Food and Agriculture Organization
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# Food Security and Nutrition

# in the context of the

# Global Nutrition Transition

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# Food Security and Nutrition in the context of the Global Nutrition Transition

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This paper was commissioned by FAO through the project Voices of the Hungry (VoH). VoH collects information on food insecurity (restricted food access) as experienced by individuals in over 140 countries using the Food Insecurity Experience Scale (FIES). The project also aims to assist countries interested in adopting the FIES as part of national food security monitoring efforts.
For further information please see: http://www.fao.org/economic/ess/ess-fs/voices/en/

# Contents

# Global Nutrition Transition

This paper presents the conceptual linkages between food security and nutrition and reviews data on the associations between experience-based measures of food insecurity and nutritional status outcomes in countries at different stages of the nutrition transition.

## 1. Food security and nutrition – definitions and concepts

The world continues to face major challenges to achieving food security. In the context of the recent food price crises, the importance of food security in various facets of society has been emphasized. The role of food insecurity in times of political instability was evidenced by the riots that followed rising food prices in 2007-2008 (1). The multiple consequences of the economic shocks and resulting food insecurity not only included reductions in food consumption and dietary energy intake, but also compromised diet quality and diversity. Access to health care and education decreased (2). Deprivation of calories or essential nutrients can erode both physical and mental health, which lead to less economically productive populations. Largely stemming from poverty and inequalities, food insecurity breaches the basic human right to freedom from hunger, and to enough nutritious, safe food (3).

Although food security is essential to ensure adequate nutrition and prevent hunger, the concepts of food security, optimal nutrition and lack of hunger and undernutrition are interlinked but not synonymous. Figure 1 illustrates the distinctions and overlaps between hunger, food insecurity, nutrition insecurity and undernutrition.

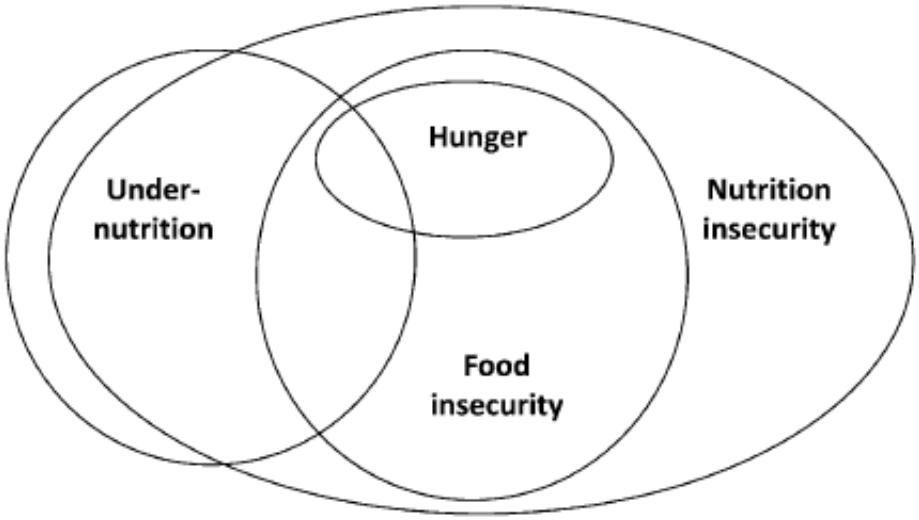


**Figure 1 Distinctions and overlaps between hunger, food insecurity, nutrition insecurity and undernutrition (4)**
Source: Benson (2004). Reproduced with permission from the International Food Policy Research Institute.

*Food security* is defined as existing when "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an

active and healthy life" (5). Food security is necessary to maintain an optimal nutritional status, and core to its definition is the requirement for nutritious food, which refers not only to sufficient quantities of food (in terms of calories), but also to sufficient quality (in terms of variety and micronutrient content). The absence of any component of the above, including cultural acceptability of food, and stability of food availability, access or utilization results in food insecurity (6).

Food security is therefore a prerequisite for nutrition security but is not sufficient to guarantee optimal nutritional status. In order to achieve *nutrition security*, one needs to have access to appropriate care giving practices and to hygienic environments and adequate health care services, in addition to a diet that meets nutritional needs for a healthy and active life(2). *Undernutrition* in children for example, may not only result from insufficient food intake but can result from an unsanitary environment that exposes children to repeated infections leading to poor absorption or utilization of the nutrients consumed.

The term *hunger* has often been used interchangeably with food insecurity to garner action to combat it (7). Hunger is more accurately defined "as an uncomfortable or painful sensation caused by insufficient food energy consumption" and could refer to short-term physical discomfort or to severe life-threatening lack of food. Whereas *hidden hunger* refers to micronutrient deficiencies (e.g. iron, iodine, vitamin A, zinc) which affect over 2 billion people worldwide, and can result from poor quality diets (8).

Improved definitions and distinct understandings of the complex causal pathways that lead to food insecurity and nutrition insecurity, as well as valid indicators to measure these constructs are important to inform programs and policies able to effectively address them. The causes of food insecurity and nutrition insecurity are interconnected and are rooted in poverty, and are affected by cultural factors and social, economic and political structures that differ by context (9).

The UNICEF conceptual framework (figure 2) illustrates the individual level immediate causes of malnutrition, its underlying causes at the household and community level and the basic structural causes at the societal level (10, 11). In this framework, household level food insecurity is on the causal pathway between poverty and inadequate dietary intake and malnutrition. Originally developed to explain the causes of childhood undernutrition, this framework has proven to be relevant in describing various forms of malnutrition as well as the intergenerational effects of poverty and poor nutrition.

The interactions between infection and nutrition for example create a cycle whereby poor diets compromise immune function making children more susceptible to infections; at the same time, infections can decrease nutrient absorption, and worsen nutritional status. Recent acute episodes of undernutrition and disease lead to weight loss resulting in low weight for height or *wasting*. Chronic or repeated exposure to undernutrition or infections affects linear growth in height leading to low height for age or *stunting*. The origins of growth faltering are now understood to begin as early as during pregnancy, emphasizing the need for adequate maternal nutrition and health status in the prevention of undernutrition in children – particularly as early life undernutrition has both short- and long-term consequences. These include impaired cognitive development in children, the intergenerational cycle of malnutrition which is perpetuated by undernourished girls becoming undernourished mothers at risk of having low birth weight infants, and the effects of undernutrition in critical periods of development leading to increased risk of cardiovascular disease in adulthood (9).

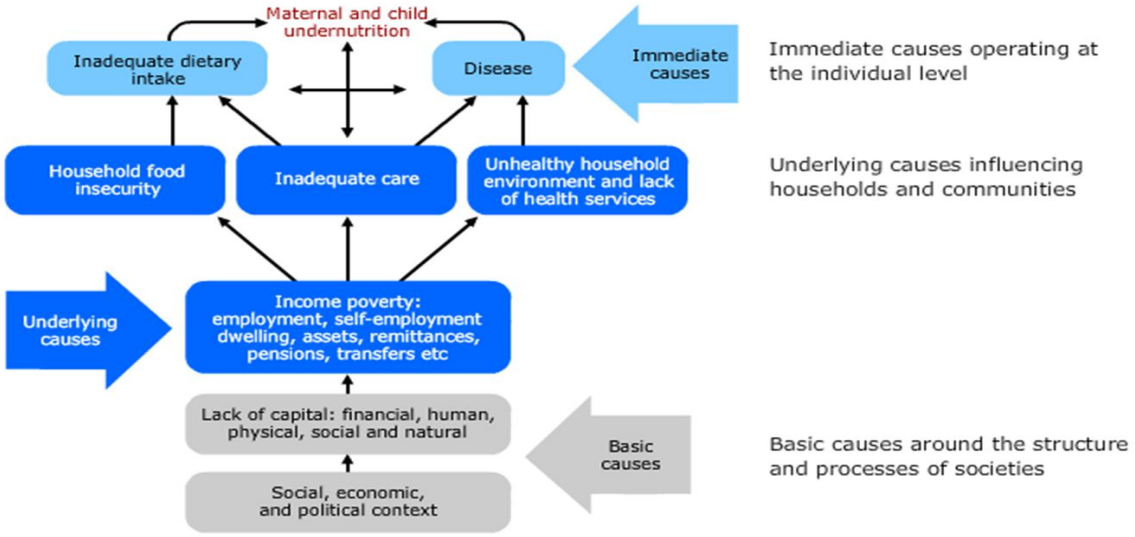


**Figure 2 The UNICEF conceptual framework for the causes of undernutrition (10, 11)**

## 2. The nutrition transition, food insecurity and the double burden of malnutrition

The developing world has achieved progress in aiming to meet the targets of reducing undernutrition set by the first Millennium Development Goal. These targets aim to halve the proportion of the population below the minimum level of dietary energy consumption and the prevalence of underweight in under five year old children. However, it is clear that there are stark differences across regions with a high prevalence of undernutrition remaining in South Asia and sub-Saharan Africa (12).

At the same time, rapid demographic, social and economic changes ongoing in many developing countries have led to increased urbanization and changes in food systems resulting in a *global nutrition transition.* This transition refers to recent global shifts in dietary patterns towards higher intakes of saturated fats, sugars and refined foods, and lower intakes of fibre rich foods, driven by technological advances that have made energy dense, nutrient-poor foods cheaply available on global food markets (13).

In this global context, while large inequalities from the burden of undernutrition persist across regions, countries and communities, a concomitant increase in rates of overweight and obesity is witnessed, often in these same communities. The result is commonly referred to as the *double burden of malnutrition*; whereby both undernutrition and overweight co-exist. Although apparently paradoxical, both undernutrition and overweight can emerge from the same root causes: poverty and food insecurity (14).

The double burden of malnutrition has been reported to exist not only within communities but also within households and in individuals. At these levels, various types of double burdens have been described.

These include households with a stunted child and an overweight mother (SCOWT), the prevalence of which is associated with economic development. Various factors related to food and nutrition insecurity may contribute to the occurrence of SCOWT pairs, including inequalities in intra-household resource allocation, food choices and caring behaviours. Childhood stunting and maternal overweight may result from lack of access to diets of adequate quality; energy dense and micronutrient poor diets would lead to micronutrient deficiencies in children, which would limit their growth and development and simultaneously lead to overweight and obesity and possible micronutrient deficiencies in women (an individual level double burden)(15). Overweight and iron deficiency anaemia have been found to coexist in women and may be explained by such diets, in addition to the compounding effect of parity that can affect both overweight and anaemia status (16).

Additionally, in the context of increased household food and energy availability between childhood and adulthood, early life undernutrition and childhood stunting may be related to later risk of obesity. Stunted children have even been reported to be at higher risk of concurrent overweight in early childhood. Slowed growth and changed hormonal response, in combination with poor dietary intake (in terms of both food quantity or food quality), may increase the susceptibility of stunted children to the effects of high fat diets (17, 18). The rapid shift in diet composition, a key characteristic of the nutrition transition, provides conditions for both stunting and overweight to occur.

Households that include an underweight and an overweight person, have also been described in middle income countries, with possible underlying causes related to rapid changes in food supply, age specific risks or reduction of energy requirements, infectious diseases, behavioural or nutritional lifestyle factors, or genetic and environmental risk factors (19).

Although household level double burdens such as the stunted child/overweight mother pairs may represent statistical increases in prevalence of maternal overweight against a static background of child stunting(20) , recognising these phenomena will be important to design strategies that address dual burdens by focusing on the food needs of individuals within households (15).

## 3. Measuring food insecurity experiences, predictors and consequences

In order to develop effective and targeted interventions to address food insecurity, a better understanding of the relationships among various factors, including the predictors and the consequences of food insecurity, is needed. Various categories of indicators are used to assess food insecurity at the macro (national ) level, including national food supply and utilization indicators that assess total food energy availability against energy requirements of populations (1). These give estimates of the food security situation of national populations but do not allow for the identification of vulnerable subpopulations or for the estimation of short term changes in food security.

Other commonly used proxy indicators for food insecurity are nutritional status markers such as wasting and stunting (micro-level markers). Although these can occur in food insecure populations, in the context of the nutrition transition, they no longer cover the full spectrum of possible nutritional outcomes of poverty and food insecurity which now include overweight and obesity (14).

Experience-based food insecurity scales were developed in order to quantify and describe the experiences of food insecurity, and are useful also in the context of the nutrition transition. These measures take into account the fact that food insecurity and hunger could be associated with both undernutrition and overweight (21). Experience-based food insecurity scales have been developed and validated to classify households and individuals according to severity of food insecurity. Originally developed and validated in the US, similar tools followed in various countries in different regions of the world (22-27).

The advantages of direct measures of food security are that they include quantitative, qualitative, psychological and social dimensions of food security as well as being cost effective tools for the measurement of food insecurity. These tools focus on inequalities in food access as well as on the social and cultural dimensions of hunger (28).

Although experience-based measures of food insecurity do not capture the broader structural determinants of food insecurity (social, economic, and agricultural policies), they have been found to be associated with poverty, unemployment, poor access to education, social exclusion, poor mental health and chronic disease(29-33). The nutritional consequences of food insecurity experience include underweight, stunting and wasting, and also overweight and obesity, depending on a broad range of contextual, economic and socio cultural factors.

## 4. Nutritional outcomes associated with food insecurity along the nutrition transition

Measured alongside anthropometric, dietary and socio demographic data, experience of food insecurity can provide insight on vulnerabilities and can help in the planning of relevant interventions to target food insecurity populations in a timely manner. This section reviews the associations between food insecurity using experience-based scales and nutritional status outcomes in countries at different stages of the nutrition transition.

### 4.1 Wasting and underweight

Studies investigating the association between food insecurity and underweight or wasting yield mixed results. Most studies in low income countries show a positive association between increased severity of food insecurity and risk of underweight. A recent multi-country study found severe household food insecurity among under five year old children to be significantly associated with underweight and wasting in Bangladesh, and underweight in Ethiopia, while moderate food insecurity was associated with underweight among children in Vietnam (34).

Data from Colombia show that mild, moderate, and severe household food insecurity were associated with underweight in a positive, dose response relationship among preschool children (35), and food insecurity with hunger increased risk of underweight among mothers and their children (5-17 years) (36). A 3 fold increase in underweight prevalence was shown among adults from food insecure households in Trinidad and Tobago (37).

Although household dietary diversity (used as a proxy for food insecurity) in Tanzania was associated with underweight among adolescents (38), an eight-country study which included Tanzania along with Nepal, Pakistan, Bangladesh, India, Brazil, Peru, South Africa, showed no significant impact of household food insecurity on underweight among children 2-5 years of age (39).

One study from Brazil (a middle income country) has shown a non-significant reduction in child weight (measured using BMI z-score) in children from food insecure households (40).

Studies are limited by their cross sectional nature, which may not capture seasonal variation in food production and consumption. Wasting is less commonly associated with the nutrition transition due to its acute nature and may occur during short-term shocks or changes in food availability.

### 4.2 Stunting

Studies assessing the association between household experiences of food insecurity and stunting give more homogeneous results. Children under 5 years of age had an increased risk of stunting in households with severe household food insecurity in Bangladesh and Ethiopia, and moderate food insecurity in Vietnam (34). Consistently, a multi-country study conducted in Tanzania, Nepal, Pakistan, Bangladesh, India, Brazil, Peru, and South Africa showed a positive, consistent association between food insecurity and stunting in all the countries with food insecurity shifting the distribution of children's height-for-age z scores toward lower values (39). Other studies conducted in Colombia and Brazil among preschool children (under 5 years) also showed a strong and positive association between food insecurity experience and stunting (35, 41, 42).

Studies that showed a lack of association between food insecurity and stunting were those conducted in middle and high income countries among children above the age of 5: school children 3-6 years from USA (43), youth 9-18 years from Canada (44) and adolescents 12- 18 years from Brazil (45).

### 4.3 Overweight/Obesity

A large body of literature largely emanating from the USA has shown mixed results regarding the association of food insecurity and overweight/obesity. Various studies have reported on the effect of household food insecurity on weight status in the USA and have shown that the strongest consistent links between food insecurity and obesity are amongst women, with growing evidence for an effect among adolescents, and contradictory results reported amongst children and men (46-49). These highlight the need for longitudinal studies to assess the temporal relationships between food insecurity and weight status particularly in children and men. In addition, the fact that intra household differences may exist in resource allocation and food choices can be masked by a household level tool and makes the case for the need to assess individuals' rather households' experiences of food insecurity to better understand age and gender differences seen (28, 50). This will be possible with the recently developed Food Insecurity Experience Scale (FIES) which aims to measure food security at the level of the individual (28).

Studies from low and middle income countries show less strong links between food insecurity and overweight/obesity (summarized in Table 1). In fact, data from Colombian (36) and Jamaican children (51) showed an inverse association between food insecurity and risk of overweight.

Various studies that have investigated the association between food insecurity and overweight/obesity did not find any significant association. These include studies of adults in Trinidad and Tobago (37), Indian women of reproductive age in Malaysia (52), migrant farm workers on the US-Mexico border (53) and two studies of Brazilian children; one on children less than 5 years of age (40) and another on adolescents 12-18 years (45).

This lack of consistency in results appears to derive from contextual differences affecting food insecurity (54) particularly the stage of the nutrition transition, differences in experiences of food insecurity within households (50) as well as age associated, gender specific, and life course effects of food insecurity (55, 56). In fact a recent study from Brazil showed an intergenerational difference in the effect of household food insecurity on nutritional outcomes of under 5 year old girls, adolescent girls and women; with household food insecurity leading to overweight and obesity in adolescents and adults respectively, but not in preschool aged girls (56).

In addition, in various settings where food insecurity was not found to be significantly associated with overweight and obesity, rates of overweight/obesity were similar in individuals from food secure and food insecure households (Table 1). For example, in Trinidad and Tobago, the mean Body Mass Index (BMI) of women from food secure and food insecure households were very similar (27.5kg/$m^2$ vs 27.3 kg/$m^2$).Both these values were above the cut-off value for overweight (25kg/$m^2$) indicating a relatively high prevalence of overweight in both food secure and food insecure women (37). Similarly in Colombia, approximately 25% of both food secure and food insecure women were found to be overweight (36). These studies are indicative of the co-existence of excess weight with food insecurity in various populations.

### 4.4 Food insecurity as a cause of obesity

Various possible mechanisms can explain the apparent paradox of food insecurity as a cause of overweight and obesity.

Food insecurity experience relates not only to hunger and malnutrition, but also to concern and uncertainty regarding the ability of a household to acquire enough food of adequate nutritional quality (55). It has been argued that food insecurity is itself a form of material hardship (57), leading to feelings of deprivation, anxiety and poor mental health and possible social and behavioural difficulties. These could differentially affect household members depending on their age and gender and result in varied nutritional status outcomes (58). Women may be particularly vulnerable due to gender inequalities within societies, their roles within households, and mothers adjusting their nutrition to buffer the effect of food insecurity on their children, all potentially leading to excess female obesity (51).

Individuals and households can attempt to manage food insecurity in various ways including reductions in spending on education or health care, diversifying livelihood strategies, and making trade-offs in various aspects of living , such as choosing inexpensive, high energy foods (13, 55). In the context of globalized food markets where the relative cost of fatty foods, refined oils, and sugar is low compared to fruits, vegetables, and legumes, the prioritization of cost for food insecure families may result in excessive consumption of energy while having diets low in diversity and micronutrient content (13).

This is evident in studies that have investigated the effect of food insecurity on diet quality in various settings including low, middle and high income countries. These indicate that food insecure households consume significantly less animal products (meat, fish, and poultry) (25, 36, 52, 59, 60) as well as fruits and vegetables (25, 37, 59), and more staple cereal products than food secure households (59). In one study of Mexican-American families, food insecurity decreased the likelihood that children met food guide pyramid guidelines (43).

In addition, extensive evidence exists for the effects of nutrition in-utero and early life on metabolic alterations in later life.Maternal undernutrition and overweight and associated morbidities – both possible conditions of poverty and food insecurity – can program metabolic, physiological, and neuroendocrine functions in offspring, fuelling an intergenerational cycle of malnutrition (both under- and overnutrition) (61).

## 5. Programmatic and policy implications

With poverty being a root cause of food insecurity across many contexts, programs aiming to tackle food insecurity should be integrated with poverty alleviation initiatives. The wide array of context specific causal factors and consequences of food insecurity need to be considered. These include the possible co-existence of undernutrition, micronutrient deficiencies and overweight within and across populations and households.

Social safety net programs that include food components need to be more rigorously evaluated as data of the unintended increases in overweight in certain segments of beneficiaries begins to emerge from Mexico and the USA. Women seem to be particularly affected. (49, 62). These data highlight the need to re-evaluate the content of food assistance to focus on fresh foods, rich in micronutrients, and the importance of incorporating nutrition education and health promotion alongside social safety net programs.

In addition, as the burdens of food insecurity and overweight are disproportionately carried by women, there is a need to focus on empowerment of women and reducing gender specific inequalities (9). With food prices being a major factor affecting food choices, improvements in markets and infrastructure are necessary to increase the affordability of healthy, fresh and safe foods.

Policies that promote availability, access, and consumption of diverse nutrient-rich foods need to be supported, particularly in the context of the global nutrition transition where such foods have the potential to reduce the multitude of nutritional consequences of food insecurity.

**Table 1 Studies investigating the effect of food insecurity experience on overweight or obesity in low or middle-income countries**

| Country | First Author, year | Title | N | Population | Methods | Effect of food insecurity on Overweight/Obesity |
|---|---|---|---|---|---|---|
| **Brazil** [40, 45, 56, 63] | Kac G et al., 2012 | Household food insecurity is not associated with BMI for age or weight for height among Brazilian children aged 0-60 months | 3433 | Children aged 0-60 months | Cross-sectional survey using 2006-2007 Brazilian DHS, food insecurity was measured using Brazilian Food Insecurity Scale (EBIA) | *No effect on BMI*<br>Mean BMI-Z scores ( 95% CI):<br>Food secure 0.52 (0.44-0.61)<br>Mildly food insecure 0.50 (0.39-0.61)<br>Moderately/severely 0.33 (0.20-0.46) |
| | Lopes TS et al., 2012 | Family food insecurity and nutritional risk in adolescents from a low-income area of Rio de Janeiro, Brazil | 523 | Adolescents aged 12-18 years | Cross-sectional survey; family food insecurity was assessed by the Brazilian Food Insecurity Scale (BFIS), validated for the Brazilian population | *No effect on overweight*<br>Prevalence of overweight (95% CI):<br>Food secure 26 % (20–35)<br>Mildly food insecure: 22% (16-30)<br>Moderately/severely food insecure: 24 % (16–35) |
| | Schlüssel MM et al., 2013 | Household food insecurity and excess weight/obesity among Brazilian women and children: a life-course approach | 10,226 women,<br><br>1529 female adolescents,<br><br>3,433 children | Women 18-49 yrs,<br><br>Female adolescents 15-19 yrs,<br><br>Children 0-60 months | Cross sectional using 2006 Brazil DHS; food security assessed using the Brazilian Food Insecurity Scale (EBIA) (an adaptation of the US HFSSM) | *No effect on excess weight in children*<br>Compared to food secure, prevalence ratio of BMI-Z> 2 SD in children:<br>Mid FI: 0.95<br>Moderate FI: 1.02<br>Severe FI: 0.49<br><br>*Significant effect on excess weight in adolescents*<br>Compared to food secure, prevalence ratio of excess weight in female adolescents:<br>Mid FI: 0.78<br>Moderate FI: 0.80<br>Severe FI: 1.96<br><br>*Significant effect on obesity in female adults*<br>Compared to food secure, prevalence ratio of obesity in adult women:<br>Mid FI: 1.16<br>Moderate FI: 1.49<br>Severe FI: 1.06 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Brazil** | Velasquez-Melendez et al., 2011 | Mild but not light or severe food insecurity is associated with obesity among Brazilian women | 10,226 | Women aged 18 to 45 years | Cross- sectional study using Brazilian DHS 2006-2007; food security level estimate was based on the EBIA (Brazilian Food Insecurity Scale) | *Significant effect on obesity in women*<br>Compared to food secure, prevalence ratio (95% CI) of obesity in adult women:<br>Light FI: 1.16 (0.98-1.36)<br>Mild FI: 1.49 (1.17-1.90)<br>Severe FI: 1.06 (0.78-1.46) |
| **Colombia**[36] | Isanaka S et al., 2007 | Food insecurity is highly prevalent and predicts underweight but not overweight in adults and school children from Bogota, Colombia | 2359 families with 2526 children | Children aged 5-12 years and their mothers | Cross-sectional study; food insecurity was assessed using a 16-item food insecurity scale, modified from the US HFSSM | *No effect on overweight in children and mothers*<br>Prevalence of overweight in children:<br>Child food security 11.9%<br>Child food insecurity 8.3%<br><br>Prevalence of overweight in mothers:<br>None or FI without hunger 25.2%<br>FI with moderate hunger 25.1%<br>FI with severe hunger 24.4%<br><br>Prevalence of obesity in mothers:<br>None or FI without hunger 5.3%<br>FI with moderate hunger 5.1%<br>FI with severe hunger 8.7% |
| **Jamaica**[51] | Dubois L et al., 2011 | Household food insecurity and childhood overweight in Jamaica and Québec: A gender-based analysis | 1674 | Children aged 10-11 years | Cross-sectional study; food insecurity was measured based on 2 questions asked to children about experiences of food insecurity | *Significant reduction in overweight among food insecure children*<br>Adjusted odds ratios (95% CI) for overweight or obese among children:<br>Food secure 1.00<br>Food Insecure 0.65(0.4-0.9) |
| **Lebanon**[59] | Ghattas H et al., 2013 | Household food security is associated with agricultural livelihoods and diet quality in a marginalized community of rural Bedouins in Lebanon | 474 | Children and adults | Cross-sectional study; food insecurity was measured using an Arabic food security scale derived from the U.S. food security survey module and the Yemen National Food Security Survey and adapted to the Lebanese context | *No significant effect of food insecurity on overweight and obesity in adults*<br>Prevalence of BMI>25:<br>Food secure & moderately food insecure =55.9%<br>Severely food insecure=58.3% |
| **Malaysia**[52] | Mohamadpour M et al., 2012 | Food insecurity, health and nutritional status among sample of palm-plantation households in Malaysia | 169 | Indian women 19-49 years old, non-pregnant, and non-lactating | Cross-sectional study, food insecurity measured using the Radimer/Cornell Hunger and Food Insecurity Instrument (10 items) | *No significant effect on BMI in women*<br>Prevalence of BMI >25 kg/$m^2$:<br>Food secure : 47.1 %<br>Food Insecure: 63.2 % |
| **Trinidad & Tobago**[37] | Gulliford MC et al., 2003 | Food insecurity, food choices, and body mass index in adults: nutrition transition in Trinidad and Tobago | 241 men, 290 women | adults | Cross-sectional study, using short-form HFSS | *No effect on BMI in both men and women*<br>Mean BMI (SE)among men:<br>Food secure 26.2 kg/$m^2$ (0.39)<br>Food insecure 25.9 kg/$m^2$ (0.67)<br><br>Mean BMI (SE) among women:<br>Food secure 27.5 kg/$m^2$ (0.46)<br>Food insecure 27.3 kg/$m^2$ (0.78) |

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