becomes negative. This is consistent with our previous finding from analysis of the descriptive statistics that SCOWT depends on the prevalences of both stunting and overweight. At higher levels of economic development, stunting in particular may decline, and thus SCOWT may decline as well, resulting in an inverse U-shaped relationship between economic development and SCOWT.

The coefficients and levels of significance of some of the joint regional-urban dummy variables indicate that other factors within some regions, and urban and rural areas, are associated with SCOWT. The results indicate, however, that the associations with these factors do not differ between rural Africa and urban and rural areas in Asia. The associations in urban Africa and rural Latin America were significantly and positively different from these regional associations, whereas the association with urban Latin America was significantly and negatively different. We do not explore these regional relationships in more depth, but once again, when placing these areas along a continuum of economic development (and, logically, other related factors not included here but represented by these dummy variables), the results would suggest a relationship in the shape of an inverse U, with an increase from lowest levels (say, rural Africa) to higher levels (urban Africa and rural Latin America) and then a decrease at the highest levels (urban Latin America).

Discussion

This paper has attempted to identify how widespread the phenomenon of SCOWT is and the conditions under which SCOWT is more or less prevalent, in particular its association with features of the nutrition transition (economic development and urbanization). We find that SCOWT is not yet widespread, but in view of its higher prevalence in Latin America and its

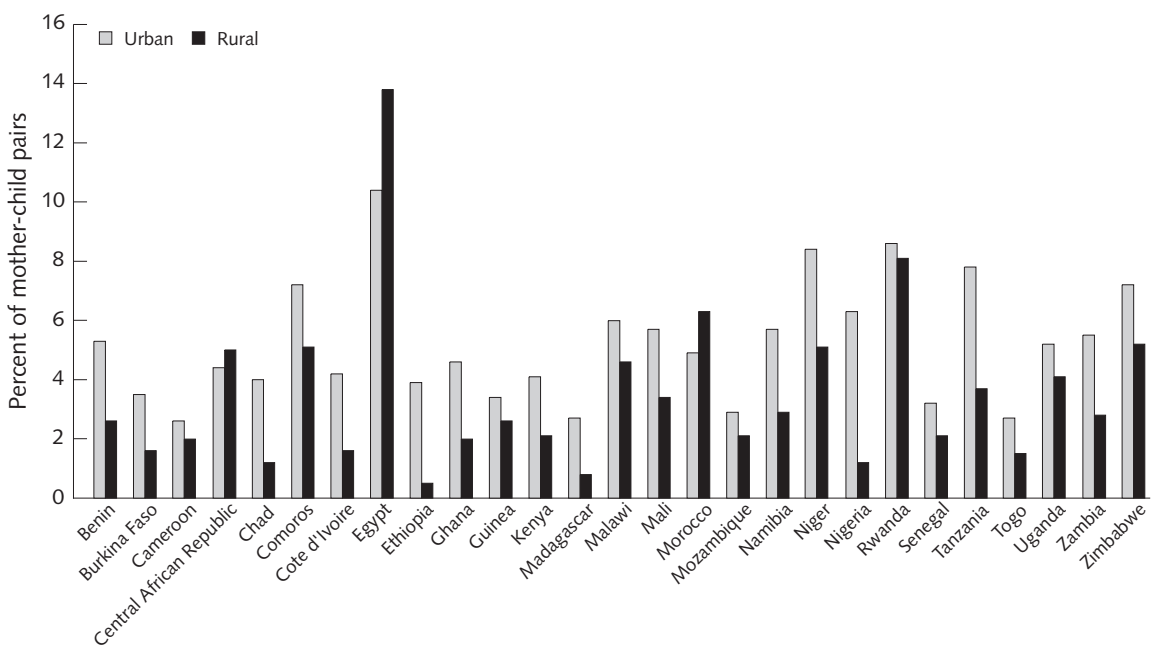

FIG. 9. Percentage of mother-child pairs consisting of stunted child and overweight mother
Source: Demographic and Health Surveys from 27 African countries

association with economic development, the findings suggest that policy makers need to be alert to it as countries advance economically and, potentially, enter the nutrition transition.

The prevalence of SCOWT in rural as well as urban areas confirms that SCOWT is not necessarily associated with living in an urban environment. Griffiths and Bentley [24] hint at this on the basis of data from the Indian state of Andhra Pradesh, where they found that socioeconomic status was a more important determinant of under- or overweight among women than was urban or rural residence. Popkin [25] also contends that it is not urban residence per se that causes overweight, but differences in lifestyle factors associated with an urban environment.

This may be because in countries with a higher level of economic development, both urban and rural areas are usually more integrated with economic markets. These rural areas may share lifestyle similarities with urban areas. Many farmers produce food not for subsistence or for their own consumption, but for cash. Mechanization of agricultural production reduces the level of physical activity. Rural towns are connected by roads and telecommunications with the rest of the world, just as are cities. The foods available to urban consumers are advertised and available in rural areas as well. The factors that lead to the nutrition transition and are associated with economic development [5] are apparent in rural as well as urban areas, and so the distinction becomes not that between urban and rural, or even between more and less urban, but between more and less developed (or industrialized).

Previous research on the coexistence of under- and overweight individuals in the same household [3, 7] indicated SCOWT could appear as part of a nutrition transition associated with increasing urbanization and economic development. Perhaps surprisingly, urbanization did not have a significant association with SCOWT in our study. But in fact, urbanization itself may not have any significant association with SCOWT beyond its correlation with economic development. Variation in the definition of "urban area" across countries could influence this result, as might collinearity of urbanization with GDP per capita. In further testing for collinearity, however, the coefficient on urbanization remained nonsignificant, even when GDP per capita terms were removed. On the other hand, the GDP per capita terms remained significant when the urbanization variable was omitted. The association with GDP per capita supports the hypothesis that SCOWT increases with economic development, up to a point. SCOWT appears to be most prevalent, as expected, roughly in those countries in the midst of the nutrition transition.

Of course, this ecological study explores only associations among SCOWT and social and economic processes at the population level. It does not investigate the exact causes of the emergence of under- and overnutrition in the same household, and findings cannot be applied to the individual or household level. For example, despite our finding that SCOWT is associated with higher levels of national GDP per capita, the poorest households within those countries could exhibit the highest levels of SCOWT. Still, the existence of SCOWT and its association with economic development encourages thinking about its causes and implications for policy, which can lead to some interesting hypotheses for future research to test.

Interpreting the SCOWT phenomenon as an expression of weakening intrafamilial associations of nutritional status, we pose a primary hypothesis that in the least developed countries, on average, household income tends to be a principal constraint on the household's ability to attain adequate nutrition for all household members. As incomes rise and countries become increasingly urbanized, *intra*household factors, including *individual* diets, activity, and disease patterns, emerge as relatively the most important determinants of nutritional status of household members. As one scenario, mothers could now be eating "enough" (or too many) calories, though possibly of low quality, while children still do not get "enough" of the right foods and suffer from other insults, such as disease, as well. In any case, generally speaking, household income is no longer the primary constraint to food security, and food security, as indicated by household caloric availability, is no longer the primary constraint to good nutrition.

Our hypothesis does find support in work of other researchers on developing societies. Monteiro et al. [15] argue that in less developed countries, undernutrition is highly dependent on food availability, so a high degree of intrafamilial association of nutritional status (say, underweight with underweight) should exist. In more developed countries, such as Brazil, where the problems of low income and lack of food are less widespread, undernutrition would be associated with specific diseases or individual characteristics. Intrafamilial association of nutritional status—of which SCOWT is one example—would be weaker in these higher-income developing countries.

The finding of Townsend et al. [26] that in the United States *low* income is associated with food insecurity and with overweight does not contradict this hypothesis. Partly this is a result of definitional differences. Townsend et al. [26] do not take "food insecurity" to mean calorie insufficiency, the indicator most commonly used in the developing-country context and what we mean here. Rather "food-insecure" women in the Townsend et al. [26] study eat enough, "but not always the foods the individual wants," and only "sometimes" do not get enough to eat. In fact, the authors exclude households that "often" do not get enough to eat, effectively excluding those households

more likely to be calorie insufficient. Among the few "severely food insecure" women in their sample (11 of 4,509), those who "often" do not get enough to eat, overweight is actually less prevalent, as expected.

Taken together as part of a global development continuum, these results suggest that the prevalence of overweight (or obesity) across income levels follows an inverted U-shape. Our own statistics show low prevalences of overweight mothers among the poorest nations. Monteiro et al. [27] looked at a country in the midst of the transition (Brazil) and found higher levels of obesity among the *higher*-income households of the *less* developed regions and among the *lower*-income households of the *more* developed regions. Likewise, Townsend et al. [26] found higher rates of overweight among lower-income households of a more developed country, the United States.

The emergence of a phenomenon such as SCOWT would also not be surprising, given that most research indicates that household members probably do not experience the changes in physical activity and diet that accompany the nutrition transition uniformly, leading to different individual outcomes [7, 28]. Indeed, differences in how infants and small children and adults experience the nutrition transition seem quite likely.

The process of economic development itself may also enhance the possibility of SCOWT. The so-called fetal origin hypothesis links fetal and early childhood nutrition to chronic disease risks later in life. The hypothesis is based on the premise that nutritional insults during critical periods of gestation and early infancy, followed by relative affluence, increase the risks of chronic diseases at adulthood [29–31]. Although most evidence to date links early malnutrition to the risk of diabetes, high blood pressure, and certain forms of cancers in adulthood, there is some indication of an association between childhood stunting and increased risk of obesity during adolescence and adulthood [32]. Thus, the prevalence of SCOWT, especially in those countries with historically high rates of childhood stunting that are now at higher levels of economic development, may be due to the fact that many children continue to experience stunting, while their stunted mothers are increasingly becoming obese as a result of increased household availability of food and energy.

On the other hand, other research supports the idea that a single factor, dietary quality, underlies the coexistence of under- and overnutrition in the same household [33]. If, as incomes increase, households address problems of hunger and energy insufficiency, dietary quality—the micronutrient content of the diet and its composition in terms of percentages of energy from saturated fats and refined sugars—may become the key nutritional constraint for both children and adults. Low dietary quality in children usually leads to inadequate micronutrient intake, which in turn causes micronutrient deficiencies and poor growth, health, and developmental outcomes. In adults, low-quality diets may result in micronutrient deficiencies and increase the risk of obesity because of the excessive amounts of energy, saturated fats, and refined sugars that these diets often contain. Poor dietary quality among energy-sufficient households may thus be related to SCOWT as well. Along these lines, overweight and obesity could exist among the stunted children in our SCOWT pairs, suggesting a broader role for micronutrient deficiencies as a cause and a lesser role for calorie insufficiency. Although recent research highlights the existence of an association between stunting and obesity in children in countries undergoing a nutrition transition [32, 34, 35], this does not appear to be a significant factor in our own sample. In only 4 of the 42 study countries were more than 5% of the stunted children overweight (> 2 SD of the WHO/NCHS/CDC reference standards).

Under either hypothesis, broadly speaking, improvements in feeding practices are called for. But in the case of an energy deficit, the most appropriate response would be changes in intrahousehold resource allocations, with more food for the child. In the case of micronutrient deficits, the quality of the diet should be improved with better, and not necessarily more, food.

Policy and program challenges

We began by noting that many would consider that in developing countries it would be likely for undernutrition to be common among members of the same household, or more generally, that nutritional status would be associated among household members. We took the prevalence of a specific example, SCOWT, where this was not the case.

The main point of the paper, however, was not to establish the statistical independence (or not) of the nutritional status of family members. For policy purposes more relevant is the fact that SCOWT is an important public nutrition phenomenon in some countries, and that these countries tend to be those with higher levels of economic development (in the context of developing-country regions). SCOWT thus poses a challenge for policymakers and programmers in developing and rapidly urbanizing countries. SCOWT is already a phenomenon that increases the complexity of nutrition and food-security interventions in Latin America. With increased economic development, SCOWT will probably emerge as a complicating factor in Asia and Africa as well.

Policy makers and programmers can no longer assume that those households with malnourished children are simply in need of "more food." They must tune their antipoverty and food and nutrition programs to a more complex reality. In higher-income developing countries, which tend to be more urbanized, policy

makers may need to emphasize changes in *individual* dietary and activity patterns and in caring and feeding behaviors, not only changes in general household access to food. They also need to address issues of dietary quality. In lower-income, and less urbanized, developing countries, however, policy makers may in fact need to continue paying attention to policies and programs that increase *household* food availability and access.

This analysis highlights the individual nature of nutritional status and food insecurity in transition countries. In these countries, policy makers and programmers must tailor policies and programs to deal with the conflicting demands of dietary excess and deprivation not only in the population, but also in the same household. The analysis reinforces Uauy and Kain's [36] concern that programmers must be careful when implementing feeding programs for children in countries in the "advanced stages of the transition," because lack of food may not be the primary constraint to good nutrition. It also casts doubt on the widespread, often informal, use of child nutritional status as an indicator of household-level food insecurity, especially in countries in transition.

To deal with the challenges of the nutrition transition, experiences in Brazil, China, and Finland suggest a number of elements of successful programs to improve diets and activity levels [37, 38]. Lessons from these programs suggest that interventions must involve a wide range of community actors, including health services and schools, homemakers' organizations, and community leaders, and encourage community ownership; build capacity among these community organizations; convey research-based messages on diet change, supported by health information and nutrition counseling; include the food industry as allies, and enact appropriate regulations, especially regarding labeling; and support appropriate amounts of physical exercise.

Although these programs encourage healthier eating and so are applicable to both undernourished (food-insecure) and overweight individuals, we have few examples of successful public nutrition programs that directly address the other part of the problem—undernutrition—at the same time. China's development of a diet-quality index and food guide pagoda is one of the few examples of a conceptual basis for policy-making that takes both deficiency and overconsumption into account [39].

We have few instances, however, of policies or programs that fully embrace the fact that they must simultaneously address over- and undernutrition. In general, even in transition countries, policy makers will still have to pursue policies to improve income, education, and health and hygiene behaviors. They must still ensure access to good health care, sanitation, and water for all. At the same time, they must develop strategies that respond to the differential needs of individuals within the household and do not affect just the household as a whole. The concrete recognition of this phenomenon could be an important step in delineating more effective and integrated strategies to do exactly that.

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Maternal employment and income affect dietary calorie adequacy in households in Sri Lanka

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Abstract

Nutritional deficiencies among children and mothers in lower-income households in Sri Lanka continue to be a major obstacle to the country's social and economic development. This study investigates the factors affecting dietary caloric adequacy in Sri Lanka, paying special attention to maternal income. An econometric analysis was performed using a household data set collected from a sample of 183 low-income households in the urban, rural, and estate sectors. The results showed that on average, mothers and children in the sample did not consume adequate levels of calories according to the recommendations of the Medical Research Institute of Sri Lanka. The mother's income and educational status, the number of children and adults in the family, and the ages, sexes, and birth orders of the children significantly influenced household and individual caloric adequacy. Specifically, the mother's income had a significant positive effect on the total caloric intake (CI) and caloric adequacy ratio (CAR) of the household, mother, and children and a significant negative effect on the relative caloric allocation (RCA) of the children. The results imply that when maternal employment generates extra income, the CIs of all individuals increase, yet the allocation of calories to the children of the household is reduced. Thus, provision of employment opportunities for mothers, along with adequate child-care facilities and nutritional educational programs, is a possible strategy to improve caloric adequacy among low-income households in Sri Lanka.

Key words: Dietary caloric inadequacy, gender, mother's income, Sri Lanka

Introduction

Poverty and malnutrition are two of the major developmental challenges facing Sri Lanka. Successive governments have identified the importance of a healthy and productive future generation for the economic and social development of the country, and have therefore placed much emphasis on improving the nutritional status of the people, especially children and mothers. Concurrent with poverty alleviation programs, governments have implemented special maternal and child nutrition improvement programs, as well as nutritional awareness programs through health clinics.

Despite such efforts, malnutrition has been continuously reported among mothers and children, especially those from low-income groups. Data on malnutrition among children and mothers, which is one of the results of dietary caloric inadequacy, show that the highest percentages of stunted (33.8%) and underweight (44.1%) children are recorded in the estate sector, followed by the rural and urban sectors. Furthermore, the highest percentage of malnourished mothers according to body mass index is recorded in the estate sector (58.6%), followed by the rural and urban sectors [1].

Household and individual income levels, sources of income, food habits, and household characteristics affect the food intake and thereby the dietary caloric adequacy of household members. Empirical evidence suggests that mothers play a significant role in determining the nutritional level of the household. Studies have shown that there are significant differences between the welfare benefits of income from men and that from women to the household, and the share of

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income generated by mothers makes a significant contribution to the proportion of the household budget that is allocated to education and staples.* Further, studies have shown that women's educational levels and status within the household, the health environment, and the care received by children affect the nutritional status of the children [2, 3]. At present, women in Sri Lanka are involved in many economic activities. Women workers are dominant in the tea plantation and garment sectors and as expatriate workers in the Middle East. It is expected that with the increase in income level of women, their bargaining power in the allocation of household resources will tend to increase. Previous studies have found that poor women in the tea plantation sector of Sri Lanka earn higher incomes than poor women in other sectors and have better access to health-care facilities and specially designed maternal nutrition programs, yet the level of nutrition of mothers and children still remains low [4, 5].

Given this context, the main objective of this study is to assess the dietary caloric adequacy among low-income groups in Sri Lanka, placing special emphasis on maternal income. The specific objectives are to determine the dietary caloric adequacy at the household and individual levels (children and mothers), and the factors affecting caloric intake and caloric adequacy at the household and individual levels and caloric allocation among different individuals in the same household.

Past studies

Many socioeconomic studies have been conducted in Sri Lanka to examine the nutritional status of households and the factors affecting food intake. Tudawe [6], who conducted a study on the nutritional status of people in the Kirindi Oya Project area, found that differences in distribution of income influenced nutritional intake. Gunasekara [7] found that the status of malnutrition, as measured by anthropometric indices, depends on the employment status of the mother, the number of living children, the pregnancy status of the mother, and her level of education. However, only a few studies have considered the effect of the income level of mothers on dietary caloric adequacy. It was found that the maternal nutritional status of tea plantation workers, as measured by caloric intake and health status, was low compared with that of many other segments of Sri Lankan society. It was also found that nutritional status and health status are the results of specific income-related, work-related, historical, social, and structural factors [4, 5]. Rathnayake and Weerahewa [8], following Senaur et al. [9], conducted a study to identify the factors determining intrahousehold allocation of calories among the urban poor. They found that on average children and mothers do not consume adequate calories in comparison with fathers. They also found that the mother's income had a significant positive effect on her own relative caloric allocation and a significant negative effect on the children's relative caloric allocation.

Studies conducted in other countries have found that improvements in women's educational levels help to reduce the level of malnutrition among children [10]. Furthermore, according to Smith et al. [11], the nutritional status of children can be improved by improving women's social status or their power relative to men. Fabella [12] found that the food intake of children increased with increased family income, and that increase in the educational level of the mother helped to increase the food intake levels of girls.

Methods

The caloric intake (CI), caloric adequacy ratio (CAR), and relative caloric allocation (RCA) of households, fathers, mothers, and children were considered the indicators of dietary caloric adequacy in the analysis. CI was calculated from the food-consumption levels of different individuals and the caloric content of different food items. This measure does not consider the individual caloric requirements, and hence it does not give any clear picture of caloric adequacy. CAR was calculated by dividing the actual CI of an individual by the recommended daily allowance of calories for each individual. CAR measures the proportion of the recommended level of CI consumed by an individual family member. Age- and sex-specific values of daily levels of calories recommended by the Medical Research Institute (MRI) of Sri Lanka were used for the individuals in all the sectors [13]. The values of per capita daily allowance of calories recommended by the World Health Organization (WHO) and the MRI of Sri Lanka are the same. However, there are differences between the vitamin and iron daily recommendations suggested by WHO and MRI, which were not considered in this study. These daily caloric requirements are not adjusted for activity levels of the individuals, because of the unavailability of data for the urban and estate sectors. In order to find out the nature of food allocation among household members, RCA was used as the indicator. The RCA is the ratio between the CARs of individuals and the household CAR, and it measures the distribution of calories among individuals in relation to the total number of calories available to the household. It delineates not only nutritional adequacy but also the distribution of calories among household members.

Multiple regression analysis was performed to determine the factors affecting CI, CAR, and RCA. Separate

* Thomas D, Chen CL. Income shares and shares of income: empirical tests of models of resource allocation. University of California, Los Angeles, USA, Mimeo, 1993.

models were estimated for households, mothers and children. CI, CAR, and RCA were used as the dependent variables, and the income levels, educational levels, and ages of the mothers and fathers, the family size, and the sex, birth order, and ages of the children were considered as the independent variables. The mother's pregnancy or lactation status was also included where appropriate. If the mother was pregnant, a value of one was assigned, and zero was assigned otherwise. Similarly, if the mother was lactating, a value of one was assigned, and zero was assigned otherwise.

Caloric adequacy elasticities with respect to the mother's income level were also calculated for households and individuals in the total sample by using the following functional forms (note that Y is the indicator of caloric adequacy, X is the vector of independent variables with $j = 1,\ldots,n$ where $j = 1$ indicates mother's income):

(i) The linear model was specified as $Y_i = \alpha + \sum_{j=1}^{j=n} \beta_j X_{ij}$, and in this formation the caloric adequacy elasticity is given by $\eta_1 = \beta_1 \bar{X}_1 / \bar{Y}$.

(ii) The log-log model was specified as $\ln Y_i = \alpha + \sum_{j=1}^{j=n} \beta_j \ln X_{ij}$, and in this formation the caloric adequacy elasticity is given by $\eta_1 = \beta_1$.

(iii) The log-linear model was specified as $\ln Y_i = \alpha + \sum_{j=1}^{j=n} \beta_j X_{ij}$, and in this formation the caloric adequacy elasticity is given by $\eta_1 = \beta_1 \bar{X}_1$.

(iv) The linear-log model was specified as $Y_i = \alpha + \sum_{j=1}^{j=n} \beta_j \ln X_{ij}$, and in this formation the caloric adequacy elasticity is given by $\eta_1 = \beta_1 / \bar{Y}$.

The field surveys conducted by Rathnayake and Weerahewa [8] during December 2001–March 2002 and by Wijewantha* and Shyamalie** during December 2002–March 2003 at the Department of Agricultural Economics and Business Management, University of Peradeniya, Sri Lanka, were used to extract relevant data. When the survey was conducted, these researchers were students at the University of Peradeniya, and they gathered these data in order to complete their research work under the supervision of the second author of this paper. The relevant authorities of the University of Peradeniya gave approval to conduct the above studies. The sample included 260 low-income households, which consisted of 60 households from an urban area (Kandy Municipal Limits), 100 from a rural area (Polonnaruwa District), and 100 from an estate area (St. Coombs Estate in Thalawakale). In the urban area, data were collected from four purposely selected Gramasevaka divisions, since lower-income groups are concentrated in these areas. Those divisions were Suduhumpola, Deyyannewela, Bahirawakanda, and Mahayyawa. In the rural area, data were collected from five randomly selected Gramasevaka divisions: including Bandiwewa, Alikimbulawa, Katukaliyawa, Bogahadamana, and Yudaganawa. From this sample, households whose monthly income fell below Rs 1,206.04 (US$1 = Rs 94.95) per person and that consisted of a father, a mother, and their children (i.e., nuclear families) were selected for the analysis. A monthly income of Rs 1,206.04 per person was considered the poverty line.*** This limited the sample to 43, 60, and 80 households from the urban, rural, and estate areas, respectively.

The researchers used structured questionnaires to collect data on food consumption and household characteristics. The questionnaire was developed by the researchers themselves and was initially pretested on 20 households in the urban area. During the pretest, it was found that the main difficulties were collecting reliable data on household income levels and daily food-consumption levels by recall. As a remedy, a few indirect questions were included in the questionnaire to cross-check the responses. For example, in addition to monthly income levels, questions on monthly expenditure levels were also included. Furthermore, questions on individual food-consumption levels were more disaggregated. Separate pretests were conducted in the rural and estate sectors, and subsequent modifications were made for the questionnaire used in the urban sector. The first survey was carried out in the urban sector by the first author of this paper, and instructions were provided to others to carry out the other two surveys.

Individual food-consumption data for the previous 24-hour period for all family members were collected by the recall method. Data on meals and snacks eaten out of the home were also collected by the recall method. The family members were asked the amount of food they had consumed during the previous 24-hour period. The questions were directly asked of the

* Wijewantha V. An assessment of intra-household allocation of calories: A case study of rural poor in Polonnaruwa. Unpublished project report. Department of Agricultural Economics, University of Peradeniya, Peradeniya, Sri Lanka, 2003.

** Shyamalie HW. 2003. An assessment of intra-household allocation of calories: A case study of estate poor in Thalawakale. Unpublished report. Postgraduate Institute of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka, 2003.

*** Siddhisena KAP, Jayathilaka MDRK. Identification of the poor in Sri Lanka: Development of composite index and regional poverty lines. Colombo: Institute of Policy Studies, 2003.

mother (or if not, of a female adult) of the household, since food allocation is done mainly by mothers or by other female members of the household. The main limitations of the recall method for gathering food-consumption data are that the respondent cannot precisely recall food-consumption levels and that the day on which the interview is conducted may not be representative. Therefore, food-consumption data were collected on five randomly selected days within a period of one month by making personal visits to each household. The caloric content of each meal of each family member except infants was calculated from standard food-conversion tables. The main limitation of the questionnaire, apart from the difficulties associated with recall, is that it is lengthy, requiring approximately 40 minutes to be filled in by the interviewer.

Table 1 shows selected socioeconomic characteristics of the sample. As stated earlier, the data set gives information from 183 nuclear families. An average household consisted of approximately three adults and two children. On average, a family earned a monthly income of Rs 5,232.40, of which the contribution of the mother was Rs 1,435.50, far below the amount contributed by men. The average educational level of the mothers and fathers in the sample was six years.

Results

Table 2 shows the status of caloric adequacy among different individuals in different sectors. On average, the subjects had a CAR of less than 1, implying that the CI was inadequate. However, there were differences between different sectors and different individuals. All the individuals in the rural sector had CARs of less than one, whereas only the children in the estate sector had a CAR of less than one.

Regression analysis was performed to identify the determinants of CI, CAR, and RCA, focusing on mothers and children, since they were the individuals who did not consume adequate amounts of calories. In addition, the determinants of household CI and CAR were examined. A number of specifications were estimated to identify the determinants by including different types of independent variables and using various functional forms.

Linear models were found to be satisfactory for the CI of households and mothers, and a log-linear model was found to be satisfactory for children. **Table 3** presents the results of the analysis. The results clearly show that the mother's income has a significant positive effect on the CIs of the household, mother, and children. It was found that the income earned by fathers did not have a significant effect, although the coefficients have the expected positive sign. Among education variables included in the specifications, the mother's education had a positive and significant effect only on the mother's CI, suggesting that the number of years of formal education of the mother influences only her own CI. The results also indicate that when mothers are older, they tend to consume more calories and feed their children well. Among children, boys consume more calories than girls. Also, the elder children were fed better than the younger children, as revealed by the coefficient for birth order. Larger families, as measured by the number of adults and children, consume more calories.

Among the specifications tested to identify the determinants of CAR of households, mothers, and children, linear specification was found to be satisfactory for households and mothers and log-linear specification for children. The analysis clearly shows a positive relation between the mother's income and the CARs of the household, the mother, and the children (**table 4**). Contrary to the popular belief that education has a strong positive impact in alleviating caloric inadequacy, the higher the level of the mother's education, the lower the CAR of the children and the higher the CAR of the mother. The larger the family size, the lower is the household CAR, but the larger the number of adults, the higher is the CAR of the children. The latter result implies that such adults, i.e., elder children in the family, help in child-care activities. Among children,

TABLE 1. Socioeconomic characteristics of the sample

Independent variable	Level	Mean	SD
Age (yr)	Father	38.51	13.98
	Mother	36.20	11.78
	Children	9.87	4.58
Educational level (yr)	Father	6.43	3.68
	Mother	6.31	3.69
Income (Rs/month)[a]	Total	5,232.40	2,094.89
	Father	3,495.69	1,643.36
	Mother	1,435.50	1,806.17
Birth order	Child	2.15	1.12
Family size	Adults	2.57	0.94
	Children	1.96	1.23

a. US1$ = Rs 94.95.

TABLE 2. Caloric adequacy ratio (CAR) for children, mothers, fathers, and households in the different sectors

Group	Rural	Urban	Estate	Sri Lanka
Children	0.56 (n = 124)	0.77 (n = 66)	0.76 (n = 152)	0.69 (n = 342)
Mothers	0.77 (n = 60)	0.87 (n = 43)	1.06 (n = 80)	0.95 (n = 183)
Fathers	0.79 (n = 60)	1.04 (n = 43)	1.06 (n = 80)	0.96 (n = 183)
Households	0.69 (n = 60)	0.88 (n = 43)	0.97 (n = 80)	0.85 (n = 183)

TABLE 3. Regression results for caloric intake (CI)[a]

Variable	Category	Households	Mothers	Children
Intercept		321.84 (757.77)	900.47** (229.58)	6.40** (0.13)
Income	Mother	0.44** (0.08)	0.10** (0.02)	4.37E–05** (0.00)
	Father	0.01 (0.09)	0.72E–02 (0.02)	4.19E–06 (0.00)
Education	Mother	–53.95 (43.79)	33.10* (13.26)	–6.29E–03* (0.00)
	Father	7.38 (48.91)	–3.70 (14.81)	NA
Age	Mother	–13.72 (15.48)	10.10* (4.69)	8.26E–03* (0.00)
	Father	37.01** (12.34)	1.36 (3.73)	NA
	Child	NA	NA	3.85E–02** (0.00)
	Child's birth order	NA	NA	–7.01E–02** (0.02)
Family size	No. of children	1,039.26** (130.65)	25.19 (39.58)	1.88E–03 (0.02)
	No. of adults	1,574.94** (197.80)	–32.86 (59.92)	5.41E–02 (0.03)
Child's sex	(Male = 1, female = 0)	NA	NA	0.10** (0.03)
Other	Pregnancy (yes = 1, no = 0)	NA	NA	NA
	Lactation (yes = 1, no = 0)	NA	NA	NA
Statistical criteria	R^2	0.54	0.19	0.47
	No. of observations	183	183	342
	Functional form	Linear	Linear	Log-linear

NA, variables not included in the analysis.
a. Numbers in parentheses are standard errors.
*$p < .05$; **$p < .01$

TABLE 4. Regression results for caloric adequacy ratio (CAR)[a]

Variable	Level	Households	Mothers	Children
Intercept		1.11*** (0.08)	0.41*** (0.12)	–0.56*** (0.13)
Income	Mother	0.44E–04*** (0.95E–05)	0.56E–04*** (0.13E–04)	4.59E–05*** (0.00)
	Father	–0.91E–06 (0.11E–04)	–0.11E–05 (0.15E–04)	1.60E–07 (0.00)
Education	Mother	–0.70E–02 (0.51E–02)	0.01** (0.70E–02)	–8.53E–03* (0.00)
	Father	0.27E–02 (0.57E–02)	–0.30E–02 (0.78E–02)	NA
Age	Mother	–0.26E–02 (0.18E–02)	–0.73E–02*** (0.24E–02)	5.61E–03* (0.00)
	Father	0.26E–02* (0.14E–02)	0.13E–02 (0.19E–02)	NA
	Child	NA	NA	–4.49E–03 (0.00)
	Child's birth order	NA	NA	–7.08E–02*** (0.02)
Family size	No. of children	–0.08*** (0.01)	0.61E–02 (0.02)	–1.57E–02 (0.02)
	No. of adults	–0.05** (0.02)	–0.01 (0.03)	6.40E–02* (0.03)
Child's sex	(Male = 1, female = 0)	NA	NA	6.76E–02** (0.03)
Other	Pregnancy (yes = 1, no = 0)	NA	NA	–0.32*** (0.09)
	Lactation (yes = 1, no = 0)	NA	NA	–2.27E–02 (0.06)
Statistical criteria	R^2	0.21	0.23	0.20
	No. of observations	183	183	342
	Functional form	Linear	Linear	Log-linear

NA, variables not included in the analysis.
a. Numbers in parentheses are standard errors.
*$p < .10$; **$p < .05$; ***$p < .01$

the boys are better nourished than the girls, and elder children are better nourished than younger children. Further, when the mother is pregnant or lactating, calorie adequacy among children tends to be reduced.

Regression results for RCA are presented in **table 5**. Log-linear and linear specifications were found to be satisfactory for mothers and children, respectively. The results show that the mother's income has no significant effect on her own RCA but has a significant negative effect on the children's RCA. The results also imply that more-educated mothers allocate more calories to themselves than do less-educated mothers. Among children, male children get a fair allocation of food compared with female children, and elder children get a fair allocation compared with younger children in a family.

The above results very clearly indicate that extra income earned by mothers by engaging in employment has a significant impact on caloric adequacy. This aspect is highlighted in **table 6** by the use of caloric adequacy elasticities, which indicate that the CI and CAR of households, mothers, and children are increased by increased maternal income. Formal education is not sufficient to alleviate caloric inadequacy, and hence specifically targeted nutritional programs will be needed. Furthermore, as the conventional wisdom suggests, provision of adequate care is important in alleviating nutritional deficiencies.

Conclusions and policy implications

This study investigated the status of dietary caloric adequacy and assessed the impact of different characteristics of mothers on caloric adequacy in low-income households in Sri Lanka. CI, CAR, and RCA were used as indicators of caloric adequacy. The data were obtained from a survey conducted in an urban, a rural, and an estate area. Separate regression analyses were performed using CI, CAR, and RCA of mothers and children and CI and CAR for households as depend-

TABLE 6. Caloric intake (CI), caloric adequacy ratio (CAR), and relative caloric allocation (RCA) elasticities with respect to mother's income[a]

Level	Measure	Elasticity
Household	CI	0.08*
	CAR	0.67*
Mother	CI	0.08*
	CAR	0.81*
	RCA	0.14
Children	CI	0.05*
	CAR	0.05*
	RCA	–0.03*

a. For calculation of elasticities, the mean income level of the mothers was considered at Rs 1,435.50 (US$1 = Rs 94.95).
*$p < .01$

TABLE 5. Regression results for relative caloric allocation (RCA)[a]

Variable	Level	Mothers	Children
Intercept		–0.16* (0.08)	0.73*** (0.08)
Income	Mother	0.11E–04 (0.77E–05)	–2.34E–05*** (0.00)
	Father	–0.10E–04 (0.92E–05)	–6.12E–06 (0.00)
Education	Mother	0.92E–02** (0.43E–02)	–4.61E–03 (0.00)
	Father	–0.01*** (0.47E–02)	7.18E–03** (0.00)
Age	Mother	–0.10E–03 (0.19E–02)	–6.57E–04 (0.00)
	Father	–0.19E–03 (0.12E–02)	NA
	Child	NA	1.06E–02*** (0.00)
	Child's birth order	NA	–2.94E–02** (0.01)
Family size	No. of children	0.08*** (0.01)	2.88E–02** (0.01)
	No. of adults	0.06** (0.01)	1.78E–02 (0.02)
Child's sex	(Male = 1, female = 0)	NA	8.24E–02*** (0.02)
Other	Pregnancy (yes = 1, no = 0)	NA	NA
	Lactation (yes = 1, no = 0)	NA	NA
Statistical criteria	R^2	0.29	0.18
	No. of observations	171	342
	Functional form	Log-linear	Linear

NA, variables not included in the analysis
a. Numbers in parentheses are standard errors.
*$p < .10$; **$p < .05$; ***$p < .01$

ent variables. Household characteristics, including the income, education, and age of the mothers and fathers, the age, gender, and birth order of the children, and family size, were considered as independent variables.

The mean CARs of households, mothers, and children were 0.85, 0.95, and 0.69, respectively, indicating that on average, households, mothers, and children did not consume adequate levels of calories as compared with the daily recommended levels. The results of the regression analysis show that the income level of the mother has a statistically significant positive impact on the CI and CAR of the households, mothers themselves, and children. This clearly implies that the higher the income of the mother, the higher the CI and the lower the calorie inadequacies of all individuals in the household. The regression results also indicate that the mother's income had a statistically significant negative effect on children's RCA. This result does not indicate that the nutritional status of the children is worsened when the mother works, because the actual CI and CAR of the children increase when their mother works. This phenomenon could be due to the fact that mothers do not have adequate time to carry out the allocation of food when they are employed. Furthermore, the results showed that the mother's educational level, as measured by her years of formal education, did not have a significant positive effect on caloric adequacies. Rather, the children's CAR increased as the number of adults in the household increased, a result implying that the adults were providing more care to the children.

The findings of this study have a number of policy implications. They suggest that significant improvements in the dietary caloric adequacy of children can be achieved by improving the level of income of mothers in low-income households in Sri Lanka. However, the results indicate that increasing mothers' incomes alone is not an effective strategy to improve the nutritional status of children, since the increase in mothers' incomes is associated with a reduction in the relative allocation of calories to children. The study emphasizes the importance of providing child-care facilities for working mothers. Furthermore, it recommends investments in targeted nutritional education programs, since formal education, as measured by years of schooling, does not seem to contribute to the alleviation of caloric inadequacies.

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Short Communication

The effect of family structure on a sample of malnourished urban Nigerian children

Lola Adekunle

Commentary

This article is of interest because it provides a different lens through which to view the role that family structure plays in the nutritional status of children. In addition to looking at socioeconomic factors, such as parental employment status, the author also looked at the mother's seniority among the wives in polygamous households. It was found that children of the first wife were more likely to be malnourished, supporting the author's assertion that these wives and their children are more likely to be neglected. At the same time, the study failed to support the notion that higher birth order is related to malnourishment. This finding is of interest because it contradicts many other studies that have found a link between higher parity (or increasing birth order) and risk of being malnourished. However, the study did not examine the total number of children in these households, raising the possibility that this could have been a significant factor. Finally, this study will be interesting to those who are interested in gender differences in care-seeking behaviors. The fact that almost two-thirds of the children in this hospital-based study were males raises the possibility that parents were less likely to seek treatment for female children, as has been documented in Southeast Asia.

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Abstract

This study focused on the role of family structure in 458 malnourished children under five years of age clinically diagnosed with protein-energy malnutrition (PEM), kwashiorkor, and marasmus. The majority of these children were of higher birth order (3rd child and higher): 63.2% based on the mother's parity and 56.4% based on the father's parity. More than half (54.8%) of the malnourished children's mothers were the first wives of their respective husbands. About 43.9% of the children's fathers were urban danfo *(public minibus transport) drivers. Half (51.5%) of the mothers who claimed to be single opted into single status and were mostly from polygamous households, but 87.6% of the children were from polygamous families, of which 18.6% of the mothers had divorced. Only 27.7% of the children lived with both parents; 40.4% lived with their grandparents, and 37.8% were the financial responsibility of their grandparents. We observed an association between children treated for malnutrition and father's occupation, parents' marital status, mothers' seniority among other wives, and source of financial responsibility for the children.*

Key words: Family structure, malnutrition, risk factors

Introduction

An estimated 85% of children born in the world live in developing countries. Of these children, 10% die before they reach the age of one year, and 4% die of malnutrition and other diseases before they are five years old [1]. The most affected are usually the children of illiterate parents in low socioeconomic brackets who have low purchasing power in the economy. The effect of malnutrition on the susceptibility of these children to a wide range of diseases has long been a major research concern. Several observations have shown that the nutritional status of children prior to the onset of serious infections has a large effect on how well they withstand the infection [2–4]. Several studies have

shown that children who are already malnourished suffered severe complications of measles and have a higher mortality rate than adequately nourished children with measles [5–10].

Children in low socioeconomic groups commonly suffer from inadequate nutrition [11,12]. The economic and political situation in Nigeria probably has increased stress on family structure. The purpose of this study was to assess the effect of conditions that might be associated with malnutrition. There is little doubt that family structure and social conditions constitute a major influence on child nutrition, but there is little or no information on the role of family structure, and the stresses on it, in malnutrition.

Methods

This investigation was conducted in Ibadan, the capital of Oyo State in Nigeria. The sampling procedure involved the consecutive selection of 458 children under five years of age who were hospitalized for severe malnutrition and received treatment at three major hospitals: University College Hospital, Adeoyo Hospital, and Oluyoro Catholic Hospital. The aim was to assess the family structure and other sociodemographic characteristics of the malnourished children's families. Each child was automatically selected into the sample based on admission for malnutrition. All the families selected voluntarily participated in the study, which was approved by the University institutional review board.

Detailed family histories, as well as socioeconomic and demographic characteristics of the parents of the children, were obtained by structured questionnaires and interviews; in addition, information regarding family stability, potential stressors experienced by the family, and family social conditions was recorded.

Results

The demographic characteristics of the 458 malnourished children were as follows: 55.7% were male and 44.3% were female; 41.3% were two or three years old; 15.5% were one year old or younger; 34.5% were four

TABLE 1. Demographic characteristics of the malnourished children (n = 458)

Characteristics	No. (%)	Characteristics	No. (%)
Sex		Mother's marital status	
Male	255 (55.7)	Single	236 (51.5)
Female	203 (44.3)	Married	107 (23.4)
Age (yr)		Separated/divorced	85 (18.6)
≤ 1	71 (15.5)	Deceased	30 (6.6)
2–3	189 (41.3)	Family structure	
4–5	158 (34.5)	Monogamous	57 (12.4)
≥5	40 (8.7)	Polygamous[a]	401 (87.6)
Birth order based on mother		Mother's seniority among wives	
1	83 (18.1)	1	251 (54.8)
2	92 (20.1)	2	90 (19.7)
3	88 (19.2)	3	30 (6.6)
4	58 (12.7)	4	87 (18.9)
≥5	137 (29.9)	Financial responsibility for child	
Birth order based on father		Both parents	71 (15.5)
1	96 (20.9)	Mother only	143 (31.2)
2	104 (22.7)	Father only	55 (12.1)
3	134 (29.3)	Grandparents	173 (37.8)
4	65 (14.2)	Other relatives	16 (3.5)
≥5	59 (12.9)	Child's living arrangement	
Father's occupation		With both parents	127 (27.7)
Civil servant/clerk	30 (6.6)	With mother only	85 (18.6)
Skilled worker (e.g., artisan)	69 (15.1)	With father only	42 (9.2)
Semiskilled worker (e.g., driver)	201 (43.9)	With grandparents	185 (40.4)
Unskilled worker	114 (24.9)	With other relatives	19 (4.1)
Unemployed	44 (9.6)		

a. The majority of women who claimed to be single were from polygamous households. They actually opted out of the marriage to remain single for lack of financial support from their spouses.

or five years old; and 8.7% were five years old or older (**table 1**).

The family structures break down as follows: 43.9% of the children belonged to families with fathers who held semiskilled jobs, mainly as urban *danfo* drivers; 24.9% belonged to families whose fathers were employed as unskilled laborers, such as in farming or petty trading; 9.6% of the fathers were unemployed; 15.1% were artisans; and 6.6% were civil servants/salary earners.

Of the 107 mothers who were married, 54.8% were the first wives of their husbands, 19.7% were second wives, 18.9% were fourth wives, and 6.6% were third wives. A little more than half (51.5%) of the mothers were single parents, 23.4% were married, and 18.6% were divorced, and 6.6% were deceased.

The majority of the children (87.6%) were from polygamous families, and only 12.4% were from monogamous families; 40.4% of the children lived with their grandparents, 27.7% with both parents, 18.6% with their mothers alone, 9.2% with their fathers alone, and the remaining 4.1% with other relatives. Only 15.5% of these children were being financially supported by both parents; 37.8% were supported by their grandparents, 31.2% by their mothers alone, 12.1% by their fathers alone, and the remaining 3.5% by other relatives.

Over 50% of the children were of higher birth order (3rd position and higher): 61.8% with respect to their mother and 56.4% with respect to their father. Of the mothers of the 458 malnourished children, 38% were between 20 and 29 years of age, 26.2% were between 30 and 39 years of age, 22.7% were under 20 years of age, and 13.1% were 40 years old or older. Of the mothers, 41.7% had primary education, 36.5% had only a Quranic education, 19.4% were illiterate, and only 2.4% had postprimary education. Half of the mothers (50.4%) were traders, 35.2% earned salaries, 12.9% were housewives, and 1.5% were students.

The prevalence of malnutrition was strongly related to the father's occupation, the mother's seniority among other wives, the mother's parity, and the child's living pattern (where the child lived and with whom) ($\chi^2 = 0.791$, 0.681, 0.771, and 0.613, respectively).

Discussion

There is little doubt that parental occupation, especially the father's employment status and ability to take responsibility for his family, plays a major role in child malnutrition [13, 14]. In this study, about half of the malnourished children belonged to families in which the fathers were semiskilled or unemployed. About half of the mothers were petty traders with low means of livelihood.

Other risk factors for malnutrition were the social conditions of the family, the living pattern of the children (where the children lived and with whom), the level of economic cooperation among the parents, and the level of financial stress experienced by the family. One of the most distinguishing features of the family as a subject of social interest is its importance as the basic unit of social life. Several studies have shown that the economic strength of a family, especially the father's occupational status, is highly correlated with family health [6, 9, 10, 15].

Although economic strength is no doubt important, it is apparent from this study that the level of interpersonal relationship that existed between the husband and wife, i.e., economic and financial cooperation for proper care of the children, was far more important. Only a few of the children belonged to families that included such cooperation. Interestingly, the majority of the mothers in this study were first wives. In a strictly traditional home, it is not uncommon for the husband to neglect, emotionally and financially, the first wife and her children. Simple analysis of the correlation coefficient showed that father's occupation, mother's seniority among other wives, mother's parity, and child's living pattern were major factors in the child's malnutrition. Only 15% of the children were financially supported by both parents and only 12% by their fathers; 38.7% were supported by their grandparents, while 30% of the mothers stated that they were solely responsible for their children, without any financial support from their husbands.

We did not have a control group in this study so our observations in the study group cannot be compared with a group similar except for presence of malnutrition. However, our observation of these families with severely malnourished children indicate that full family support, especially from fathers, is an important factor in a child's nutritional status.

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Letter to the Editor

In response to Gargari et al., "Prevalence of overweight and obesity among high-school girls in Tabriz, Iran, in 2001"

To the Editor:

I would like to congratulate Dr. Gargari on the work he has done on assessing the prevalence of overweight and obesity among high-school girls in Tabriz, Iran, [1]. This will undoubtedly contribute to the pool of much-needed data on obesity in the Asia region. However, I would like to make some comments about the methodology the authors adopted during the analysis of the data.

1. Why were NHANES I percentiles used when body-mass index (BMI)-for-age percentile charts from NHANES III were available online at the time of this study? [2]
2. The International Obesity Task Force (IOTF) cutoff values given for female adolescents are confusing. According to the published IOTF cutoff values, [3] the reference BMI cutoffs were not given as a range for a specific age range, but as a specific cutoff value for each age. It is true that IOTF published the BMI cutoffs for every six-month age group from 2 to 18 years. However, for a child whose age falls between an age group for which cut off values have been given (e.g., 14 years and 9 months, or 9.75 years) the BMI cutoff for overweight or obesity should be calculated by linear extrapolation.

   The BMI ranges that are given for overweight are likewise confusing. For example, the BMI range for overweight among 14- to 14.9-year-old girls was given as 23.66 to 28.87, but the two figures are the BMI cutoffs for overweight and obesity, respectively, in 14.5-year-old girls. If I were to determine the state of obesity/overweight in a girl 14 years and 11 months old with a BMI of 28.9, would this child be classified as obese? Not really, since the cutoff would be 28.87 + (29.11–28.87/6 months × 5 months) = 29.07. So this child is not obese but only overweight. Therefore, if this correct technique were used, I am sure the prevalence would change.
3. When IOTF overweight and obesity cutoffs are compared with the 85th and 95th percentiles, respectively, of the NCHS/CDC 2000 BMI-for-age charts, the 95th percentile of BMI-for-age is lower than the age-matched IOTF BMI cutoff for 14- to 16.9-year-old girls. Therefore, I believe that the number of children diagnosed as obese according to IOTF should be lower than the number of children diagnosed as obese according to the NCHS/CDC 2000 charts for the age group from 14 to 16.9 years.
4. Finally, please clarify where the underweight definitions were drawn from. To the best of my knowledge, the best references for definition would be the WHO Technical Report on Physical Status: The use and interpretation of anthropometry [4]**.** Underweight is a descriptive term based on weight-for-age parameters, and this report dismisses the use of weight-for-age in adolescents (page 272, paragraph 3). The descriptive terms related to BMI-for-age are thinness, overweight, and obesity (page 271, table 29). Thinness is defined as BMI-for-age < 5th percentile. Therefore, I think that definition should be used universally in defining thinness or underweight.

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Author's response

To the Editor:

I thank Dr. Wickramasinghe for his thoughtful remarks on our paper on overweight and obesity in high-school girls in Tabriz [1]. The authors' responses appear below.

1. We used two criteria.
   - » One is the BMI cutoffs of Must et al. [2], which are based on the NHANES I study. These cutoffs have been introduced by the World Health Organization/National Center for Health Statistics (WHO/NCHS) for international use. A WHO expert committee recommended BMI at or above the 85th percentile for international use to classify adolescents as overweight [3], whereas the National Center for Health Statistics/Centers for Disease Control and Prevention (NCHS/CDC) BMI cutoffs are based on the 2000 CDC BMI-for-age-growth charts for the United States and thus are country-specific. I do not think that these cutoffs have been introduced by WHO for international use. In this set, based on current recommendations of expert committees, children with BMI values at or above the 95th percentile of the sex-specific BMI growth charts are categorized as overweight [4].
   - » The other is the IOTF [5] sex- and age-specific BMI cutoffs. These were developed on the basis of data from many nations, including Brazil, Great Britain, Hong Kong, the Netherlands, Singapore, and the United States. They are derived from sex-specific curves that pass through a BMI of 25 and 30 by age 18 years for overweight and obesity, respectively.
2. We used the midyear values (for example, 14.5-year BMI values for the 14- to 15-year age group) for definitions of overweight and obesity. If we want to define a person as overweight or obese in the clinical setting, we need to linearly interpolate BMI cutoffs to the subject's exact age, whereas for epidemiologic use, with age groups one year in width, the cutoff point at the midyear value will give an essentially unbiased estimate of the prevalence, as Cole et al. [5] have discussed.
   - » According to table 4 in Cole et al. [5], the IOTF BMI cutoffs that correspond to BMI = 25 kg/m^2 in adults for the middle of the female age groups 14–15, 15–16, 16–17, and 17–18 years are 23.66, 24.17, 24.54, and 24.85 years, respectively.
   - » According to table 4 in Cole et al. [5], the IOTF BMI cutoffs that correspond to BMI = 30 kg/m^2 in adults for the middle of the female age groups 14–15, 15–16, 16–17, and 17–18 years are 28.87, 29.29, 29.56, and 29.84, respectively.
   - » Therefore, we considered BMI values of 23.66–28.87, 24.17–29.29, 24.54–29.56, and 24.85–29.84 to indicate overweight, and BMI values of ≥ 28.87, ≥ 29.29, ≥ 29.56, and ≥ 29.84 to indicate obesity for the above respective age groups.
3. We did not use NCHS/CDC BMI-for-age cutoffs.
   - » The BMI cutoffs have been widely used to define childhood and adolescent underweight, and they were also recommended for international use for adolescents aged 10 to 19 years by a WHO expert committee [3]. In many studies, they have been used for the definition of underweight [6-10], although some studies have used BMI-for-age < 20th percentile, some have used BMI-for-age < 15th percentile, and some have used BMI-for-age < 5th percentile for the definition of underweight.
   - » The CDC has used BMI cutoffs for the definition of underweight in children and teenagers [11]. The CDC has defined underweight and overweight as follows:

Underweight	BMI-for-age < 5th percentile
At risk of overweight	BMI-for-age 85th percentile to < 95th percentile
Overweight	BMI-for-age ≥ 95th percentile

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Counter-response

To the Editor:

I thank Dr. Gargari for his responses to my comments. His paper is now quite clear to me. To wrap up this exchange of views, I would like to share some thoughts that came to my mind while reading these responses.

1. My question was, Why was an old set of data used when the new data for percentile cutoffs were available? The NHANES I is a set of data collected from 1971 to 1974 in the United States. NCHS/CDC 2000 was also based on US data from 1963 to 1994. However, the weight and BMI of the group above six years of age were excluded from NHANES III to prevent any distortion that could arise due to the increase in the prevalence of obesity during that period. (IOTF also did not use this data set when they used data from the United States.)

   WHO would have recommended NHANES I because at that time it was the best. However, when the CDC 2000 charts became available, they would have not done so because by that time they had their own growth chart project as well as IOTF functioning.

   My personal reservation about the IOTF cutoffs is about whether they are truly world representative. They do not include any South Asian or Middle Eastern countries (the two Asian countries included mainly subjects of Chinese ancestry). It is very well known that South Asians have a low BMI but a high percentage of fat mass, and even WHO thinks that the BMI cutoff for adults in the subcontinent should be as low as 27 kg/m^2. (Some of the work I did on Sri Lankan migrant children in Australia had similar results. I failed to detect a single case of obesity based on IOTF, but the children had a very high percentage of fat mass [1,2]). This could also be the case for children in the Middle East. Therefore, ideally we should cross-validate these cutoffs before we apply them, otherwise they could really be underestimating the problem.
2. I agree with you and I hope the age had a normal distribution. I wish this had been explained in the text. However, my personal belief is that rather than using a shortcut, it would have been better to analyze individual cases in order to determine the prevelance. In the example I have quoted it is clear that results do get distorted if there is an imbalance in the distribution of the ages.
3. This is an observation I have made in my work, and it would have been the case if you had used the CDC 2000 charts.
4. I wish these references had been quoted in the text. However, I believe that you will agree that in the WHO Technical Report 854 [3] has stated that "BMI was recommended as the basis for anthropometric indicators of thinness and overweight during adolescence"[3], and that it has described BMI below 5th percentile as indicating thinness rather than underweight and has not entertained a gradation of underweight in this age category. Further, I think that even the CDC uses BMI below 5th percentile as indicating underweight rather than severe underweight. Therefore, I believe there should be uniformity in defining various types of nutritional status.This will make it possible to compare data from various countries and regions and provide a more meaningful context to future research.

Dr. Pujitha Wickramasinghe

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What can food policy do to redirect the diet transition?

International Food Policy Research Institute (IFPRI) Discussion Paper 165 (December 2003)

Lawrence Haddad

Key words: Food policy, diet transition, health outcomes

In the twenty-first century, developing countries will have to cope with the transition from acute disease to acute plus chronic disease. The two main contributors to this trend are diet and activity levels, both of which are changing at historically rapid rates. This paper focuses on dietary changes. Where good data on food consumption are available, they show that the availability and intake of foods that are risk factors for chronic diseases are increasing rapidly in urban and rural areas and across all income groups. Increases in overweight and obesity rates in the developing world show similar patterns. The coexistence of a double burden of undernutrition and "overnutrition" adds to human suffering and economic costs. It also complicates the design of food policy.

This paper asks: "What can food policy do to redirect the transition in diets toward healthier outcomes?" The paper reviews the drivers of the changes in diet and the potential of both demand- and supply-side food policy options to influence the drivers. The paper ends by highlighting the challenges posed to food policy design by the coexistence of—and linkages and trade-offs between—under- and overnutrition.

Drivers of Dietary and Nutrition Trends

The commonly listed drivers of consumption trends include (1) income growth, (2) changes in relative prices caused by technology, institutional, and policy changes, and (3) the socioeconomic and activity changes associated with urbanization.

As income grows, consumers want to diversify out of cereals and other starchy staples. The consumption of the poorest households tends to be most responsive to increases in income. Preliminary simple regression analysis of producer prices in Nigeria, South Africa, and India did not demonstrate any significant systematic differences in relative price increases by food category. In China, however, oils low in saturated fats (soybean, sunflower, rapeseed, and sesame) posted significantly higher price increases over the 1976–95 period than palm oil (high in saturated fat), which showed one of the lowest price increases over the period. In the United States, the price of nonalcoholic beverages (dominated by carbonated sweetened soft drinks) dropped dramatically over the 1982–97 period compared to an all-food average, as have the prices of dairy products, fats and oils, eggs, meat, poultry, and fish. Projections of the internationally traded prices for nonstaple, nonfruit, and nonvegetable goods indicate a continuation of these trends.

More analyses of past trends in producer and retail food prices need to be undertaken from a health perspective. For example, we do not have consumer food price trends by fat content or, preferably, by type of fat content. Such trends would help identify the main sources of any decline or increase in the price of fat or added sugar. Such information, as we will see, is important for policy formulation. In addition, more studies are needed that seek linkages between price trends and health outcomes. Many studies link undernutrition to price changes but few link rates of chronic disease or obesity to relative price changes while controlling for a range of other factors. Two of the few such studies to do so using U.S. data suggest that 40 percent of the growth in weight of the U.S. population between 1976 and 1994 is due to technology-based reductions in food prices.

Technology innovation and policy may be one important source of change in the relative prices of foods that pose a chronic health risk; institutional policy changes are another. For example, more research is needed from a health perspective on how trade liberalization (e.g., China's membership of the WTO and its impact on edible oil prices faced by Chinese consumers) will affect the price of different foods that represent different health risks.

Urbanization is proceeding rapidly in the developing world and is accompanied by a marked reduction in physical activity for the majority of the labor

force. The higher population density of urban areas lowers the per person cost of mass-media advertising, where the spending power of food manufacturers and processors surely outweighs that of public health authorities. The urban environment is also marked by a greater physical disconnect between places of work and residence and smaller household sizes, especially for women. In this environment, free time is scarcer, at least for those gainfully employed, and where the fixed costs of food preparation are higher in smaller families, more food tends to be purchased outside the home even for poor households. This food tends to be much more highly processed, and higher in salt and fat.

What can food policy do?

What is the rationale for public action to steer the diet transition toward greater healthiness? Perhaps the most obvious rationale is information asymmetry between producers and consumers about what is and is not healthy. The paper reviews options from the supply and demand sides and discusses some of the trade-offs between addressing under- and overnutrition that are accentuated in developing countries.

Possible supply-side interventions considered include (1) more public investment in technology to deliver high-productivity, low-cost vegetables and fruits and low-fat livestock products to poorer consumers, (2) eliminating incentives on growing high-fat foods and relaxing restrictions on growing healthier foods, and (3) evaluating food trade policy from a health perspective.

Demand-side interventions considered include (1) increasing the relative cost of purchasing unhealthy choices (either through changing location of purchases or price), (2) providing clearer information about product contents, and (3) improving awareness about consequences of poor diet.

Policy formulation on dietary change in the developing world must build on the evidence base accumulated in the industrialized world. However, the developing country context is very different. First, policymakers in the developing world are faced with food consumption deficits. Second, certain groups need to consume even foods that are "empty" sources of the dietary component being discouraged, e.g., edible oils, to increase the energy density of infant complementary foods. Third, the capacity to influence preferences via the public sector is likely to be lower than in the industrialized world.

Finally, it is important to note that food represents a class of commodities that is difficult to influence in a predictable manner—for example, efforts to increase the price of high fat products will also increase the price of any micronutrients they contain. Moreover, food is not yet like tobacco, in that there are fewer "triggers" in place for strong public action to occur.

Information and analysis gaps

Research in the area of diet transition in developing countries is in its infancy. Most of the work has been spent documenting the transition and, to a lesser extent, analyzing its causes. Much of this work has made do with crude food consumption data, and very little research has focused on policy analysis.

The paper suggests that (among other things) there is a need to (1) use existing nationally representative household survey data to systematically chart trends in availability of "bad" diet components, (2) better connect the location of food purchase and the health content of that purchase, (3) generate food-price elasticities for large developing countries that are disaggregated enough to be policy relevant (e.g., "edible oil" is not useful, but "high-saturated fat edible oil" is), (4) evaluate nonprice interventions to change diets, both in terms of quality and quantity, (5) spell out the trade-offs in terms of the consumption changes of different dietary components of different population subgroups resulting from the change in the price of a single commodity and the implications for smallholder income generation, and (6) conduct more research on the investments and institutional innovations that smallholder farmers need to link up with growing domestic and international markets for healthy foods.

Conclusion

The diet transition in the developing world seems to be accelerating. It seems to be a transition toward an increased burden of chronic disease. It is increasing human costs in terms of mortality and the disease burdens, and it is increasing economic costs in terms of lower productivity. It is driven by changing preferences fueled by growing incomes, changing relative prices, and urbanization; by changing food choice options fueled by changes in food technology and in food distribution systems; and by a legacy of low birth weights from the previous generation. Is there a case for public investment in efforts to influence the transition toward increasingly healthy outcomes? The existence of information asymmetries and negative externalities suggests that there is.

What can food policy do? We have identified a number of options from the food supply and demand sides. These options have had mixed success in industrialized countries. The policy trade-offs in the developing world are even more complicated. For example, efforts to overcome overnutrition might undermine efforts to overcome undernutrition. The public health

antismoking policy model offers some insights, but it should not be leaned on too heavily—food is not tobacco. There are plenty of areas in which additional technical research is needed to assess competing risks and to help develop policy options. But there is also a great need for research to engage actors in the policy process underlying the diet transition. In a debate where so much is at stake—market shares, profits, livelihoods, and life itself—there is a potentially powerful role for researchers to bring different actors to the table. This may help to improve the decisionmaking processes underlying the attempts of food policy to redirect the diet transition toward healthier outcomes.

From research to program design: Use of formative research in Haiti to develop a behavior change communication program to prevent malnutrition

International Food Policy Research Institute (IFPRI) Discussion Paper 170 (December 2003)

Purnima Menon, Marie T. Ruel, Cornelia Loechl, and Gretel Pelto

Key words: Child-feeding practices, childhood malnutrition, caregiving behaviors, formative research, program design, Haiti

Positive changes in child health and nutrition are manifested in many forms, including improved growth and development and reduced morbidity and mortality. Each child health outcome results from complex interactions between community, familial, and caregiver resources that, in turn, lay the ground for either optimal or poor caregiving behaviors.

Background: Purpose of behavior change communication programs

For children to grow normally, there are many parental caregiving behaviors related to food that are essential to ensuring adequate nutritional intake: obtaining and selecting foods that meet nutritional requirements, preparing them safely and in a form that is appropriate for the child's age, and feeding them in a manner that encourages adequate intake. To engage in these critical caregiving behaviors, parents need access to the foods their children require; fuel, water, and other materials to prepare and preserve these foods; and the time and energy to carry out the activities. They also need knowledge. These are essential underpinnings of nutrition and health-giving behaviors, and the prerequisites for child health and well-being. Because caregiving behaviors are the links between resources, knowledge, and child health, programs that seek to improve child health and nutrition must, by definition, change caregiving behaviors. Programs that aim to improve child outcomes by improving childcare behaviors are collectively referred to as behavior change communication (BCC) programs.

Purpose and methodology of this study

This paper summarizes findings from a formative research study conducted in Haiti to develop a BCC strategy to improve infant- and child-feeding practices and to reduce childhood malnutrition. It also describes the tools developed to facilitate decision-making and effective use of formative research for program planning.

The study used formative research methods that included individual and group interviews, food rating exercises, and participatory recipe trials. The aims of the study were to

1. Study current infant- and young child-feeding practices in the Central Plateau of Haiti;
2. Identify individual, household, and community factors that may facilitate or constrain adoption of recommended behaviors; and
3. Use the information from the formative research to prioritize behaviors to be targeted and design an effective BCC strategy.

Results

The study revealed some nonoptimal infant and young child-feeding practices in this part of rural Haiti, such as low rates of exclusive breastfeeding, early introduction of nutrient-poor gruels, and the scarcity of nutrient-dense foods such as animal products in the diet. A number of constraints were also identified that may limit the ability of families to engage in optimal feeding practices. These include the early resumption of work outside the home by women, which is driven by economic necessity and results in frequent and sometimes long separations of the mother from her young infant. The lack of time to prepare special complementary foods for the child, the perception that 12-month-old infants are ready to consume the family diet, and the low availability of micronutrient-rich foods (animal-source foods in particular) are additional constraints on poor families to achieving optimal child-feeding practices.

The data also highlighted some facilitating factors that could be used to design locally relevant and

powerful communication messages. The few mothers who reported having exclusively breastfed their infants, for example, emphasized that this practice improved their infants' health and reduced healthcare costs. Similarly, the absence of cultural restrictions regarding feeding animal-source foods to infants and young children, and the knowledge among some mothers that these foods are good for children, are positive factors likely to facilitate behavior change related to these practices. The recipe trials also provided valuable insights regarding feasible, affordable, and acceptable recipes for enriched complementary foods that could be promoted through the BCC intervention.

Organization of results into a "decision tool"

To simplify interpretation of the findings, we organized the information gathered into a decision tool. This tool consists of a matrix containing the following elements:

1. A goal to achieve,
2. Practices to promote to achieve this goal,
3. Current practices in the population studied,
4. Facilitating conditions for behavior change, and
5. Issues that may affect the capacity for behavior change (e.g., potential constraints).

A second, complementary matrix summarizes the constraints and facilitating factors identified for the different practices and includes columns to identify programmatic options (either within or outside of the current program context) to alleviate some of these constraints or to optimize use of facilitating factors in promoting behavior change.

Conclusion

The use of formative research for program design proved extremely useful, especially for identifying priority areas of intervention. The decision tool developed in this study helped to structure the large amount of data gathered, and it allowed presentation of the information in a systematic, clear, and easy-to-grasp manner. The tool also proved valuable in discussions related to program planning, as it helped build consensus and set priorities for action in the short and long term.

In Haiti, the tool was used after World Vision's five-year program cycle had been established. This limited the flexibility of the program to design interventions that are outside of their current mandate. In the future, formative research and the type of decision tool developed in this study should be used to plan forthcoming program cycles. This would help ensure that constraints to behavior change are addressed though appropriate programmatic interventions, even if these may be outside of the usual scope of activity of the implementing agency.

Book reviews

Phytochemicals in health and disease (oxidative stress and disease). Edited by Yongping Bao and Roger Fenwick. Marcel Dekker, New York, 2004. (ISBN 0-8247-4023-8) 384 pages, hardcover. US$195.

Interest in the role of phytochemicals in the diet for disease prevention has risen rapidly in recent years as the scientific evidence has provided increasing confirmation of their importance. This book, by contributors from 16 institutions in 8 countries, describes the functions, metabolism, and biological activities of selected phytochemicals and documents their role in the modulation of enzyme activity and gene expression. It presents the latest molecular evidence for biological effects of selected phytochemicals on cellular processes involved in cancer, cardiovascular disease, and hypertension. The phytochemicals are found in fruits, vegetables, teas, and spices.

Chapter 1 introduces the fundamentals of nutritional genomics (nutrigenomics), chapter 2 the factors affecting bioavailability, and chapter 3 reviews the role of polyphenols. Chapters 4 through 6 present specific compounds that may influence the risk of cancer, including genistein-induced gene expression; ginkgo biloba extracts, and isothiocyanate sulforaphane. Chapter 7 demonstrates how heterocyclic amine-induced DNA adduct formation, a biomarker of DNA damage and risk of cancer, can be affected by phytochemicals. Chapters 8 through 11 are devoted to consideration of the two main classes of phytochemicals—organosulfur compounds and polymethylated flavonoids. Chapter 12 summarizes the role of dietary phytochemicals in the prevention of cardiovascular disease, while chapters 13 through 15 examine the action of resveratrol, lycopene, and oltipraz. The concluding chapter elaborates on these as it addresses research directions, challenges, and opportunities.

The significance of phytochemicals in the diet is of such great interest to health workers that this book provides a very useful source of current knowledge. Although written for the research and scientific community, the editors have presented the information in a manner that should be understandable and conveyed accurately to science writers and the general public, especially in light of the demonstrated health significance of some phytochemicals.

Towards the global elimination of brain damage due to iodine deficiency. Edited by B. Hetzel (senior editor), F. Delange, J. Dunn, J. Ling, V. Mannar, and C. Pandav. Oxford University Press, New Delhi/Oxford, 2004. (ISBN 019-567095-7) 578 pages, softcover. US$20.

Basil Hetzel, the senior editor of this substantial book, has been the global leader in alerting governments, international agencies, and nutrition and health workers to the high prevalence and grave consequences of iodine deficiency. The most serious is the impact of iodine deficiency in pregnancy on the development of the fetal brain. Unfortunately it is too late to correct the deficiency after birth. In much of the world iodine is deficient in the environment due to glacial ice or heavy rainfall, and the distribution of IQ is lower without the availability of salt or some other staple with added iodine.

An introductory chapter gives the history and magnitude of iodine deficiency disorders (IDD). The global program for the elimination of brain damage due to iodine deficiency promoted by the International Council for Control of Iodine Deficiency Disorders (ICCIDD) to engage the international, bilateral, nongovernmental agencies and the salt industry is well described. As pointed out in a section of the book, the program bridges the gap between research and application through the multiple partners. The scientific basis for the elimination of brain damage due to iodine deficiency is thoroughly discussed as are the problems related to production of iodized salt and the role of education and communication.

In general the global program has been a great success as the iodation of salt is in various stages of implementation in most countries at risk of IDD. Individual chapters describe the process in Africa, Asia,

Central Europe, China, the Middle East, North Africa, Southeast Asia, and the Americas. Once implemented, iodization must be sustained permanently. Examples are given of countries that achieved universal salt iodation, thus eliminating IDD, only to have it recur when monitoring and enforcement was discontinued due to political turmoil. An appendix provides valuable documentation of the progress of the campaign to eradicate IDD country by country.

The subtitle of the book, "A global program for human development with a model applicable to a variety of health, social and environmental problems" is well justified. It is not only the most complete account available of a remarkable public health campaign, but is also useful to those promoting other public health initiatives. The book is also available as a CD-ROM from the ICCIDD. For information, send e-mail to cpanday@iqplusin.org. For the ICCIDD newsletter, available free of charge, visit http://www.iccidd.org.

Mendel in the kitchen: A scientist's view of genetically modified foods. Nina Fedoroff and Nancy Marie Brown. Washington, D.C., National Academies Press/ Joseph Henry Press, 2004. (ISBN 0-309-09205-1) 370 pages, hardcover. US$24.95.

There is a great need for this balanced and authoritative treatment of the issues surrounding the application of biotechnology to the improvement of food crops. The preface points out that all of the food crops we depend on today are the result of human manipulation, emphasizing that we cannot turn back the clock because the human population is too large and the available land too small. As the authors put it, "The challenge of the coming decades is to limit the destructive effects of agriculture even as we coax ever more food from the earth." They describe how the task is made less daunting by new knowledge and new methods—if they are wisely used.

The first chapters review the profound genetic changes induced in crops that are now considered natural, including examples of past, fierce resistance to new foods, such as the potato, when it was introduced in Europe, and the flexible barriers between species even with so-called conventional breeding techniques. Transgenic techniques for creating new plant varieties are described with an emphasis on the properties of the product, not the way in which it has been produced. Yet in most countries today plants, modified using molecular tools, are subjected to evaluation by multiple agencies and restrictive legislation never applied in the past to induced mutation with equally profound results on the resulting cultivars.

A large section of the book is devoted to the possible risks and hazards of genetically modified plant varieties. Eating any food is potentially dangerous, and all new foods need to be screened for safety regardless of how they are produced. However, when plants are engineered to produce new proteins that may affect human health the foodstuffs made from them must be carefully evaluated. The possible risk of introducing an allergen through plant breeding is thoroughly discussed. It is also demonstrated that breeding can make plant varieties safer and healthier.

The book investigates in depth some of the claims that have been made for the risks for human consumption and the environment of genetic modification of plant potential hazards, and exposes the poor science, or lack of science, behind them. It also documents the impossibility of feeding the present population of the earth with the plant varieties available in 1961. The challenge for the 21st century is to greatly increase our food supply on roughly the same amount of land in production today. Despite the appeal of "organic farming," the book estimates that the world has less than 20% of the organic nitrogen needed to support global organic farming. The conclusion is we will need all of the help available from new technologies to meet the food requirements of 2 billion more people by mid-century.

The authors investigate many examples and claims, use frequent quotations, and thoroughly document their conclusions in each chapter. An extensive bibliography is provided. This book is written from the objective viewpoint of an outstanding scientist and published through the National Academies Press. *Mendel's Kitchen* makes for informative reading, and for the scientist or the lay person willing to consider objectively the scientific evidence for and against genetically modified foods, it will prove easy to follow and promote an understanding of the complex issues surrounding the remarkable and essential advances of food technology. Negative claims and political issues are not ignored, but rather discussed with the knowledge of the best available evidence. The book should be made available in many languages, and widely circulated. It is strongly recommended for all concerned with the subject it deals with.

Adult obesity: **A paediatric challenge.** Edited by Linda D. Voss and Terence J. Wilkin. Taylor & Francis, New York, 2003. (ISBN 0-4153-0015-0) 112 pages, hardcover. US$99.95.

There is concern in Great Britain that levels of obesity have tripled in the last 20 years to the highest rates in Europe, and are approaching those in the United States, where one person in four is obese. It is clear that obesity and many associated adult diseases begin in childhood, which makes adult obesity a challenge for pediatricians. This small volume presents a series of essays from a 2001 National Symposium on Obesity

in the United Kingdom. It attempts to provide answers to such questions as: What are the early factors responsible for adult obesity? To what extent do fat children become fat adults? and What can be done to halt the trend toward adult obesity?

Individual topics include obesity as a global problem; over-nutrition and under-activity, role of genes, social inequities and obesity, and effect of self-image and self-perception.

The chapters explore the pediatric origins of obesity and the role of primary health care. The final chapter is devoted to the title theme of adult obesity as a pediatric challenge. This small, well-written book will be useful to all health workers concerned with preventing obesity and its outcomes.

Guidelines for the inpatient treatment of severely malnourished children. A. Ashworth, S. Khanum, A. Jackson, C. Schofield. WHO, Geneva, 2003. (ISBN 92-4-154609-3) 48 pages, softcover. US$9.

This book provides simple, practical guidelines for successfully treating severely malnourished children. It also takes into account the limited resources available in many hospitals and health units in developing countries. The book is directed toward health workers, dietitians, nurses, and doctors, as well as their trainers and supervisors.

Substantial reductions in mortality are reported by hospitals using these guidelines, with mortality rates of 30–50% having fallen to 5–15%. The aim is to assist in improving the quality of inpatient care, and prevent unnecessary deaths. The guidelines are authoritative, and the instructions clear and concise.

These guidelines can be used as a practical 10-step treatment tool and as additional support material to the WHO training courses on severe malnutrition management.

Perinatal nutrition: Optimizing infant health and development. Edited by Jatinder Bhatia. Marcel Dekker, New York, 2004. (ISBN 0-8247-5474-3) 440 pages, hardcover. US$179.95.

The high infant mortality rates in developing countries are due about equally to neonatal and postnatal mortality. In turn, neonatal death in the first month of life is a significant and most intractable component of infant mortality. This book presents nutritional strategies for the care of perinatal patients from preconception through infancy. So regardless of the quality and value of the 14 chapters the book title is misleading. The first five chapters deal with maternal nutritional factors, many of which contribute to perinatal mortality. The next six chapters cover aspects of nutrition throughout infancy. Two chapters deal with prenatal and infant nutrition in the pathogenesis of type 1 diabetes and with adolescent preconception. A final chapter discusses the ethical issues of artificial hydration of the neonate, but the application to actual clinical conditions is not specified.

The book contains recommendations for iron and vitamin intake and energy expenditure-based maternal body-mass index (BMI), and reviews current routines in infant nutrition. The information provided is appropriate and timely, however, the contents are not described by the title of the book, therefore the audience for this publication is not clear.

—Nevin S. Scrimshaw

News and notes

PAHO/WHO promotes the new international growth curves in the region of the Americas

Growth references are among the most commonly used and valuable tools for assessing the health and well-being of individuals, groups of children, and the communities in which they live. However, the current international reference, the US National Center for Health Statistics (NCHS)/WHO International Growth Reference poses major limitations, and incongruities are presented by the apparent poor growth of healthy breastfed infants of well-nourished women living in favorable conditions. In the early 1990s, the Working Group on Infant Growth convened by the World Health Organization (WHO) concluded that new references were necessary and that it was time to consider the production of references that would more closely approximate standards, i.e., to describe how children should grow in all settings rather than a description of how children grow in a specific setting and time. In 1997 WHO, in collaboration with a number of institutions worldwide, began to conduct a community-based, multi-country study to develop new international growth references for infants and young children—the Multicentre Growth Reference Study (MGRS). Data collection was completed in late 2003, and by the end of 2005, operational materials (i.e., growth charts, software, training materials, etc.) are expected to be ready for dissemination and implementation at the country level. The MGRS rationale, planning, and implementation document was published in the *Food and Nutrition Bulletin* in March 2004 (Vol. 25, No. 1 [Supplement 1]).

In preparation for the implementation phase and as part of a broader global work plan, the Pan American Health Organization (PAHO) conducted a regional consultation with the purpose of promoting the new international growth standards by sharing details of the MGRS, reviewing the current use of growth charts and practices in child growth monitoring, and discussing the implications of implementing the new standards, in order to elaborate a dissemination strategy for adopting them in the PAHO Region (i.e., Latin America). The regional consultation, the first in the Region and part of a worldwide process, was organized by the PAHO Nutrition Unit with key members of the MGRS Executive Committee. It was hosted by the Research Center in Nutrition and Health of the National Institute of Public Health of Mexico (Centro de Investigación en Nutrición y Salud, Instituto Nacional de Salud Pública, CINyS/INSP). The two-day meeting took place on December 9-10, 2004, in Cuernavaca, Mexico.

Representatives of the Maternal and Child Health, Nutrition and/or Immunization Programs of the Ministries of Health and representatives of national pediatric societies from eight Latin American countries gathered to exchange experiences and lessons learned and to discuss actions to improve child growth monitoring. Participants from the United Nations University (UNU), the International Union of Nutritional Sciences (IUNS), the University of Chile, the Epidemiological Research Center of Brazil, and the Latin American Pediatric Association (ALAPE) also participated to provide their technical expertise and perspectives in the discussion of a regional adoption framework and dissemination strategy. As child growth monitoring involves a wide array of governmental departments, health professionals, academic institutions, and other national and international partners, participants representing some of these various entities were invited to propose how to advocate and plan for the implementation of the new growth standards in the different arenas.

For more information contact: PAHO/WHO Nutrition Unit, 525 23rd Street, NW, Washington, D.C. 20037, USA; tel: 202-974-3853; fax: 202-974-3675; e-mail: kimsunny@paho.org; web address: www.paho.org

PAHO, ILSI, and CDC's "Healthy Lifestyles, Healthy People" Initiative: A three-country pilot project in Latin America

Healthy Lifestyles, Healthy People (HLHP) is an initiative

of the Pan American Health Organization (PAHO), the International Life Sciences Institute (ILSI), and the US Centers for Disease Control and Prevention (CDC). The project's main objective is to make a contribution to obesity and non-communicable disease prevention in Latin America through the evaluation of existing or new population-based dietary and/or physical activity interventions.

The HLHP initiative shares similar goals with the WHO Global Strategy on Diet, Physical Activity and Health, and therefore constitutes an important Regional effort to implement the strategy by providing scientific programmatic evidence, guidelines for policy development, and stakeholder involvement. Oversight for HLHP will be provided by an Executive and a Coordination Committee integrated by PAHO, ILSI, and CDC representatives. In addition, a Scientific Advisory Committee (SAC), with five highly qualified professionals, will assist in reviewing proposals, selecting the best ones for funding, and assessing project results.

At present, the HLHP initiative is concentrating its efforts in three countries—Brazil, Chile, and Mexico. In order to capitalize on the knowledge, strengths, resources, and commitment of the multiple sectors within each target country, ILSI and PAHO are promoting the organization of a local consortium in each country, integrated by representatives from public (e.g., Ministry of Health and other public institutions) and private sectors (e.g., local private companies, scientific and academic institutions). The main activities of the local consortium include identifying promising programs or interventions, promoting their evaluation among local research groups, submitting promising proposals for funding to the SAC, and collaborating in the dissemination and use of the studies' results. In each country, the three best proposals will be awarded a grant of up to US $100,000 each. Local research groups in each country will be invited to develop proposals according to predetermined criteria.

Timeline for proposal selection:

» March 10, 2005: Deadline for submission of pre-proposals
» April 12, 2005: Announcement of selected pre-proposals. The Scientific Advisory Committee (SAC) will select 18 pre-proposals (6 per country)
» April 27–29, 2005: Workshop—one representative from each of the selected pre-proposals will attend a workshop to improve their proposals
» June 30, 2005: Deadline for the 18 pre-selected research groups to submit a full proposal
» July 29, 2005: The SAC will announce the nine awarded project proposals

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Joint FAO/WHO nutrient risk assessment consultation

An interdisciplinary technical workshop to develop a model for risk assessment for nutrients and related substances will be convened by the Food and Agriculture Organization (FAO) and WHO. Such work will provide scientific advice on the principles and methodologies to be used in conducting risk assessment for nutrients and related substances. It is anticipated that the workshop will be scheduled for May 2005.

For further information, please visit: http://www.who.int/ipcs/highlights/nutrientraproject/en/

FAO/WHO workshop on functional food

The Food and Agriculture Organization of the United Nations (FAO) and WHO jointly organized a workshop on "Functional Foods: Safety and Regulatory Aspects," on September 6, 2004, at the Lotte Hotel Jeju in Jeju-do, Republic of Korea, immediately prior to the 14th Session of the Codex Coordinating Committee for Asia.

For further information, please visit: ftp://ftp.fao.org/es/esn/food/meetings/2004/korea_report.pdf

Global Strategy on Diet, Physical Activity and Health (World Health Organization, 2004)

Responding to concerns over the threat of an epidemic of diet-related noncommunicable diseases (NCDs) such as heart disease, certain types of cancer, diabetes, and obesity, WHO prepared a Global Strategy on Diet, Physical Activity and Health, which was endorsed by the World Health Assembly in May 2004. The full text of the strategy is available in several languages at: http://www.who.int/dietphysicalactivity/strategy/eb11344/en/

Marketing food to children : The global regulatory environment (World Health Organization, 2004)

As part of the strategy development process, WHO has been examining a range of interventions that have the potential to play a role in tackling the globally rising rates of noncommunicable diseases. In this respect, the regulation of the marketing of food, especially to children, has emerged as one area necessitating

further attention. This document reviews the regulatory environment that surrounds the marketing of food (including nonalcoholic beverages) to children. It is available at: http://whqlibdoc.who.int/publications/2004/9241591579.pdf

Nutrition labels and health claims: The global regulatory environment (World Health Organization, 2004)

This review of the global regulatory environment concerning nutrition labeling and health claims aims to provide an overview of existing international, regional, and national regulations and a description of past and future regulatory developments. It compiles, categorizes, and tabulates international, regional, and national regulations, and compares differing regulatory systems in 74 countries and areas. It also reviews regulations on the quantitative declaration of ingredients (information that indicates to consumers the proportion of healthful to less healthful components of the food product). The report is available at: http://whqlibdoc.who.int/publications/2004/9241591714.pdf

Fruit and vegetables for health. Report of a FAO/WHO workshop (World Health Organization/Food and Agriculture Organization of the UN, 2005)

In 2003 FAO and WHO joined forces to promote the production and consumption of fruit and vegetables for health. This workshop, bringing together health and horticulture scientists, developed a framework for the promotion of fruit and vegetables at the national level and reviewed current science on the health effects of fruit and vegetables, the effectiveness of fruit and vegetable promotion programs, and production trends. The report and the background papers are available at: http://www.who.int/dietphysicalactivity/fruit/en/

Protecting and promoting good nutrition in crisis and recovery. A resource guide (in press)

This book complements the Technical Handbook Series on FAO's Emergency Activities. It offers guidance in adopting a longer-term perspective in addressing problems of household food insecurity and malnutrition during periods of crisis and recovery. It provides a framework for an implementation strategy that focuses not only on saving lives in the short term, but also on strengthening livelihoods to ensure that households are less vulnerable to food and nutrition insecurity in the future.

The book presents different types of interventions in areas that range from promoting improved food production and diversification to improving information systems. It provides examples of how the these interventions can be translated into actions to protect and promote good nutrition. The book will be relevant and useful to planners and technicians in the fields of nutrition, food security, agriculture, and community and social development who are able to "cross over" from relief to development modalities of working and who recognize the need to adopt a multisectoral approach to achieving the common goal of improved nutritional well-being.

Family nutrition guide (FAO, Rome 2004)

The *Family Nutrition Guide* is basic nutrition education material, written primarily for health workers, nutritionists, agricultural extension workers, or other development workers in developing countries. It provides an up-to-date summary of relevant nutrition information and gives many suggestions on how to share this information when working with groups of people. The guide will also be useful for training and is a resource for designing more effective nutrition education curricula and material.

While the illustrations and food examples in this guide mainly reflect the situation in countries of Eastern and Southern Africa, the basic information is relevant for all regions. Similar nutrition education material for developing countries worldwide can be prepared using this book as a guide. Suggestions for adapting the guide's technical information to other areas, as well as for preparing a specific country version, are given.

The guide is divided into 11 topics that cover basic nutrition, including micronutrients, family food security, meal planning, food hygiene, and the special feeding needs of children, women, and men, and of elderly, sick, and malnourished people.

Guide for planning nutrition education curricula (coming in 2005)

The overall goals of school nutrition education programs are to improve the health and nutrition status of schoolchildren and to establish lifelong healthy eating habits and life styles among the school population. Using this planning guide can result in a variety of action programs planned and carried out at either the local or national level, or both. Applying the planning process promoted in the document, these action programs will be specifically tailored to suit local, regional, or national circumstances and resources.

The planning guide is aimed at establishing effective

nutrition education programs in schools involving the family, the community, and all relevant sectors and stakeholders. It comes in two volumes, a technical reader and a collection of activity sheets. The main use of the planning guide will be in curriculum development covering activities both in the school environment and in the classroom; it may also be drawn upon for policy formulation and for advocating nutrition education in schools. The guide can be an instrument for teacher training and development and institutionalized in teacher education programs. It is considered essential preparation for the development of teaching materials and lesson plans for nutrition education.

In Memoriam

George Davis, pioneer in animal nutrition research, dies at 94

George Kelso Davis, the University of Florida researcher whose pioneering work in micronutrients gave a lift to Florida's once-ailing cattle industry, died October 27, 2004, in Gainesville. He was 94.

"He was an outstanding scientist and a man of great accomplishment," said Bob Cousins, an eminent scholar in nutritional biochemistry at the University of Florida Institute of Food and Agricultural Sciences.

Educated as a biochemist, Davis filled a wide variety of roles at the University of Florida, from animal science researcher to head of the university's nuclear sciences program. He was the first University of Florida faculty member to be elected to the National Academy of Sciences.

Born in Pennsylvania, Davis received his bachelor of science degree from Pennsylvania State University and his Ph.D. from Cornell University.

He came to the University of Florida in 1942, at a time when cattlemen often had trouble raising cows in the Sunshine State. Cattle seemed to be unable to put on weight while grazing on pastures in some areas of the state, even when the grass seemed lush and healthy.

"When I came to Florida, I was told, in all seriousness, that purebred cattle could not survive in Florida," Davis said in a 1992 speech commemorating his 50th anniversary at the university.

Davis believed the problem could be traced to deficiencies in trace metals, such as copper or zinc, in the diets of livestock. By feeding radioactive isotopes of zinc, copper, and other trace metals to animals, he was able to track their use in animal metabolism and prove that the metals were vital to the animals' health.

His work led to the use of trace metals as nutritional supplements for cattle, not just in Florida, but also in parts of Asia, Africa, and South America where soils are deficient in those metals.

"We wanted to know why you could put cattle on a seemingly lush field and see them starve," said Bill Davis, the researcher's son. "When he was done, you could put 10 times the number of cows on the same field and see them put on 250 pounds each."

His work with radioisotopes and his ability to attract large research grants led University of Florida administrators to appoint him director of the university's fledgling nuclear sciences department in 1960. The University of Florida Nuclear Sciences Building was constructed during his tenure in the position. In 1965, he was appointed director of the university's biological sciences program.

From 1970 to 1975, Davis served as the University of Florida's Director of Sponsored Research, overseeing research funding for the entire university. Sponsored research funding grew from $18 million to $35 million per year during that time.

In 1976, Davis was elected to the National Academy of Sciences. He was the first University of Florida professor to be so honored.

After retiring from his administrative positions in the late 1970s, Davis continued his research in animal nutrition, investigating the role of plant compounds that have been linked to the development of cardiovascular disease in livestock, pets, and laboratory animals.

"Much of his work addressed fundamental questions, but he always tried to balance it with applied research," said Cousins. "He wanted to do work that offered a tangible benefit to society."

By Timothy Lockette, Institute of Food and Agricultural Sciences, University of Florida. Reprinted with permission.

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—corporate author:

2. Committee on Enzymes of the Scandinavian Society for Clinical Chemistry and Clinical Physiology. Recommended method for the determination of gammaglutamyltransferase in blood. Scand J Clin Lab Invest 1976;36:119–25.

Book or other monograph reference

—personal author(s):

3. Brozek J. Malnutrition and human behavior: experimental, clinical and community studies. New York: Van Nostrand Reinhold, 1985.

—corporate author:

4. American Medical Association, Department of Drugs. AMA drug evaluations, 3rd ed. Littleton, Mass, USA: Publishing Sciences Group, 1977.

—editor, compiler, chairman as author:

5. Medioni J, Boesinger E, eds. Mécanismes éthologiques de l'évolution. Paris: Masson, 1977.

—chapter in book:

6. Barnett HG. Compatibility and compartmentalization in cultural change. In: Desai AR, ed. Essays on modernization of underdeveloped societies. Bombay: Thacker, 1971: 20–35.

World Wide Web reference

7. WHO HIV infections page. WHO web site. Available at: http://www.who.int/topics/hiv_infections/en/. Accessed 12 October 2004.
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