

## A Review of the Relationship between Obesity and Food Insecurity

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### Abstract

**Introduction:** Food insecurity refers to the limited or unreliable access to sufficient quantity and quality of food or the restricted opportunities to obtain food through socially approved ways which turning into the major health concern, has been the cause of so many chronic diseases such as obesity.

**Methods:** To achieve the present study's objectives certain data bases as google scholar, Science Direct, PubMed, Scopus, Ovid, Eric, CINAHL, EMBASE, Cochrane Library and PsychInfo concurrent with the key words "food insecurity", "food hardship", "hunger", "food security", "obesity", "race", "minority", "poverty", "food assistance" and also various other related words and phrases have comprehensively been searched since 1995 till 2016. The main criterions for the articles to be enlisted in the study were availability of the full text, English standing as the source language of the article, and the publication date being between 1995 and 2016.

**Results:** Food insecurity and the obesity prevalence among the members of the families strongly depend on certain factors as the age, sex, marital status, stressors, income levels, ethnicity and race. After reviewing the articles enlisted in the current study regarding the risk of obesity among various age and sex groups, diverse results were obtained.

**Conclusion:** Due to similar affecting agents on the emerge of food insecurity and the obesity prevalence, there seems to exist direct associations between food insecurity and the obesity which could be obviously recognized among most of the age and gender groups.

**Keywords:** Food insecurity, obesity, general health, nutrition

### Introduction

Food security is defined as: "when all people at all times have access to sufficient, safe and nutritious food in order to maintain a healthy life". This concept is established on the basis of three pillars as "food availability", "food access" and "consistent food use". Unlike the past, the notion of food availability is not essentially dependent on the existing food amount that is confined by the national boundaries of a country and it is less regarded as the major food security element. Rather it is basically viewed as the rate of production (domestic supply) and the food stuff import. Food availability, on the other hand, pertains to the physical and economical access to the healthy food resources to help providing essential food items for a community. And the "consistency in food intake" denotes the consistent intake of essential nutrients and nutritious food in a population. Furthermore, the descriptions above will also include healthy and adequately nutritious food availability and also the guarantee of people's potency to obtain acceptable food and through socially approved procedures (1,2,3,4).

Studies conducted by the world wide organizations reveal that more than 800 million people in the developing countries do not have access to sufficient nutrition. Food insecurity is not specifically restricted to the developing countries, rather the traces of that could be easily followed in the developed countries either. In a study done on 1423

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mothers having children less than 5 years old, the prevalence of the food insecurity has been reported to exist for 94.2% in west Indonesia (6). In another study conducted on 199 households in Thailand the prevalence of food insecurity was detected as 55.8% (7). This rate was equal to 58% among the rural Malaysian families (8). Food insecurity prevalence in US displayed high percentages and according to the reports coming from US researchers, exceeding 33 million people have so far experienced food insecurity (9). Some other studies in US also confirmed the existence of almost 16.1% food insecurity among the US community in 2002 (10). Besides that, there are almost 3 million people suffering from food insecurity in Canada as well (11).

Food insecurity contributes to the lack of sanitation and the mal-nutritional status like overweight, obesity, mental and physical disorders. The imbalance existing in the people's diet could be regarded as another health concern accelerating nowadays. Although poverty induced malnutrition is still considered as one of the hitting causes of death throughout the world, other diet induced disorders such as obesity, cardiovascular diseases, infarction and diabetes are also spreading in a high speed. Overeating and inactivity inspired by the present modern life has caused obesity to stand as the primary basic-hygiene challenge in the communities in 21<sup>st</sup> century while raising the world



anxiety regarding the accelerating progress of pediatric obesity. Besides the developed countries, due to the alterations in food habits and decrease in the level of activity, obesity prevalence is empirically promoting in the developing countries as well. Traditional way of thinking in the assessment of food insecurity consequences, focused on the issues such as emaciation and the severe weight loss, while the brand new concept, moving in parallel, is the emerge of obesity among those affected by the food insecurity(12,13,14,15).

In the recent studies, the correlation between poverty and obesity has been forcefully highlighted while so many modern academic researches are also documenting that interrelation(16,17,18,19).

During the recent years world populations have been critically experiencing obesity and weight gain as a severe epidemic health problem which has been drastically increasing throughout the world. This phenomenon is seriously interconnected with the incidence of hyperlipidemia, cardiovascular diseases, hypertension, diabetes, some cancers, hepatitis, sleep apnea, arthritis and stroke(21,22). Obesity is defined by the BMI  $\geq$  30 (22). Different studies are suggesting that if the ongoing lifestyle is maintained it could be well predicted that by the year 2030, 57.8% of the world population would be affected by obesity and overweight (23).

The major food concern in developed countries is the excess intake of food stuff. This is while in developing countries, it has turned into some critical consideration proposing poverty, hunger and malnutrition. In the developed countries, excess intake of sugar and fat is equivalent with the calorie surplus derived from a low nutrient dens diet, that accompanied with certain nutritional and environmental factors it will definitely prompt and raise the incidence of several chronic diseases. The results of some studies reveal that sometimes the anxiety and the fear of failing to access sufficient food may lead to weight gain or obesity. In the other words, the state of being uneasy to supply the family food requirements would result in the lack of food security, predominantly common among low income households. Low income family members are often engaged with the problem of overweight and it is believed that if governments could take this fact into consideration the epidemic obesity concern may come into balance (24,25). There exist some causative links between the family income and the rate of weight gain incidence. It is so that when referring to food security, infact the people's easy access to sufficient food for fulfilling dietary needs is addressed. Sometimes geographical locations are the main cause for failing to have access to the dietary necessities, and sometimes the incorrect viewpoints and certain mental and psychological concerns about certain food stuff may deprive the person from using them. However in the majority of cases economical limitations may force the person not to have a proper food selection and as a consequence to that he will be deprived from a healthy balanced diet. It is a fact that members of the low income families will have foods with affordable prices as their dietary choices, so that they can help feed themselves (26). The lower the price of a food item, the higher fattening one

it will be. Starch, sugar and fat are considered as the satiating foods existing abundantly in most of the families food baskets. If these food items are permanently present in a dietary program and are extensively used they will certainly induce obesity. Infact people in the absence of fruits, vegetables, whole grains and other essential nutrients are just trying to satisfy their sense of hunger and this lack of food security sense will obviously lead to gaining weight. Hunger satisfaction by carbohydrates, fats and sweets together with lack of sufficient daily exercise and physical activity will offer nothing but weight gain. Some other obesity inspirations are eating junk food, fear from not having sufficient food, skipping breakfast and to carry on a wrong dietary program. It is believed that obesity and overweight would be the straight forward outcome of the family welfare and excessive fast food intake while the incidence of overweight in low income households is the consequence of missing healthy and essential dietary food and the excessive daily intake of high calorie food items. In other words people seem to eat based on their income not based on their needs(27,28,29,30,31).

The current study targets to comprehensively review all the research projects so far conducted that discuss food insecurity and the relationship it has with obesity.

## Methods

### Search strategy

To achieve the present study's objectives certain data bases as google scholar, Science Direct, PubMed, Scopus, Ovid, Eric, CINAHL, EMBASE, Cochrane Library and PsychInfo concurrent with the key words "food insecurity", "food hardship", "hunger", "food security", "obesity", "race", "minority", "poverty", "food assistance" and also various other related words and phrases have comprehensively been searched since 1995 till 2016. The main criterions for the articles to be enlisted in the study were availability of the full text, English standing as the source language of the article, and the publication date being between 1995 and 2016.

In the present study 6030 articles with substantially connected issues were the subjects of the review. Duplicated titles were deleted. After deletion of the articles missing the essential criterion, about 430 full text articles and abstracts were adopted basically regarding the general recruitment criterion and after final evaluation essentially based on the recruitment criterion and the reviewer comments, 41 articles were compromised and chosen as the finalists.

## Results

The correlation between food insecurity and obesity is enormously dependent on various agents such as: Gender, age, level of income, race and ethnicity (32). Potent influence of the age factor has led to diverse results among different age groups. It is so that obesity and excess weight gain could be expectedly derived from food insecurity among non-elderly women. However, these findings include a bunch of positive and negative responses. Another review article indicated no correlation between food insecurity and pediatric obesity and the children exposed to

food insecurity haven't gained excess weight as compared to their counterparts(30,33,34). A huge number of studies revealed a significant correlation between food insecurity and pediatric obesity among pre-school children (35). While other studies exhibited no correlation at all (19,36,37). The impact of gender on the correlation between food insecurity and obesity has been so outstanding that such correlation has widely been detected among girls rather than boys. The other significant component that strongly affects this relationship is the body mass index (35,38). However when BMI >85% , no correlation between food insecurity and obesity or overweight has been recognized. In the same study, mothers of young children were not reported to be affected by obesity. The reason underlying that may be the fact that mothers have devotedly reduced their own food portion sizes in order to totally supply their kids meals (33). Food insecurity among Hispanic adolescents increases the risk of obesity incidence. In 2011 , 15% of the non-Hispanic households were exposed to food insecurity when compared to their 27% of the Hispanic households. This increased rate turned into an anxiety when the people exposed to food insecurity showed a higher incidence of obesity, cardiovascular diseases, diabetes and overall physical and mental deterioration (39,40,41). Theoretically, the relationship between food insecurity and obesity is a paradox, as obesity refers to the state when the energy access and intake had been more than required while food insecurity exhibits insufficient nutritional support and food access as opposed to well-nourishment. But practically speaking members of the families exposed to food insecurity have proved to consume higher calorie dens and lower nutrient dense foods like salty snacks, fatty desserts and foods predominantly observed in the countries with lower income (28,29,30,42).

Among the Hispanic-American women , food insecurity is the inducement of both weight loss and weight gain similarly. This procedure could be the outcome of : level of education, marital status, number of children, employment status, monthly income, health history, nationality, language and the duration of stay in US (26,43,44,45,46). The rate of obesity is accelerating among the lower income Mexican-American women over the recent decades in US(47). There exists a direct link between food insecurity and pediatric obesity among the Hispanic community. Maternal weight status will both indicate the correlation between food insecurity and maternal obesity and predict the state of pediatric obesity for the unborn baby (22). Besides that , one of the influential components on the relationship between food insecurity and obesity is believed to be race or ethnicity. Lower food security is closely interconnected with the higher BMI and the higher incidence of obesity among Hispanic men and women and also among multiracial men and Asian women . However, there was no significant correlation between food insecurity and obesity among non-Hispanic white women and men, African-American men and women, Asian men and multiracial women (26).

Abdominal obesity and metabolic syndrome markers undergo significant differences among members of the families exposed to food insecurity as compared to their

food secure counterparts. This happens in a way that households being modestly or severely food secured, showed a significantly higher percentage of average in abdominal circumference . There was no significant difference detected in blood sugar levels, total cholesterol, triglyceride and blood pressure in the food secure households. However in the families highly food secured, the average of HDL levels were reported highly as compared to the households with moderate food security or insecure at all. Having access to a healthy dietary program and food security is perceived to protect against central obesity and provide physical health, promote mental components and contribute to the reduction of health costs imposed on the society. On the other hands, those exposed to higher food security, because of their higher income, more physical activity, less restriction to the available resources and living in better neighborhoods with more entertainment facilities, are seldom the subject of obesity and weight gain. While the members of the families undergoing food insecurity, as they gain lower income, do less exercise, consume higher calorie dense and unhealthy foods, lack of entertainment facilities and limited access to natural recourses, will experience abdominal obesity and over weight as well as indicating significant raise in metabolic syndrome index (1,41,48,49).

Rural populations are basically more affected by food insecurity, poverty and obesity when compare to their non rural counterparts. Obesity among rural populations (especially among the kids) is widely induced by home and family environment, family eating habits, food preparation methods, the amount of access to healthy food stuff, family income, level of physical work and activity of the family, behavioral components and food insecurity (50,51,52).

Obesity and food insecurity are two major constituents of the general health, essentially existing together. Food insecurity or lack of access to sufficient food, essential for maintaining a healthy and active life, could be considered as a life threat to the general health which might endanger children's health promotion together with undesirable consequences as the poor state of health, iron deficiency anemia, mental and neurological disorders , educability disorders and finally the obesity and overweight (19,53,54). Food insecurity can induce obesity and weight gain in both men and women. However there are paradoxical findings on which sex is more powerfully affected. Some studies indicated the correlation between food insecurity and obesity more significantly among women. While others have shifted the tendency towards men. As a sample, in one study conducted over 35747 Hispanic non-elderly adult men and women in California, the results argued that very low levels of food security among men induced 1Kg/m<sup>2</sup> raise in their BMI and 36% increase in the obesity prevalence. On the contrary, very low levels of food insecurity among women resulted in 1.1Kg/m<sup>2</sup> raise in their BMI and 22% increase in the obesity prevalence (26). The state of family food insecurity causes the normative templates of eating to be disrupted and the natural resources allocated for food supply not to be spent for healthy food exploitation while increasing the intake of salty, sweet, fat and high caloric food at the same time. This issue is

substantially interconnected with the level of knowledge and awareness of a community. The results of the studies carried out in France also confirm the correlation between food insecurity and obesity, and at the same time high light the role of economical crisis and the household income decline that could induce obesity through creating an environment of food insecurity (55,56). In Brazil, moderate food insecurity tended to correspond with the higher obesity prevalence among women and severe food insecurity led to dramatic and enormous incidence of obesity (57,58). On the contrary in some Latin-American countries such as Colombia who are undergoing nutrition transition, food insecurity was unexpectedly associated with weight loss (43).

Food insecurity raise has always been accompanied with lower consumption of healthy food as fruits, vegetables, sea food, dairy and milk. This dietary program with unhealthy dietary patterns due to small amounts of fiber, antioxidant and other necessary nutrients is associated with higher fat absorption and fat storage by the body and as a consequence to the increased volume of fat mass, obesity initiates (42,59). There are many children all over the world who experience obesity induced by household food insecurity. Also the quality and the health of the dietary plan might be affected by food insecurity so that the households would rarely keep healthy food at home. Instead unhealthy and more affordable food stuff would be replaced and since the children nutrition is mostly supplied from the home supplies or homemade packages this would alter the children eating pattern so undesirably towards incorrect templates. Many studies propose certain strategies for food insecurity reduction and so for obesity eradication. Some are as follow: Educating children, adolescents and their parents on healthy cooking skills, reinforcement of the children-parents cooperation for preparing healthy shopping lists, educating parents and caregivers on proper management of the funds for preparing essential and healthy food items, educating parents on avoiding to insert unhealthy food items in their shopping lists and not to keep them at home (60,61,62).

obesity and food insecurity Risk factors often overlap, that is why there seems to be a direct relationship between the two. The most common and the most important link between obesity and food insecurity is "poverty". Different ways of food access and financial status to afford nutritious food options (such as fruits and vegetables) is the main inducement for chronic diseases and health problems and obesity in low income populations and races. The term "food desert" is frequently used to describe the strategic areas with limited financial resources and access to nutritious food. Populations with the highest risk of obesity, including those who live in food deserts remain at greater threat of food insecurity (27,63,64).

There are several aspects of synergy existing between public health, food insecurity and obesity. These aspects titled as the potential environmental conditions, would share a mutually influential relationship and improving each one of them might alter the undesirable conditions governing the society for the benefit of public health. Some of these aspects are: Physical, economical, political and

socio-cultural conditions. Population increase, followed by obesity and food insecurity, strongly demand for critical requirement of developing comprehensive strategies to improve and promote food systems for preventing the catastrophe of obesity which could be achieved by creating social justice in access to food, food security, promotion in the food qualities and welfare in the general health (27,65). One of the strategies to control food insecurity is achieved by means of participation in food assistance programs for the communities at risk. Several studies have reported positive and valuable results from these strategies. Accordingly in low-income communities among the youth with food security obesity and weight gain initiated while the reverse happened among their food insecure counterparts. Abdominal circumference and BMI among the youth with food security had a raise and tended toward obesity after participating in food assistance programs. One of the most commonly used food assistance programs for the youth is school nutrition programs the quantity and the quality of which will leave strong impact on the children's food consumption. The quality of the school food and nutrition services has always been a matter of consideration and the general compromise is targeting towards its promotion. Because these meals may contribute to additional calorie access derived from consumed fat, excess sodium intake, lower fiber intake and as a result obesity prevalence and BMI raise among adolescents and the youth (14,66).

There has always been a significant correlation between pediatric obesity and maternal food insecurity, maternal stressors and the low income of mothers. Maternal stressors specifically could magnify this interrelation. Although there were some specific results extracted from assessing mutual influence of stressors and the state of food security, the level of pediatric obesity with or without stressors was assessed and the following results were obtained: In the absence of stressors the children of food insecure households gained more extra weight while in the presence of stressors children of food secure households gained extra weight and the food insecure children were not affected at all. Of course these results were just significant among the children waving from 3-10 years of age (30,67,68). Raising the level of individual stress among adolescents will induce overweight and obesity through establishing an imbalance between energy intake and expenditure. Being directly exposed to stressors will result in overweight via biological and behavioral mechanisms. The biological mechanism pertains to hypothalamic-pituitary-adrenal axes and the sympathetic system of the body. The behavioral system associates with establishing poor eating habits or decreasing physical activity levels in response to stressors (68,69,70).

The correlation between obesity and food insecurity is more significant among adolescents rather than children and it has been reported upto 35% in some studies. On the other hands, this relationship among the homeless adolescents appears as a multidirectional link, components of which are having a healthy dietary program, food insecurity and obesity (71). The dietary evaluation of adolescents indicated that the reason behind adolescents food insecurity is the minimal

consumption of fruits, vegetables and dairy and the maximal consumption of fat, saturated oils, sweets and salty snacks. Also food insecurity forces many adolescents to go to bed hungrily. It may be the case that among some adolescents due to the lack of sufficient food at home and lack of food supply the correlation between food insecurity and BMI is reversed. In other words, among these people the more food insecurity exists the more weight loss initiates (30).

Food insecurity can equally induce obesity among adults which is basically influenced by certain other components such as gender, age and the marital status (72). In a study conducted upon 4338 men and 4172 women over 20 years of age, marital status proved to be an outstanding component leaving its strong impact on food insecurity. As such that among the divorced men, the issue of minimal food insecurity was a real threat, comparing to their single counterparts. However married women with food security and widows tended to be more obese than their single counterparts. In this research, men with food security had gained higher BMI as compared to their food insecure counterparts and were eventually undergoing obesity. While the obtained results were totally reversed among women (73). A group of other researches have regarded the correlation between food insecurity and pediatric obesity as substantially influenced by their parents behaviors and that, food insecurity may be established in a context of child nutrition guidelines (74). Food insecurity is a major concern pertaining to the maternal weight and nutrition among the pregnant women that can leave its ever lasting impact on the fetus growth and its exposure to obesity during the next years of its life. Studies carried out on the intense impact of food security on the maternal weight gain in pregnancy and also 2 years after birth, indicated that food security in teenage pregnancy do not seem to be closely connected with weight gain and obesity. However 2 years after birth it would turn into a real threat inducing the incidence of obesity (75,76,77,78).

### Discussion

The aim of the current review article is the description and evidence based assessment of the correlation between food insecurity and the state of overweight and obesity. Food insecurity refers to the restricted or unreliable access to sufficient and healthy food from nutritional viewpoint or the limited capabilities to obtain food through socially acceptable ways which as the major health concern, has induced a great deal of chronic diseases such as obesity over the last two decades. Food insecurity and the prevalence of obesity among households and their members basically depend on several various factors like : age, gender, marital status, stressors, income, ethnicity and race. In the articles studied in the present research work, diverse results were obtained regarding the obesity prevalence among different age and sex groups. Food insecurity may exist chronically, seasonally, transitionally or in household context, regional or among a nation. It is a sophisticated and multidimensional phenomenon that besides the life quality and quantity, it comprises socio-cultural and psychological aspects, not specifically confined to those lacking sufficient energy and nutrients storages. Rather it is

so that when people do not have the right to select their own food, have fear of running out of food or become forced to make outstanding alterations in their food preferences, it still carries on (79,80,81,82).

A considerable interrelation between older maternal age and food insecurity could be recognized. To interpret the verified relationship between parental age and food insecurity, it can be argued that older age is for sure equal to significant fall in psychological and physical capabilities, social isolation, deprivations, financial problems and prevalence of certain diseases affecting food security at the same time. There is a causative link between mother's education level and food insecurity (83). In a study conducted among Indonesian rural and urban households, a significant correlation was detected between education level and food insecurity (84). Also in another study performed on Brazilian households, lack of parents academic education was significantly interconnected with food insecurity (85).

The results obtained from studying the correlation between food insecurity and obesity among men and children comprises a variety of positive and negative documents. The results pertaining to women are approximately more consistent which reinforce the idea of overweight women in food insecure households. In the studies extracted from participating in food assistance programs for establishing the correlation between food insecurity and obesity, the women failing to receive food assistance and experience food insecurity were again affected by obesity. So food assistance could safely play a protective role towards women against food insecurity and obesity (86,87).

Various interferences such as food assistance participation and Supplemental Nutrition Assistance Programs can reduce food insecurity while there's no trend of pediatric obesity within them (34).

As obesity and food insecurity risk factors are in a mutual relationship with each other, they may logically have overlaps at times. The most common and the most fundamental link between obesity and food insecurity is considered as Poverty. Unequal nutrient dense food access and financial potency to afford that ( fruits and vegetables) could be regarded as the main inducer of chronic diseases, health problems and obesity among low income populations and races. The term food desert is widely applied to refer to certain geographical regions with limited financial potency and nutritional food access. Populations with the highest rate of obesity prevalence comprise those who live in food deserts and are severely exposed to the threat of food insecurity (27,63,64).

This study similar to others, suffer from certain limitations such as: lack of access to some of the present articles full texts, insufficient number of samples in some of the studies, failure of making a definite conclusion in some of the studies and postponing the final conclusion to the future research works, small number of review articles contributing to the present study subject and availability of the studies conducted in just a limited range of countries.

### Conclusion

According to the studies and researches so far conducted there seems to be some correlations between obesity and

food insecurity so that the food insecurity raise will eventually induce obesity among households. The factors involved in the incidence of obesity and food insecurity are perceived to be similar in most of the cases and they all tend to endanger general health. Since food insecurity in some critical periods of life like the fetal period and the childhood will leave more destructive impact, the attempt for eliminating food insecurity via correct nutritional policies could effectively prevent certain undesirable sequences consisting chronic diseases and health disorders like obesity. Food insecurity may substantially endanger general health and establish obesity due to certain factors as poverty, low income, low levels of education and knowledge, incorrect food choice as a result of restricted resources, stressors, incapability to provide food through acceptable social ways and also limited food access due to some geographical and ecological concerns. For future research projects, it is widely recommended to study food insecurity accompanied with one or a few influential components among certain age and sex groups and the amount of probable destruction among certain races and ethnicities, as the food insecure target groups, should be evaluated.

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