United States
Department of
Agriculture

Economic
Research
Service

Economic
Information
Bulletin
Number 34

March 2008

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National Agricultural Library Cataloging Record:

Ver Ploeg, Michele

Food stamps and obesity : what do we know?
(Economic information bulletin ; no. 34)
1. Food stamps—United States.
2. Poor—Nutrition—United States.
3. Food supply.
4. Obesity—United States.
5. Nutrition policy—United States.
I. Ralston, Katherine.
II. United States. Dept. of Agriculture. Economic Research Service.
III. Title.
HV696.F6

Photo credit: Elderly woman, Eyewire; Woman shopping, USDA/NAL; Man, Photodisc; Children, Corbis; EBT cards, USDA.

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of Agriculture

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A Report from the Economic Research Service

www.ers.usda.gov

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Michele Ver Ploeg and Katherine Ralston

Abstract

Results from reviewed studies indicate that for most participants in the Food Stamp Program—children, nonelderly men, and the elderly—use of food stamp benefits does not result in an increase in either Body Mass Index (BMI) or the likelihood of being overweight or obese. However, for nonelderly women, who account for 28 percent of the food stamp caseload, some evidence suggests that participation in the Food Stamp Program may increase BMI and the probability of obesity. Different results for age and sex subgroups remain unexplained. Further, because food stamp benefits are issued to households, not individuals, mixed results across age and sex subgroups make it difficult to target policy alternatives to address potential weight gain among some participants while not affecting others in the household.

Key Words: Food Stamp Program, obesity, Body Mass Index.

Acknowledgments

The authors thank the following individuals for reviewing the manuscript: Patricia Anderson, Dartmouth College; Charles Baum, Middle Tennessee State University; Ed Frongillo, University of South Carolina; and Steve Carlson, USDA, Food and Nutrition Service. Thanks also to Elise Golan and Mark Prell, both of USDA, Economic Research Service, for their thoughtful comments.

Contents

Recommended citation format for this publication:

Ver Ploeg, Michele, and Katherine Ralston. Food Stamps and Obesity: What Do We Know? EIB-34, U.S. Dept. of Agriculture, Economic Research Service. March 2008.

Summary

The Food Stamp Program provides benefits for low-income individuals to purchase food at grocery stores. The program was begun in the 1960s and expanded in the 1970s at a time when a problem facing many Americans was underconsumption of food and nutrients. Today, however, the primary nutrition problem facing the U.S. population has shifted from too little intake to overconsumption and obesity, even among some low-income populations.

What Is the Issue?

Past research finds that the Food Stamp Program increases food expenditures and stabilizes incomes of the poor. Yet, critics of the program have suggested that the program is too successful—that it has unintentionally contributed to higher rates of obesity among some low-income populations. Recently published studies that have explored the link between participation in the Food Stamp Program and body weight have come to varying conclusions. This report reviews the findings of this emerging body of work and discusses policy implications.

What Did the Study Find?

Results from the reviewed studies indicate that for the majority of program participants—children, nonelderly men, and the elderly—use of food stamp benefits does not increase either Body Mass Index (BMI) or the likelihood of being overweight or obese. For some subgroups, food stamp participation has a negative association with the probability of overweight.

Nonelderly adult women, who account for 28 percent of the food stamp caseload, are the only group of food stamp recipients for whom multiple studies show a link between food stamp receipt and elevated BMI and obesity. According to these studies, food stamp participation over a 1- or 2-year period increases the probability of a woman's becoming obese by 2 to 5 percentage points and may lead to a 0.5-point increase in BMI, or about 3 pounds for a woman 5'4" to 5'6" tall.

The length of time one participates in the Food Stamp Program may have an impact on obesity. The reviewed studies found that long-term participation among nonelderly women was linked to a higher probability of obesity by 4.5 to 10 percentage points. One study also found a smaller, but positive relationship between long-term food stamp participation and obesity for men. These results may suggest that small changes in BMI due to food stamp use accumulate over longer "spells" of participation. But enough is not known about the causal mechanisms of participation and weight gain to conclude that long-term use of food stamp benefits causes weight gain. Long-term food stamp participants are likely to be different from short- and medium-term participants in ways that one cannot observe.

It is also unclear why food stamp participation may affect women, but not men or children. Factors that may account for this effect include differences in energy requirements, activity levels, or household allocation of resources.

Some evidence indicates that food stamp participation, food insecurity, and weight status are related. One study shows that weight change over a 2-year period among women who were persistently food insecure was less than that for women who were persistently food secure. But, food stamp participation roughly offset the smaller weight change for those who were persistently food insecure—a result consistent with the program's serving as a nutritional buffer during difficult economic times.

The reviewed studies were faced with separating and measuring two distinct relationships. On the one hand, food stamp participation may result in obesity. On the other hand, individuals who are heavier may be the very people who are more likely to apply for food stamps, because of larger appetites, for example. Causal attribution is a major challenge for these studies. Methodological and data weaknesses limit the ability of analysts to be certain that increased BMI and obesity risk are due to food stamp participation. Differential effects across sex and age groupings are also unexplained.

The Food Stamp Program is a household-level program, and 89 percent of food stamp benefits go to households that contain a child, elderly adult, or nonelderly disabled adult. Devising program changes that are appropriately targeted to household members who may be at risk of gaining weight, without harming those who are not and who need the nutritional assistance, presents a difficult challenge. Policy changes that help improve overall diets of all household members may be more effective.

How Was the Study Conducted?

ERS reviewed studies that explored the link between food stamp participation and weight status. Particular attention was given to studies that used multivariate analysis, longitudinal data, and accounted for self-selection bias. Results are summarized by population subgroup: children (who make up the majority of food stamp participants), nonelderly adult women, nonelderly adult men, and the elderly.

Introduction

The Food Stamp Program, the Nation's largest food and nutrition assistance program, was designed to provide low-income households with monthly benefits that can be used to purchase the food they need for good health. In 2006, the program served about 27 million people at a cost of almost $32 billion. In addition to providing these benefits, the program also helps stabilize the incomes of the poor and promote food expenditures.

While the Food Stamp Program was founded to help undernourished households put food on the table, the primary nutrition problem facing the U.S. population has shifted from too little intake to overconsumption of calories and obesity. Nearly two-thirds of all Americans are overweight and nearly one-third are obese (Flegal et al., 2002), conditions that are risk factors for heart disease, diabetes, cancer, and other illnesses. The prevalence of overweight and obesity is even higher among some low-income populations, leading policymakers and researchers to question whether the Food Stamp Program might have been too successful in boosting food consumption so that participants eat too many calories and gain weight.

The purpose of this report is to review and interpret what is known about the effect of food stamp participation on the weight status of those who receive program benefits. This review provides a snapshot of the results of studies of the effect of food stamp participation on body weight and is conducted at a time when adjustments to the Food Stamp Program to promote improved dietary health are currently under consideration by policymakers. Note that many of the reviewed studies in this body of literature are recently completed and that additional studies employing different data and methods are currently under way. The results of these studies and future efforts that expand upon them will further inform researchers and test the strength of the findings in this report.

Food Stamp Program Background

The Food Stamp Program furnishes participants with Electronic Benefit Transfer (EBT) cards that can be used at supermarkets and grocery stores, convenience stores, and other food retailers to purchase foods to be prepared at home. The program is an entitlement program available to all U.S. households that meet eligibility requirements pertaining to income, assets, work, and immigration status. Eligibility and benefits are based on household size, household assets, and gross and net income. The average benefit level in 2007 was $96 per person and $215 per household each month (Oliveira, 2007).

The Food Stamp Program serves a diverse population. The largest group of participants is children, who accounted for almost 50 percent of caseloads in 2006 (USDA, 2007). Over the same period, working-age women made up 28 percent of the caseloads, working-age men made up 13 percent, and the elderly age 60 and older made up 8 percent. Just over a third of all households that receive food stamps are single-adult households with children (34 percent). Of all food stamp benefits issued, most go to households that contain a child, an elderly adult, or a nonelderly disabled person (89

percent of all benefits). Although gross income eligibility for the program includes those households with incomes up to 130 percent of the Federal poverty guidelines, the majority of food stamp households had gross monthly incomes below the poverty line (88 percent). The median length of time that participants received food stamps was 6 to 8 months during the 1990s (Cody et al., 2005). The program affects about half of Americans at some point in their lives: 49 percent of children and 51 percent of adults age 20-65 receive food stamps at some point (Rank and Hirschle, 2003).

Why Might Food Stamps Cause Weight Gain?

If food stamp participation does cause weight gain and, more severely, overweight and obesity,[1] then participants may not have become overweight or obese if they had not participated in the program (or if they received a smaller benefit). Two hypotheses attempt to explain how food stamp benefits could contribute to weight gain that may lead to obesity: (1) food stamps encourage beneficiaries to spend more money on food than they otherwise would and to consume more calories as a result; and (2) food stamp participation is linked to a cycle of deprivation followed by abundance and binge eating, which results in weight gain over time.

The first hypothesis implies that food stamp benefits, while having the intended effect of reducing undernourishment or underweight for at least some participants, also may be pushing a portion of participants into overweight or obesity. Citing evidence that offering benefits as cash induces smaller increases in food spending than offering coupons that can only be spent on food (Fox et al., 2004, pp. 45-47), Besharov (2002) suggests food stamp benefits should be delivered as cash to combat obesity among program participants.

This hypothesis is intuitively appealing and is backed with some empirical evidence on food spending from cash-out experiments. These experiments, which randomly assigned some food stamp participants to receive an equal

[1]Body Mass Index (BMI), a measure of weight adjusted for height, is used to classify individuals as overweight or obese. BMI-for-age percentiles are used to classify children as at-risk of overweight or overweight (see box, "Definitions of Body Mass Index and Weight Status").

Definitions of Body Mass Index and Weight Status

Body Mass Index (BMI) is calculated as an individual's weight in kilograms divided by the square of his or her height in meters. For adults, numerical thresholds of BMI distinguish healthy weight from underweight, overweight, and obesity. For children and adolescents, sex-specific BMI-for-age thresholds, using the 2000 Centers for Disease Control and Prevention growth charts, distinguish healthy weight from underweight, at risk of overweight, and overweight.

Adults

Underweight = BMI below 18.5

Healthy weight = BMI at or above 18.5 but below 25

Overweight = BMI at or above 25 but below 30

Obese = BMI at or above 30

Children (age 2 to 19)

Underweight = Below the 5th percentile of BMI-for-age

Healthy weight = At or above the 5th percentile but below the 85th percentile of BMI-for-age

At risk of overweight = At or above the 85th percentile but below the 95th percentile of BMI-for-age

Overweight = At or above the 95th percentile of BMI-for-age

level of benefits as cash, showed that for every dollar, food expenditures from food stamp benefits were $0.18 to $0.28 greater than food expenditures from cash (Fraker et al., 1995). Nonexperimental data show greater differences—marginal propensities of spending on food ranging from $0.17 to $0.47 for every dollar of food stamp benefits, compared with $0.05 to $0.13 for every dollar of cash (Fraker, 1990). Note that these estimates refer to greater food expenditures from food stamps, which would be consistent either with greater quantities consumed or with better quality and greater variety of food, or both. The implicit assumption in the argument that food stamp benefits may be linked to obesity is that the greater expenditures lead to greater calories consumed.

The hypothesis that food stamp benefits encourage participants to consume more food than they otherwise would and to gain weight is also theoretically intuitive. The effect is like a pure income effect in economic theory—if someone is given more resources, he or she will use those resources to purchase more food and more of other goods. If benefits are lowered, the individual will spend less on food and other goods. An increase (decrease) in spending on food would result regardless of whether the benefit came in the form of cash or a food stamp benefit, although the size of the increase (decrease) would not be the same because of different marginal propensities to spend on food from food stamps and from cash.

But just because food stamp participants spend more on food does not mean that the additional spending leads to overconsumption and obesity. It is possible that food stamp benefits allow people to choose a different bundle of foods than they otherwise would. For example, participants could shift spending toward relatively more expensive foods that were previously out of reach (e.g., fresh meats versus canned beans or fresh fruits and vegetables instead of canned items). Or, since food stamps can only be redeemed for food in grocery stores, participation in the program may shift a household's food spending toward foods prepared and consumed at home, as opposed to food away from home. In either case, an increase in food expenditures may not necessarily lead to overconsumption of calories or a poorer diet that then leads to overweight or obesity; rather, it could lead to a more healthful diet, which then leads to a healthier body weight.

Some evidence indicates that the types of foods that food stamp participants are choosing may serve to meet their caloric needs but may not include more healthful foods. Wilde et al. (2000) found that food stamp participants consumed more meat and more added sugars and total fats, but the same amount of fruits, vegetables, grains, and dairy than nonparticipants. Further, in an analysis of data from food stamp cash-out experiments in San Diego and Alabama, Whitmore (2002) found that households that were constrained by the food stamp benefit level spent less on nondairy beverages (primarily soda and juice) when they received their benefits as cash instead of food stamps.[2] Those who were not constrained by the benefit (i.e., their food spending was at least as much as the food stamp benefit) did not shift consumption.

The second hypothesis posits that the administrative practice of distributing food stamps only once a month results in alternate periods of under- and overconsumption, a pattern dubbed the "food stamp cycle," which may result

[2]For a constrained household, the amount of benefits received is worth more than what the household usually spends on food in a month, and thus, the household is constrained to spend more of its budget on food than it would if it received the benefits as cash. Whitmore (2002) estimates that between 20 and 30 percent of food stamp recipients are "constrained."

in weight gain (Townsend et al., 2001). Households consume food every day but purchase food less regularly—every few days for some households, every few weeks for others. Some households make a large monthly shopping trip and smaller shopping trips during the rest of the month. Food stamp participants might spend all or most of their food stamps soon after receiving them, but they may spread out the actual consumption of these foods over the month—purchased foods can be stored for use later in the month. But it is possible that food stamp participants run out of food to consume (and benefits with which to purchase more food) near the end of the month. As food becomes scarce and food intake is restricted, a person may lose weight. Then, when food is abundant, the individual may overeat. This distorted pattern of consumption with its periods of binge eating gradually can lead to increased weight (Brownell et al., 1986; Coscina and Dixon, 1983; Franklin et al., 1948; Keys et al., 1950; Kochan et al., 1997; Lavery and Loewy, 1993; Polivy et al., 1994). In addition to an individual "overshooting" in food consumption, his or her metabolism may slow in response to periods of lower calorie intake (Manore et al., 1991), which could exacerbate the effects of higher average consumption of calories. Consumption cycles may lead some individuals to become more comfortable with extra weight as a perceived cushion against food insecurity.

The food stamp cycle hypothesis of weight gain has not been explicitly tested, although some related evidence is consistent with the hypothesis. Evidence suggests that food security status is associated with weight and weight gain, particularly for those who were in households with marginal and low food security (but not those in households with very low food security) (Townsend, 2001; Wilde and Peterman, 2006). However, the direction of the relationship—whether food insecurity leads to weight gain or whether heavier individuals are more likely to be food insecure—is not clear. Research on the household food choices of marginally and low food secure households indicates that these households tend to reduce the quality and variety of their diets in order to avoid a reduction in the amount of food they eat (Nord and Prell, 2007). Evidence also suggests that the frequency of food shopping, the types of stores visited (i.e., supermarket vs. nonsupermarket), and spending on food vary over the food stamp benefit month (Wilde et al., 2000). Some food stamp participants also reduce their food consumption toward the end of the monthly benefit cycle, although the mean effect is small and not as large as the reduction in food spending at the end of the month (Shapiro, 2005; Wilde and Ranney, 2000).

Both of these hypothesized mechanisms may play roles in the weight status of food stamp recipients. This study examines the evidence for each. The assessment may benefit program designers because if program participation is found to contribute to obesity, policies to reduce such effects will need to address the mechanisms linking participation with weight status. For example, if monthly issuance of benefits is the root problem behind obesity, the most effective policy response may be to issue the benefits more frequently because the boom-and-bust cycle could exist regardless of whether the benefit is cash or a food stamp EBT.

Teasing Out Cause and Effect

Assessing causal relations between food stamp participation and body weight is difficult because researchers have not conducted experiments that compare the body weight outcomes of some participants who are randomly assigned to receive program benefits with those of others who are assigned to a comparison program (or lack of program). Researchers must instead rely on nonexperimental methods that try to determine the counterfactual—that is, what would have happened if no one received food stamp benefits or if an alternative program to food stamps was implemented. A simple comparison of food stamp participants to eligible nonparticipants is an obvious starting point, but such a comparison may be problematic. Those who choose to participate in the Food Stamp Program may have different characteristics than those who are eligible but choose not to participate. Very poor individuals, for example, may be more likely to participate than individuals who are less poor but still eligible. This is consistent with the observation that households that participate in the Food Stamp Program receive almost twice as much in food stamp benefits as the amount that nonparticipating but eligible households would have received had they decided to participate (Downer, 2005).[3] Other differences between participants and nonparticipants also may affect the comparison.

[3]Households with fewer resources are eligible for larger food stamp benefits.

While most studies try to control for as many differences between participants and nonparticipants as possible, it is likely that important differences are not observed. If these differences are related to body weight, then estimated effects of food stamp participation could be biased. This bias is called selection bias because individuals self-select into the Food Stamp Program. Linz et al. (2005) note that poverty is associated with higher risk of obesity among some population groups (e.g., White women) but lower risk of obesity among other groups (African-American and Hispanic men), suggesting that selection bias can be positive or negative in the case of food stamp participation and obesity. Accounting properly for selection bias can reveal a higher or lower risk of obesity than estimates that do not account for such bias.

Several of the early studies of the relationship between food stamp participation and body weight used cross-sectional data (observations of many individuals for a single point in time) and multivariate regression analysis to control for as many other factors that might be related to weight (see box, "Studies Linked by Type of Methodology"). While these studies are useful for understanding broad trends and highlighting possible relationships for further exploration, they do not account for potential selection bias and only observe individuals at a point in time, so they are limited in drawing causal conclusions.

As the studies have evolved, more sophisticated methods and data have been applied. Recent studies used an array of statistical techniques to address selection bias, including instrumental variable models, simultaneous selection models, difference-in-difference models, fixed- and random-effects models, and hazard analysis to control for selection bias and/or to try to decipher causal mechanisms. Both cross-sectional data and longitudinal data (multiple observations on the same individuals over time) have been used in these studies. While a complete review of these techniques is beyond the scope of this report, a brief overview is provided.

Studies Listed by Type of Methodology*

Studies that account for selection bias and use longitudinal data:

Baum (2007) – instrumental variables and fixed effects.

Gibson (2004 & 2003) – fixed effects.

Meyerhoefer & Pylypchuk (2008) – discrete factor random effects and instrumental variables.

Studies that account for selection bias and use cross-sectional data:

Chen et al. (2005) – simultaneous bivariate probit.

Hofferth & Curtin (2005) – instrumental variables.

Kaushal (2007) – difference-in-difference with repeated cross-sections of data.

Studies that use longitudinal data and dynamic models (examine changes in weight status associated with changes in food stamp participation) but do not account for selection bias:

Baum (2007) – survival models of probability of becoming obese; models of the transition to and from obesity status over a 2-year time period.

Kim & Frongillo (2007) – multivariate regression of change in food stamp participation and in food security status on change in BMI.

Jones and Frongillo (2007) – weight change over 2 years regressed on baseline characteristics; weight change over 2 years regressed on changes in other characteristics and baseline characteristics.

Cross-sectional data studies:

Bhattacharya & Currie (2000) – multivariate analysis of the likelihood of having BMI above the 85th percentile for young adults.

Boumtje et al. (2005) – multinomial regression on probability of healthy weight, at risk of overweight, and overweight .

Gibson (2001) – multivariate logistic regression on probability a youth is obese.

Jones et al. (2003) – multivariate logistic regression on probability of at risk of overweight.

Townsend (2001) – multivariate logistic regression on probability of overweight among women.

Ver Ploeg et al. (2007) – multiple cross-sections of data and multivariate regression to predict BMI, probability of overweight, and obesity.

*Some studies use multiple methods and, thus, are listed more than once.

Longitudinal data enable researchers to explore the dynamics of food stamp participation and body weight. Such data are especially important because body weight is the accumulation of past behaviors with respect to diet and exercise and because food stamp participation itself is a dynamic process. Observing study participants' behaviors for a longer time period and observing changes in behaviors can better explain current weight. For example, Jones and Frongillo (2006) examine the relationship between changes in food insecurity status, changes in food stamp participation, and changes in body weight, controlling for as many other intermediating factors as possible. Hazard model analysis of the probability of becoming obese conditioning on current and past observable characteristics (including current

and past food stamp participation) also gives a dynamic perspective to understanding the mechanisms behind food stamp participation, food security, and body weight (Baum, 2007).

Longitudinal data aid in studying these types of transitions. Still, other factors that have not been controlled for are changing and driving changes in body weight and in food stamp participation (see Frongillo, 2003). Thus, researchers also employ methods to correct for any bias due to those unobserved changes along with longitudinal data. "Fixed-effects modeling" essentially models the change in body weight corresponding to a change in program participation status while controlling for "fixed" or time-invariant characteristics of each individual (both observed and unobserved) (Gibson, 2003 & 2004; Baum, 2007). Fixed-effects models control for unobserved time-invariant characteristics at the individual level but not for unobserved time-varying characteristics. Food security status is a time-varying unobserved variable that was not controlled for in most of the studies that used fixed-effects models.

Other studies have accounted for selection bias by identifying observable characteristics that predict food stamp participation (or eligibility) but are not correlated with body weight or changes in body weight using instrumental variable models (with cross-sectional or longitudinal data), simultaneous selection models, or difference-in-difference approaches.

Instrumental variable estimates predict food stamp participation and then use those data to explain BMI or weight status. This approach relies heavily on finding information that can predict food stamp participation but which is not correlated with unobserved characteristics that might also be correlated with weight. Diagnostic tests can reveal the suitability of the instruments, but if the chosen instruments are found to be not suitable, then it will remain unclear as to whether selection bias is not a problem or if the right instruments to account for the bias have not been found.

Chen et al. (2005) used a simultaneous selection model and cross-sectional data to model the decision to participate in the Food Stamp Program simultaneously with body weight, allowing for unobserved determinants of both outcomes to be correlated. Estimation of this model relies heavily on assumptions about the distribution of the errors, and the maximum likelihood estimation of the parameters is sensitive to misspecification error (Chen et al., 2005; Vella, 1998). The models estimated by Chen et al. (2005) use variables to identify food stamp participation (specifically, employment status and region) and test the sensitivity of their findings, but these variables have been found to predict body weight and obesity in other studies (Cawley, 2004; Averett and Korenman, 1996; Meyerhoefer & Pylypchuk, 2008).

A difference-in-difference approach with multiple cross-sections of data has also been used to study the effect of food stamp participation on body weight. Kaushal (2007) used differences in food stamp eligibility rules for immigrants across States and over time to compare BMI and obesity among foreign-born individuals with low education levels. The 1996 Personal Responsibility and Work Opportunity Reconciliation Act excluded some immigrants from eligibility for the Food Stamp Program, but some States enacted "substitute" programs for immigrants. To account for selection bias,

Kaushal compared the body weights of foreign-born individuals in States with substitute programs with those of individuals in States without substitute programs. Eligibility for the program among immigrants is assumed to be randomly distributed across States and across time (or at least it is not correlated with body weight). Thus, the selection into the Food Stamp Program is random among immigrants.

Two studies used both instrumental variable estimators and longitudinal data to study the effects of food stamp participation on weight (Meyerhoefer and Pylypchuk, 2008; Baum, 2007). Meyerhoefer and Pylypchuk used a discrete random factor model with Medical Expenditures Panel Survey data to relate food stamp participation to obesity. They also used instrumental variables to predict food stamp participation. In addition to using the hazard model and fixed-effect analysis discussed earlier, Baum also used instrumental variable estimates of food stamp participation on BMI and obesity.

Most of the studies reviewed assume that food stamp participation causes weight gain. But it is plausible that the causation may be reversed—that is, obesity may raise the need for food stamps (e.g., heavier individuals have larger appetites and need more calories per day to maintain their weight) or obesity may hurt the economic chances of individuals and increase the probability they will be eligible to receive food stamps. It is also possible that some other factor is causing both weight gain and food stamp participation.

Some evidence shows that obese women, especially White women, have lower incomes than healthy weight women (Averett and Korenman, 1996). The lower incomes of obese women are primarily due to lower probabilities of marriage and lower spousal incomes when they do marry, and, secondarily, to lower wages of obese women themselves. Interestingly, Averett and Korenman found that among men, underweight rather than obesity can have a negative effect on wages and marriage probabilities. Cawley (2004) finds that weight lowers the wages of White women (but not Hispanic or Black women); body weight that is two standard deviations greater than the mean leads to wages that are 7 percent lower, which is equivalent to the wage effect of 1 more year of schooling. Given these differences in income and wages for heavier women, all else equal, excess weight may be correlated with women's eligibility for the Food Stamp Program.

Also, there may be feedback effects between overweight/obesity and food stamp participation. For example, those with greater BMIs need to consume more calories than those with lower BMIs just to maintain their current weight. Thus, those who are overweight/obese may have greater food needs (and perhaps are more likely to be food insecure), and are more likely to receive food stamps than those with lower BMIs. Or, food insecurity may be driving both weight gain and the need for food stamps (Frongillo, 2003). That is, food insecurity may change the amount and type of foods eaten in ways that could lead to weight gain, and food stamp participation may be an indicator of food insecurity. It is also possible that psychological factors (e.g., depression) associated with low income, lower marital prospects, food insecurity, or food stamp participation may be tempered by consuming more food—especially foods that give the most enjoyment (like cookies or potato chips—not spinach or bananas).

Different Surveys, Different Measures

In addition to differing techniques used to account for selection bias, the studies and the data sets reviewed also differ in inclusion, measurement, and response quality of key variables, such as participation in food and nutrition assistance programs, food intake, weight and height, food security status, and physical activity.

Different surveys provide different measures of food stamp participation. Some only record whether the individual or household received benefits, whereas others record the amount of assistance received and the length of time benefits were received. Some provide information on current benefit receipt, and others provide information on receipt over the past year or at anytime in the past year. Data on the amount of benefits received and the length of time they were received provide more information about the "intensity" of program participation (one might expect that if food stamp participation affects body weight, those who receive more benefits or receive benefits for longer periods of time may be more affected). This information, however, is harder to collect, and, because respondents are asked to recall more detailed information, the measurements are prone to error.

With the exception of data compiled in the National Health and Nutrition Examination Survey (NHANES), all of the other data sets used in the reviewed studies contain only self-reported height and weight to compute BMI. However, weight is known to be underreported and height is known to be overreported. This potential data weakness will be a problem only if food stamp participants are more likely than nonparticipants to overreport height and underreport weight. While this relationship has not been adequately tested, Kuchler and Variyam (2003) did find that overweight food stamp participants were more likely to report their weight as "healthy" than overweight nonparticipants. Further, most of the studies reviewed make an adjustment for reporting bias (see Cawley, 2000).

Some of the studies focused on changes in BMI associated with food stamp participation, while others focused on overweight or obesity status—whether the individual's BMI is high enough to classify the individual as overweight or obese. Some studies examined both measures (see tables 1 and 2). Increases in BMI do not translate into obesity for individuals who are underweight to begin with or for those who are far enough from the cutoff that designates obesity status (or overweight status). Thus, interpretation of the studies requires a clear focus on what outcome was measured and modeled. Jolliffe (2004) used a continuous measure of overweight status that captured not only whether an individual was overweight or obese but also by how much (i.e., overweight or obesity "depth" and "severity" measures). These measures are less sensitive to errors in height and weight measurement. They also produce different rankings for overweight and obesity status of different ethnic groups than the discrete measure. The depth and severity measure have not been applied to models of food stamp participation and obesity, however.

Most of the studies of the relationship between food stamp participation and body weight do not control for physical activity (the exceptions are Jones and Frongillo, 2006; Kim and Frongillo, 2007; and Townsend et al., 2001). Even

Table 1

Studies of the effect of food stamp participation on children's weight: data, methods, and results by methodology

Authors	Population studied	Data set used	Methods	Results
Account for selection bias and use longitudinal data (fixed effects)				
Gibson (2004)†	Children 12-16	NLSY 1979 child sample	Multivariate logistic regression with child & family fixed effects. BMI, prob(at risk of overweight) & Prob(overweight) examined.	Not significant for girls or boys age 12-18; Girls age 5-11: FSP ↑ P(Owgt); long-term FSP ↑ P(Owgt) even more (5 years of FSP ↑ P(Owgt) by 42.8%) Boys age 5-11: FSP ↓ P(Owgt); long-term FSP ↓ P(Owgt) even more (5 years of FSP ↓ P(Owgt) by 28.8%)
Account for selection bias and use cross-sectional data (instrumental variables predicting food stamp participation)				
Hofferth & Curtin (2005) †	Children 6-12	PSID – Child Development Supplement	Regress predicted FSP benefit amount on BMI & probability of overweight.	Not significant for boys or girls
Cross-sectional data but do not account for selection bias				
Bhattacharya & Currie (2000)	Children 12-16	NHANES 1988-94	Multivariate logistic regression of probability of obesity.	Not significant for girls or boys
Boumtje et al. (2005)	Children age 5-18	CSFII 1994-96 & 1998	Multinomial logit for probability of at risk of overweight, & overweight relative to healthy weight.	Not significant for girls or boys
Gibson (2001)	Children age 12-16	NLSY 1997	Multivariate logistic regression of the probability of obesity.	Not significant for boys or girls
Jones et al. (2003)	Children age 5-12 in households <185% FPL	PSID – Child Development Supplement	Multivariate logistic regression of prob(at risk of overweight). Participation in FS, NSLP, or NSBP for food secure & insecure.	Boys: Not significant Girls: Food secure: ↓ risk of overweight Food insecure: ↓ risk of overweight
Ver Ploeg et al. (2007)	Children age 5-19	NHANES data: 1976-80, 1988-94, 1999-2002	Multiple cross-sections comparing FSP to eligible nonparticipants & higher-income nonparticipants over time.	No consistent pattern in association between FSP and BMI, at risk of overweight, or overweight

† Study received at least partial funding through the Food and Nutrition Research Program of USDA, Economic Research Service.

Key to data set abbreviations:
CSFII – Continuing Survey of Food Intake by Individuals
NLSY – National Longitudinal Survey of Youth
NHANES – National Health and Nutrition Examination Survey
PSID – Panel Study of Income Dynamics

Source: USDA, ERS.

Table 2

Studies of the effect of food stamp participation (FSP) on adult weight: data, methods, and results by methodology

Study	Population studied	Data set used	Methods	Results
Account for selection bias and use longitudinal data				
Baum (2007)†	Men & women age 20-28 in 1985	NLSY 1985-2000	OLS; IV estimates for FSP; fixed effects; hazard analysis; lagged receipt of FS benefits – long-term vs. short-term participation; examined BMI & Prob(obesity) as outcomes.	Women: OLS: 2-5 percentage point ↑ in obesity Fixed effects: ↑ in BMI & obesity IV: Not different from OLS Hazard: ↑ in BMI & obesity Lag FSP: long-term use ↑ BMI & obesity; short- & medium-term do not Men: OLS: Not significant Fixed effects: food stamp benefit amount ↑ BMI IV: Not different from OLS Hazard: Not significant Lag FSP: long-term use ↑ BMI & obesity; short- & medium-term do not
Gibson (2003) †	Men & women age 20-28 in 1985	NLSY 1985-1996	Fixed effects; examined long-term FSP; Prob(obese) was outcome examined.	Women: Fixed effects: FSP ↑ obesity 2 percentage points, or 9.1%; Long-term FSP ↑ 20.5% Men: Not significant for short- or long-term
Meyerhoefer & Pylypchuk (2008)	Men & women age 18-64	MEPS 2000-03	Discrete factor model for random effects w/ IV estimates for FSP & longitudinal data Prob(normal, overweight or obese) weight status examined.	Women: 6.7% increase in obesity Men: Not significant
Chen et al. (2005)	Men & women age 15+ in households w/ income<130% of poverty line	CSFII 1994-96	Bivariate probit to predict FSP and BMI & Prob(obese).	Women: ↑ BMI 3.6 points; 33% obesity Men: Not significant
Kaushal (2007) †	Men & women age 21-54, foreign born & low education	NHIS 1992-2001 & CPS 1994-2002	Difference-in-difference comparing BMI of foreign born in States with substitute Food Stamp Programs to BMI of those in States without substitute programs. IV estimates using State substitute programs to predict FSP.	Women: Not significant for either D-in-D or IV estimates Men: Not significant for D-in-D or IV

continued...

Table 2 (Cont.)

Studies of the effect of food stamp participation on adult weight: data, methods, and results by methodology

Study	Population studied	Data set used	Methods	Results
Longitudinal data and dynamic models				
Jones & Frongillo (2006) †	Women age 18-74	PSID 1999 & 2001	Lagged FSP & food security status on change in weight; change in FSP & food security status on change in weight	Lagged and dynamic results are similar—no effect of change in food security status, but persistently food insecure lost weight; FSP had no effect for food secure in both time periods & for those who change food security status; for persistently food insecure, FSP offset weight change
Kim & Frongillo (2007)	Men and women age 54+ (AHEAD) & age 71+ (HRS)	AHEAD & HRS 4 waves of each from 1995-2002	Examined current, lagged & changes in food insecurity status & food stamp participation on BMI & overweight status. not significant.	Results similar for men & women. Food insecure FSP less likely to be overweight than nonparticipants. Interactions between food insecurity & FSP
Cross-sectional studies without accounting for selection bias				
Townsend et al. (2001) †	Men & women age 20+	CSFII 1994-96	Prob(overweight) as function of FSP & food insecurity.	Women: Food insecurity & FSP ↑ obese Men: Not significant
Ver Ploeg et al. (2007)	Men & women age 20+	Multiple cross-sections of NHANES 1976-80, 1988-94, 1999-2002	Multivariate regression comparing BMI and Prob(overweight & obese) of FSP to eligible nonparticipants	Women: Differences in early years between FSP & non-participants not present in recent years. Men: Few differences for FSP & nonparticipants over time

† Indicates the study received at least partial funding through the Food and Nutrition Research Program of USDA, Economic Research Service.

Key to data set abbreviations:

AHEAD – Asset and Health Dynamics Among the Oldest Old
CPS – Current Population Survey
CSFII – Continuing Survey of Food Intake by Individuals
HRS – Health and Retirement Survey
NHIS – National Health Interview Survey
NLSY – National Longitudinal Survey of Youth
MEPS – Medical Expenditure Panel Survey
NHANES – National Health and Nutrition Examination Survey
PSID – Panel Study of Income Dynamic

Source: USDA, ERS.

those that control for exercise and activity rely on imprecise, self-reported measures. Ignoring or inadequately controlling for physical activity would distort results of these analyses if food stamp participants have different physical activity patterns than similar nonparticipants against whom they are compared. But this is untested. Physical activity differences across gender and across the income spectrum, particularly related to occupation and types of work, could explain differential patterns of weight—for example, if low-income men are more likely to work in physically demanding jobs than high-income men.

Studies Reviewed

Despite these limitations, the body of literature examining the effect of food stamp participation on weight has grown. This ERS review summarizes the state of knowledge at this point in time, and there is certainly room for more research on the topic. In drawing conclusions from the available literature, greater emphasis was placed on studies that account for selection bias.

Note that a panel of experts formed by USDA's Food and Nutrition Service (FNS) studied the effect of all food and nutrition assistance programs and poverty on obesity (Linz et al., 2005).[4] This panel concluded that poverty and obesity are associated for some populations, but that there is an inconsistent association between food and nutrition assistance program participation and obesity and no evidence to support a causal relationship between the programs and obesity. This review builds upon the FNS study and benefits from the recent publication of additional studies that have exploited longitudinal data and applied different statistical techniques to account for selection bias. ERS reviewed 15 studies. Table 1 lists the methods, data used, and results for studies of children. Table 2 presents the studies, methods, data, and results for adults. The studies of adults use a greater variety of data sets and methods than those that focus on children. Further, only two of the studies of children account for selection bias (Gibson, 2004; Hofferth and Curtin, 2005), compared with five of the studies of adults.

This review discusses statistically significant results that show that food stamp participants have different BMIs or are more or less likely to be obese than similar nonparticipants with at least 90 percent confidence. The review notes the size of these effects (positive or negative and magnitude). Statistically insignificant results may still provide evidence that food stamp participation affects weight; however, the effect is just not very important or the statistical power for detecting an effect is too low.

For results concerning the probability of obesity, it is important to be clear about the magnitude of reported changes because the probability of obesity is itself a fraction, measured in percent. Specifically, findings and summaries in the literature may report the *percent* increase in obesity associated with food stamps, a measure that differs from the *percentage point* increase in obesity. For example, if the base probability of obesity were 20 percent, then an increase of 2 percentage points from 20 to 22 percent translates into a 10-percent increase (2 percent relative to 20 percent). This 10-percent increase is not the same as a 10-percentage-point increase in obesity, which would be from 20 percent to 30 percent. Caution is warranted whenever reading and interpreting statistical findings involving percentage points and percentages.

[4]Many food stamp participants receive benefits from other food and nutrition assistance programs, such as the Special Supplemental Nutrition Program for Women, Infants, and Children, and the National School Lunch and School Breakfast Programs. This review considers only the relationship between food stamp participation and body weight. Jones et al. (2003) considered participation in all four programs for children, and Hofferth and Curtin (2005) considered participation in food stamps and the two school feeding programs.

Effect of Food Stamp Participation on Weight Status

Children

Children account for about half of all food stamp participants, and among all participants, the long-term consequences of overweight and obesity for children are greater in terms of both the possibility of current and future weight-related health problems and the pecuniary costs of treating those health problems. Most studies that address the link between food stamp participation and weight for children examine only schoolage children and separately analyze adolescent children (age 12-18) and pre-adolescent children (age 5-12) (see table 1). Studies of children age 2-4 focus on participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) rather than on participation in the Food Stamp Program.[5]

[5]BMI-for-age is not defined for children under age 2.

Food stamp participation does not seem to be related to BMI or the probability of overweight for adolescent children. None of the studies reviewed found a link between food stamp participation and body weight for boys or girls between ages 12 and 18.

For children age 5-12, the studies show mixed results. Most studies found no significant relationship between food stamp participation and weight. However, two studies are of note because they did find links—although in opposite directions. Gibson (2004) found that for young girls, additional years of food stamp participation led to greater probability of overweight; for boys, however, additional years of food stamp participation were associated with lower probability of overweight. Jones et al. (2003) examined the effect of food stamp participation by food security status. This study found no significant relationship between food stamp participation and the probability of at-risk of overweight for boys regardless of their food security status. For girls, the study found that food stamp participation had a negative effect on risk of overweight regardless of food security status.

The mixed results for young girls could be due to the different approaches of the studies. Jones et al. (2003) used 1 year of data and only observed food stamp participation and at-risk of overweight and overweight status for one time period and did not control for selection bias. The study did, however, investigate the interactive effects of food security status and food stamp participation on weight. Further, it controlled for participation in other food and nutrition assistance programs (National School Lunch and Breakfast Programs). Gibson (2004) does account for time-invariant family and individual characteristics that may be correlated with food stamp participation and overweight status. It finds that the positive effect of food stamp participation on the probability of overweight becomes both stronger statistically and larger when controls for time-invariant family or individual characteristics are included; however, it is difficult to reconcile these results with the results for young boys and for older children, which show that when time-invariant family and individual characteristics are controlled for, the relationship between food stamp participation and overweight status either becomes negative (i.e., food stamp participation is associated with lower risk of overweight) or becomes statistically insignificant. Further, when both age

groups are analyzed together, the fixed-effects estimates show no relationship between food stamp participation and the probability of overweight.

In general, therefore, the evidence for adolescents seems to indicate that food stamp participation is not linked with body weight, while the evidence for younger schoolage children is mixed.

Nonelderly Adult Women

Several studies of the effect of food stamp participation on nonelderly adult women, who make up 28 percent of all food stamp participants, show that food stamp participation increases BMI and the probability of obesity. Other studies find no effect and/or point to specific segments of the population for whom the effect is larger or nonexistent (see table 2). Baum (2007), Gibson (2003), and Meyerhoefer & Pylypchuk (2008) each use longitudinal data and attempt to control for unobserved characteristics that increase a woman's propensity to be a food stamp participant. Results from these three studies indicate that current food stamp participation increases the probability that a woman is obese by a range of 2-5 percentage points over a period of 1-2 years.[6] These changes in the probability of obesity of 2-5 percentage points translate to an increase in the probability of obesity ranging from 5 to 21 percent. Using a single period of cross-sectional data, Chen et al. (2005) find a much larger effect of food stamp participation on obesity—a 33-percent increase. Unlike the other three studies, this study uses cross-sectional data with only one measurement of weight and food stamp participation for each sampled individual.[7] Further, the study uses weak information to identify food stamp participation and strong assumptions about the distribution of unexplained variance to estimate the impact of food stamp participation on weight.

[6]Gibson (2003) and Baum (2007) use yearly data for part of the study period, but biennial data for other years. Meyerhoefer and Pylypchuk (2008) use biennial data.

[7]The use of a single period of cross-sectional data also means that more of the sample of food stamp participants are long-term participants, which may explain the larger estimated impact discussed later in this report.

Baum (2007), Kaushal (2007), and Jones and Frongillo (2006) also study the link between food stamp participation and body weight using continuous measures of body weight—BMI or just weight unadjusted for height. Baum finds that food stamp participation is associated with a 0.5-point increase in BMI for women. For women between 5'4" and 5'6" tall, this effect would translate into about a 3-pound difference. Kaushal finds that food stamp participation does not lead to increases in BMI for foreign-born women (the population studied). Jones and Frongillo examine the increase in body weight after 2 years for women who change food security and food stamp participation status over those years. They find that food stamp participation is not a significant factor in weight change for women who are persistently food secure or who changed food security status over the 2-year period. Women who were persistently food insecure had significantly smaller changes in body weight than other women when food stamp participation was not controlled. But, among these persistently food insecure women, food stamp participation offset the lower weight change associated with being persistently food secure—increasing weight change by almost 8 kg, or about 17 pounds. Thus, it appears that food stamp participation has a moderating effect on weight change among persistently food insecure women.

Both Baum (2007) and Gibson (2003) examine the effect of long-term participation in the Food Stamp Program on the probability of obesity. Gibson finds that women receiving food stamp benefits for all 5 years of the study's

data span are 4.5 percentage points (or 20.5 percent) more likely to be obese. Baum finds a larger effect—long-term participants (those who have received food stamp benefits for at least 24 months) have an increased probability of obesity of 10 percentage points (or about a 50-percent increase in obesity).

Nonelderly Adult Men

Nonelderly men age 20-59 account for 13.4 percent of all food stamp participants. With one exception, none of the studies found a significant link between concurrent food stamp participation and BMI, overweight, or obesity status for men (see table 2). Baum (2007) found that food stamp participation was positively related to BMI for men in fixed-effects estimates; however, these results did not show a significant link between food stamp participation and the probability of overweight or obesity. Thus, the positive effect on BMI was not large enough to shift more men into the categories of greater health risk, or the shift in BMI was an improvement among underweight men. The ordinary least squares (OLS) and hazard model estimates from Baum (2007) do not show any effects of food stamp participation on BMI, overweight, or obesity for men.

The evidence with respect to long-term participation in the Food Stamp Program and men's weight is mixed. Gibson (2003) finds no significant effect of long-term participation (up to 5 consecutive years) on BMI or the probability of obesity. Baum (2007) finds that long-term participation (received benefits for all 24 months in between observation periods) increases BMI and the probability of obesity for men, but short- and medium-term participation does not, nor do multiple spells of participation.

Elderly

Elderly food stamp participants (age 60 and older) make up 8 percent of all food stamp participants. Only two studies have examined the relationship between food stamp participation and weight among the elderly. Kim and Frongillo (2007) examined weight and participation in food and nutrition assistance programs in the context of food insecurity for elderly individuals. They found some evidence that among food-insecure elders, those who participated in food and nutrition assistance programs were less likely to be overweight than those who did not participate. An earlier descriptive study (Fox and Cole, 2004) compared the prevalence of obesity among food stamp participants with that of income-eligible nonparticipants by age group, without accounting for other factors that could influence obesity. It found that for women age 60-69, food stamp participants were more likely to be obese. The differences did not hold for women age 70 and older. Elderly men receiving food stamps were not more likely to be obese than nonparticipants of the same age group.

Short-Term Versus Long-Term Participation

Most of the studies summarized in the previous sections used current food stamp participation as the measure of food stamp participation. The outcome measures were either current measures of weight status (BMI, overweight, or obese) or the change in weight status over a period of 1-2 years. The "effect" of food stamps was then modeled as the effect of current participation on current weight or on a change in weight over the same length of time.

Most "spells" of food stamp participation (the number of consecutive months an individual receives food stamps) do not last very long—the median spell length of newly enrolled food stamp participants was 6-8 months in the 1990s (Cody et al., 2005). Given this short time frame, it should not be surprising that food stamp participation has little impact on BMI and obesity; however, some individuals have much longer spells of participation. Some low-income households cycle on and off the Food Stamp Program, making the weight effects of any one spell an underestimate of the overall potential weight effect of the program.

Three studies examined the effects of long-term participation in the Food Stamp Program on BMI (Baum, 2007; and Gibson, 2004 and 2003). Gibson (2003) found that for women, long-term participation was linked with even greater probability of obesity relative to otherwise similar women who did not receive food stamp benefits. The same study did not find a long-term effect for men. Baum (2007) found that long-term (but not medium-term, short-term, or multiple spells of) participation increases the probability of obesity among men, but that the effect is much larger for women. For children, Gibson (2003) finds that long-term food stamp participation is associated with a sizable increase in the probability of overweight for young girls (5 years of food stamp participation increases the probability of overweight among girls by 42.8 percent), but that long-term food stamp participation greatly reduces the probability of overweight among young boys (5 years of participation lowers the probability of overweight 28.8 percent).

A cross-section of food stamp participants at a given point in time will always include more long-term participants because these participants accumulate as a larger portion of all participants. For example, Cody et al. (2005) found that among a cross-section of food stamp participants in March 1996 (not just new entrants), the median spell length was between 2 and 4.5 years. Studies based on a single cross-section of data will necessarily include more long-term food stamp participants. This may at least partially explain why Chen et al. (2005), which uses only a single cross-section of data, found much larger effects of food stamp participation on obesity among women.

Long-term food stamp participants (however defined) are a subset of all food stamp participants and are likely to have different characteristics than other participants in ways other than weight status. Long termers are most likely the poorest participants and the least likely to be able to support themselves from earnings. Cody et al. (2005) found that the elderly and single mothers were two subgroups of new food stamp participants who had longer median spell lengths in the program (15 and 11 months, respectively).

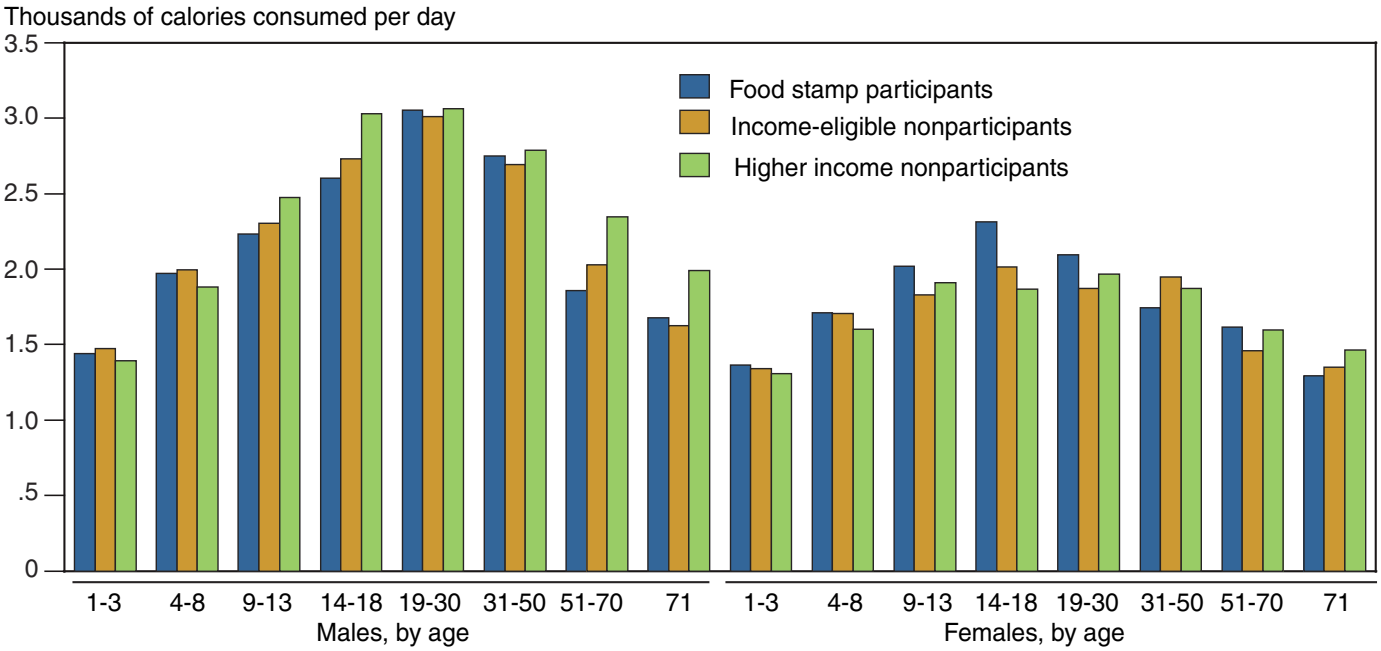
Small but positive effects of current food stamp participation on BMI for women may accumulate over longer spells of food stamp participation or over shorter, but repeated spells, and result in substantial total effects on BMI over time. Or, if the causal mechanisms underlying weight gain for women are related to the food stamp cycle, then prolonged use of the food stamps could result in long-term weight gain. Or, the weight gain itself may increase the need for food stamps if a heavier woman needs to eat more calories just to maintain her weight or if her economic need for food stamp benefits is increased because of reduced wages and marriage opportunities associated with heavier women—associations that have been documented in previous studies.

Interpreting Differences Across Demographic Groups

The literature does not thoroughly examine the factors that account for different results by sex. The study results show almost no effects of food stamp participation on men or boys, while several studies find that food stamp participation increases weight for women and young girls, although the results for young girls are not as consistent. Several factors may help account for the differences between adult men and adult women. Chen et al. (2005) suggest that differences in caloric requirements between men and women may account for differences in the effects of the program on weight because food stamp benefit levels do not differ by the sex of recipients. Devaney et al. (2005) found that average energy requirements for men participating in the Food Stamp Program are higher than those for women participants, although the ranges for requirements for each group overlap. This study did not consider activity levels that affect caloric need; accounting for this factor would accentuate this difference if male food stamp recipients are more likely to have higher physical activity levels (e.g., from jobs requiring more physical exertion) than women recipients. Consumption trends reveal that male food stamp participants consume fewer calories than higher income male nonparticipants for most age groups. In contrast, female participants consume more calories than higher income women in the younger age groups—particularly for adolescent and young women (fig. 1).

Food stamps are targeted toward households, not individuals, and, thus, the benefits are part of the process of household allocation decisions for food expenditures and consumption (e.g., allocation of the food portion of a household's resources to individual household members, such as children). Differences in household structure and household allocation of food

Figure 1
Caloric intake by age, sex, and food stamp participation



Source: USDA, ERS using Fox and Cole (2004), based on NHANES 1988-94.

resources could result in sex differentials in consumption and body weight. Women are more likely to have children in their households than men, and the presence of children could have an impact on how food resources are allocated and eventually on consumption and body weight. For example, boom-and-bust cycles of consumption due to the monthly allocation of food stamp benefits may lead to weight gain. In poor households with scarce food resources, adults may shield their children by reducing their own food intake, and allocate more of the food resources to their children. Food security studies show empirical results that are consistent with this behavior (Nord et al., 2007). If this type of allocation affects women more than men, since women are more likely to have children in their households, then the periods of reduced intake linked with the monthly issuance of food stamp benefits (the food stamp cycle hypothesis) may affect women's weight more than men's. It is also possible that in households with both men and women, food stamp benefits are a part of the household budget that women are more likely to control than men, so women may buy more of the foods they prefer or that the children prefer than what their spouses or partners prefer.

Perhaps women use food consumption to cope with the hardships of poverty or depression whereas men have other means of coping. Some evidence shows that the relationship between BMI and depression differs for men and for women (Dragan and Akhtar-Danesh, 2007).

Selection bias that is not entirely controlled for could also be driving the differences in results by sex. For example, the stigma of receiving food stamps is likely to be greater for men than for women. Men are still viewed as the "providers" for families, and a man who relies upon food stamps is probably stigmatized more than a woman who relies on food stamps. Women are also more likely to live in households with children than men, and the stigma from participation is probably less for households that contain children since participation may be for the benefit of the children. If the stigma for men is greater than the stigma for women, it could be that only those men who are the worst off financially (with the most unmet food need) participate in the Food Stamp Program, while women participants include women who are not as bad off (have less unmet food needs and are more likely to be overweight). If that is the case, then giving both groups more resources for food may give enough food to avoid undernourishment to men who participate, but may give some women enough food to push them into overconsumption and weight gain.

If long-term participation in food stamps is linked to weight gain, then differences in spell lengths of food stamp participation for males and females may help account for the differences in the estimated effects of participation on weight status for men and women. Estimates of the length of time that participants receive benefits have been conducted only at the household level, but these estimates show that households headed by single mothers had much longer median spell lengths than all food stamp households (15 months versus about 7 months).

The mixed results for young boys and girls are harder to explain. One study finds that food stamp participation reduces the risk of overweight among boys but increases the risk of overweight among girls. Why would food stamp participation make young boys less likely to be overweight but young

girls more likely to be overweight, and have no effect on older children of either sex? Perhaps young boys' and girls' food consumption and activity levels are different so that the amount of food provided through food stamp participation is too much for girls but just right for boys. One might expect differences in consumption between teenage boys and girls—USDA's Thrifty Food Plan is derived by incorporating differences in consumption between boys and girls age 12 and older—but not for younger children, where the research shows differential effects of food stamp participation on weight.

Even with a plausible explanation as to why food stamp participation would have a different effect on young boys than on young girls and on women and men, the policy implications may be disconcerting because it would be impractical from an administrative standpoint (and inequitable) to tie benefit levels to sex, or more generally, to caloric requirements.

Although most studies controlled for race and ethnicity and the fixed-effect estimates controlled for those time-invariant characteristics and others, two studies in particular provided specific information on how the effects of food stamp participation on women's weight may vary across race/ethnicity. Kaushal (2007) examined the effect of food stamp participation on the BMI of foreign-born women (which could include people of many different ethnicities but likely comprises mostly Mexican and other Latin American immigrants). Kaushal found no effect of food stamp participation on weight for the foreign-born population. In a study using repeated cross-sections of data to examine the association between food stamp participation and BMI over time, Ver Ploeg et al. (2007) found that non-Hispanic Black women who received food stamps had similar BMIs to eligible nonparticipants and some higher income nonparticipants over time (from 1976 to 2002). Greater differences between food stamp participants and eligible nonparticipants were found among non-Hispanic White women, but the latest cross-section of data used in this study (covering 1999-2002) showed no differences between food stamp participants, eligible nonparticipants, and low/moderate income nonparticipants for non-Hispanic White women. Thus, some evidence points to possible differential effects by race/ethnicity, although mechanisms to account for these effects have not been hypothesized or tested.

Interpreting Selection Bias

A key methodological question in deciphering the relationship between use of food stamps and weight gain is whether unobserved characteristics correlated with both food stamp participation and weight might bias results of simple multivariate regression models. Both Meyerhoefer and Pylypchuk (2008) and Gibson (2003) find that accounting for unobserved time-invariant individual characteristics reduces the size of coefficient estimates of food stamp participation on the probability of obesity. In other words, accounting for individual characteristics reduces the size of the association of food stamp participation on obesity, whereas not accounting for them upwardly biases the estimated effect. Interestingly, Baum (2007) finds the same effect for women, but the opposite for men—that is, once time-invariant individual characteristics are controlled for, the estimated effect of food stamp participation increases in size for men (and becomes statistically significant). Taken together, these results suggest that women with higher proclivities for obesity are more likely to participate in the Food Stamp Program, while men with lower proclivities for obesity are more likely to participate.

Hypotheses Revisited

What does this body of work reveal about the causal mechanisms between food stamp participation and weight gain? A few of the studies provide material to draw upon, although none give a clear answer to this question.

Meyerhoefer and Pylypchuk (2008) provide an informal test of the theory that higher marginal propensities to consume food out of food stamps are causing participants to gain weight. Using evidence from the cash-out experiments showing that only households with multiple adults had higher marginal propensities to consume food out of food stamps while single adult households did not (Breunig and Dasgupta, 2005), Meyerhoefer and Pylypchuk conducted separate estimates of the effect of food stamp participation on the probability of obesity for women in single-adult households and compare them with women in multiple adult households. If greater marginal propensities to consume food acquired through the use of food stamps are driving the weight gain among women, then the effects of the use of food stamps would be expected to be greater for women in multiple-adult households; however, this test finds that the effect of food stamp participation on obesity is larger for women in single-adult households than in multiple-adult households (2.8 percentage points). Thus, initial evidence does not support the idea that obesity is a byproduct of food stamp benefits enabling participants to consume more food than they otherwise would. This analysis suggests that cashing out food stamp benefits to reduce overconsumption of food may not have the intended effect on body weight.

If the level of food stamp benefits are too high for some participants and enable them to gain weight, then one would expect that the value of food stamp benefits received (per food needs for a given family size) would be positively related to BMI and the probabilities of overweight and obesity. While none of the studies use a benefit-relative-to-need measure of food stamp participation, some of the studies use the amount of food stamp benefits received (or a prediction of that amount) instead of or in addition to a dichotomous measure of food stamp participation.[8] The results of studies that include measures of the food stamp benefit level show either similar results as those that use a dichotomous variable or a weaker link between food stamp participation and body weight. Jones and Frongillo (2006) use the total amount of food stamp benefits received over the study time period as their control for food stamp participation and find a relationship for only those women who are persistently food insecure (see results explained earlier). Two studies used both a continuous and a dichotomous measure of food stamp participation (Baum, 2007; Gibson, 2003). The fixed-effects models estimated in Baum (2007) show no relationship between food stamp participation and BMI or obesity for women when benefit levels are used to measure food stamp participation. However, for men, the amount of food stamp benefits is positively related to BMI (but not obesity) and is marginally significant. The OLS estimates from Baum (2007) using the food stamp benefit amount are consistent with results when a dichotomous measure of food stamp participation is used. In contrast to findings using a dichotomous measure of food stamp participation, Gibson (2003) finds no relationship between the benefit amount and obesity for women.

[8]Most studies do control for some measure of family or household size.

Two studies examine the interplay between food security, food stamp participation, and weight, although neither tests the food stamp cycle hypothesis. Jones and Frongillo (2006) find that among the persistently food insecure, food stamp participation offsets most of the smaller change in weight (compared with those who were persistently food secure). [9] Food stamp participation offsets about 5-8 kg of the 7 kg difference in weight change between those persistently food secure and those persistently food insecure. The study does find that those who change food security status (become food secure or food insecure) had greater weight change than those who were persistently food secure. It also finds a positive association between food stamp participation and weight change for those who are persistently food secure, although the statistical significance of this association varies across model specifications. Although Jones et al. (2003) did not examine the dynamics of food security, food stamp participation, and weight, the results of this study support the finding that food stamp participation had a moderating effect for low income girls who were food insecure. The results of these studies cannot be interpreted as evidence that the food stamp cycle is the cause of increased obesity among women; however, it is clear that some factor associated with persistent food insecurity and food stamp participation may be affecting weight status for women, or that some unobserved factor is driving the results (Jones and Frongillo, 2006).

[9]Changes in food security and food stamp participation in this study are measured over the course of a year—not on a monthly basis, which would be required to examine the food stamp cycle hypothesis

Conclusions

Results from the reviewed studies indicate that, for the majority of participants, food stamp benefits do not have an impact on overweight or obesity. Even taking the results of studies that find a consistent link, the effect of short-term food stamp participation on overall obesity levels is, at most, very small. For example, say that researchers observe 100 individuals who receive food stamp benefits in a given month and then observe the recipients' BMIs over the next year or two. If all of these recipients were nonelderly women, one would expect that BMIs after 2 years would reveal that between two and five of the women would be obese due to food stamp participation. But nonelderly women make up only 28 percent of all food stamp participants. Thus, of the 100 participants, the number that would be observed as becoming obese after food stamp participation would be lower—between 0.6 and 1.4 individuals (28 percent of 2 to 5). Thus, of 100 people who received food stamps in a given month, it could be expected that about 1 participant would be obese due to food stamp participation and 99 would not change their weight status (i.e., due to food stamp participation).

Using the results of his study and assuming that the Food Stamp Program has a causal relationship to obesity (at least for some participants), Baum (2007) estimated the impact of the Food Stamp Program on the overall increase in obesity in the United States. The study found that overall, the Food Stamp Program has had a negligible effect on obesity in the United States—use of food stamps may account for 0.5 percent of the increase in obesity among adults since the mid-1970s. Results from Chang and Lauderdale (2005) and Ver Ploeg et al. (2007) show that differences across income groups in BMI and overweight and obesity are also diminishing. It is clear that factors other than the Food Stamp Program play a larger role in explaining the obesity epidemic.

Two reviewed studies found that long-term participation in the Food Stamp Program may have a larger impact on BMI and obesity for women (Gibson, 2003; Baum, 2007). Further research could explore why effects are different for long-term participants or why long-term participation has a different effect on weight status than short- and medium-term participation.

Not enough is known about the causal mechanisms of food stamp participation and weight gain among some participants—particularly nonelderly women—but not other participants to make policy recommendations. The Food Stamp Program serves a diverse population, and any change in policy or administration will need to consider that some participants may be helped by the changes while others may be hurt. For example, reducing the overall benefit level may have the intended effect of lowering weight gain for some participants but may have the unintended effect of adding hardship for others. Further, because adult women are the only group for which a link between participation and body weight may exist, any policy solutions would have to consider the differential effect across age and sex. Nonetheless, with some caution, this report discusses the implications of these findings for policy alternatives.

The analysis conducted in reviewed studies suggests that the "cash out" solution to reducing obesity may only change the consumption of a group of women for whom the program has less of an impact on weight—women in multiple-adult households. Further, cashing out food stamps may not solve the problem of cyclical consumption, and reducing benefit levels could make the problem worse for some participants. Evidence from Jones and Frongillo (2006) suggests that food stamp participation influences weight change of the persistently food insecure but does not affect women who change their food security status or who are persistently food secure. This study provides some evidence that food insecurity and food stamp participation have an interactive effect on weight for women. The study did not attempt to pinpoint how changes in food security status within a monthly food stamp benefit cycle repeated over time may affect weight (any such study would run into severe data limitations). Thus, it is not known whether boom-and-bust food consumption patterns tied to monthly benefit issuance are driving weight gain among women. If the boom-and-bust pattern does contribute to obesity, possible policy solutions include either increasing the frequency of benefit payment (to biweekly or weekly) or even increasing the benefit amount, which could, paradoxically, help reduce obesity by reducing the number of hungry days at the end of the payment cycle.

Some alterations to the Food Stamp Program have been suggested to improve the overall diets of food stamp participants and to combat obesity. Proposed changes include restricting the types of foods that can be purchased with food stamps, offering bonuses or vouchers for buying healthful foods, such as fruits and vegetables, and expanding Food Stamp Nutrition Education. Such policies, if effective, could benefit recipients at risk for development of overweight and obesity without adversely affecting recipients who depend more heavily on food stamps to meet their food needs. However, the effectiveness of such policies is untested, and some initial examination of the potential effects of these policies raises doubts that they may substantially change food expenditure and consumption behaviors (Guthrie et al., 2007).

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