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Maternal and Child Dietary Intake: The Role of Maternal Healthy-Eater Self-Schema

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Abstract

Background—Mothers play a key role in shaping the dietary intake of their young children through their own dietary intake and the foods they make available at home. Therefore, understanding the mechanisms underlying maternal food choices is crucial. Cognitions about the self as a healthy eater, referred to as healthy-eater self-schema (HESS), predict dietary intake in diverse samples, but the linkage has not been investigated in mothers and their feeding behaviors. This study examined the relationship between a maternal HESS, maternal and child intake of fruits, vegetables, saturated fat, and added sugar, and home food availability.

Methods—A cross-sectional, descriptive design was used with mothers and their 2–5 year old children (N=124 dyads). Kendzierski's Healthy-Eater Self-Schema questionnaire was used to measure HESS. Block Food Frequency Screeners were used to measure diets (mother and child) and the Home Environment Survey was used to measure home availability of fruits/vegetables and fats/sweets. Multiple regression and multiple mediation analyses were performed.

Results—Maternal HESS was positively associated with maternal intake of fruits and vegetables, and negatively associated with intake of added sugar. Maternal HESS was not directly associated with child dietary intake, but was indirectly associated with child intake of fruits, vegetables, and added sugar through maternal intake of the same foods. Home food availability was not significantly associated with HESS.

Conclusion—This study found that a mother's HESS was positively associated with her diet, which was subsequently associated with aspects of her child's diet. Interventions to foster

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development of HESS in mothers may be an effective means to promote healthy dietary intake in mothers and their young children.

Introduction and Background

The majority of American preschool-aged children consume less than the dietary recommendations for vegetables (Kim, et al., 2014; Krebs-Smith, et al., 2010) while their usual intakes of fats and added sugar exceed maximum allowances (Butte, et al., 2010; Krebs-Smith, et al., 2010; Slining & Popkin, 2013). This is concerning because poor dietary intake can lead to excessive weight gain and related health consequences, including cardiovascular disease, dyslipidemia, and type-2 diabetes (Grundy, 2004; Mokdad, et al., 2003; Poirier, et al., 2006). Additionally, dietary intake patterns during childhood persist into adulthood, so it is important to establish healthy eating habits early in life (Mikkilä, Räsänen, Raitakari, Pietinen, & Viikari, 2005). Improving dietary intake and preventing excessive weight gain in childhood are complex, multi-faceted problems which require knowledge of determinants at the individual, parental/family, community, and societal levels in order to develop effective multi-pronged interventions (Pratt, Stevens, & Daniels, 2008). The present study focuses on maternal factors affecting child dietary intake because preschool-aged children consume approximately 70% of their total energy intake in the home,[67] and mothers are the individuals predominantly responsible for meal planning and food preparation (Colavito, Guthrie, Hertzler, & Webb, 1996; Hannon, Bowen, Moinpour, & McLerran, 2003).

Numerous studies have reported strong associations between various aspects of mother and child diets including: overall diet quality, macronutrients, fruit, vegetables, snacks, desserts, and soda (Cooke, et al., 2004; Fisk, et al., 2011; Hart, Raynor, Jelalian, & Drotar, 2010; Hoerr, Lee, Schiffman, Horodynski, & McKelvey, 2006; Miller, Moore, & Kral, 2011; Papas, Hurley, Quigg, Oberlander, & Black, 2009; Vereecken, Keukelier, & Maes, 2004). Although most of these studies were correlational, one large prospective cohort study of mothers and their young children found that maternal diet quality explained 30% of variance in her child's diet quality (Fisk, et al., 2011). One mechanism underlying the linkage between maternal and child dietary intake is the modeling of food choices by mothers. If a child observes his or her mother eating certain foods, it increases his or her acceptance of that food, which may lead to increased consumption (Birch & Fisher, 1998; Papas, Hurley, Quigg, Oberlander, & Black, 2009).

Additionally, multiple studies involving mothers and preschool-aged children have found that home availability of healthy and unhealthy foods are related to maternal (Bryant, et al., 2011; Kratt, Reynolds, & Shewchuk, 2000) and child intake of those foods (Busick, Brooks, Pernecky, Dawson, & Petzoldt, 2008; Spurrier, et al., 2008; Wyse, et al., 2011). For example, a study was conducted with 400 parents of preschoolers, in which parents were asked to indicate the fruits and vegetables available in their home at that time from a checklist of commonly consumed fruits and vegetables. Results showed greater consumption of fruits and vegetables in children was positively associated with availability of these foods in the home, after controlling for parental education and household income (Wyse, et al., 2011).

Due to the strong impact mothers have on their children's dietary intake, understanding the mechanisms underlying maternal food choice is critical to developing effective interventions to promote healthy diets in children. Cost, convenience and local accessibility of food are commonly reported by mothers as factors influencing food choices (Alderson & Ogden, 1999; Bevan & Reilly, 2011; Jones, et al., 2010; Laraia, Siega-Riz, Kaufman, & Jones, 2004; Larson, Story, & Nelson, 2009; Sherry, et al., 2004), but these are environmental factors which require intervention at a community level (Papas, et al., 2007; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008). Individual level factors also play a critical role in food choice and may be more amenable to change through interventions.

One individual level factor that has been shown to consistently influence dietary intake is a healthy-eater self-schema (HESS), also known as a healthy-eater identity. Individuals with a HESS describe themselves as healthy eaters and indicate that eating in a nutritious manner is an important source of self-definition. Individuals with a HESS have been shown to consume a healthier overall diet (Noureddine & Stein, 2009), higher fiber, fruit and vegetable intake (Allom & Mullan, 2012; Holub, Haney, & Roelse, 2012; Kendzierski & Costello, 2004), less total fat intake, and less junk foods (Holub, Haney, & Roelse, 2012). Additionally, having a healthy-eater identity has been associated with both healthy eating intentions (Brouwer & Mosack, 2015; Carfora, Caso, & Conner, 2016) and overall healthy eating behaviors (Blake, et al., 2013; Brouwer & Mosack, 2015; Carfora, Caso, & Conner, 2016; Ma, et al., 2017; Strachan & Brawley, 2009).

Self-schemas are well-developed, chronically accessible knowledge structures about the self that are formed in specific behavioral domains that are of interest and importance to an individual. These functional knowledge structures serve as a framework through which incoming information is organized, processed and interpreted (Markus, 1977; Markus & Sentis, 1982; Markus, Smith, & Moreland, 1985). Compared to individuals without an elaborated self-schema in a behavioral domain, individuals with a self-schema direct their attention to schema-relevant information, selectively encode this information into long-term memory, and demonstrate enhanced future recall (Markus, 1977; Markus & Sentis, 1982; Markus, Hamill, & Sentis, 1987; Markus, Smith, & Moreland, 1985; Taylor & Crocker, 1981).

In addition to enhanced information processing, self-schemas strengthen the link between intentions and behaviors, and predict consistent behaviors in specific domains, including health-related behavioral domains. For example, individuals with a dieting self-schema displayed a strong linkage between their dieting intentions and behaviors, and were more likely than non-schematics to return to their previous level of intention-behavior consistency related to dieting after a lapse in their behavior (Kendzierski & Whitaker, 1997). Similarly, individuals with an exerciser self-schema demonstrated stronger intentions to exercise (Banting, Dimmock, & Lay, 2009; Kendzierski, 1988) and actual exercise behaviors (Banting, Dimmock, & Lay, 2009; Estabrooks & Courneya, 1997; Kendzierski, 1988; Kendzierski, 1990; Yin & Boyd, 2000) than non-schematics, and had more strategies and plans articulated in memory to accomplish desired exercise behaviors (Kendzierski, 1988).

While possessing a self-schema is clearly associated with health behaviors, the majority of studies that have investigated the linkage between HESS and dietary behaviors have focused primarily on Caucasian college-aged young adults. The extent to which mothers define themselves in terms of healthy eating and the influence of this schema on their own and their child's dietary intake are unknown. Additionally, while evidence has shown that schematics possess the plans and strategies needed to accomplish relevant behaviors, it is unknown if healthy-eater schematics possess similar strategies, such as having more healthy foods and less unhealthy foods available at home, to accomplish healthy eating behaviors. Qualitative studies have shown when mothers personally identified themselves as having a healthy food-related identity, they purchased healthier snacks, including fresh fruit and vegetables (Johnson, et al., 2011) and limited or avoided purchasing unhealthy foods, such as soda (Johnson, et al., 2011) and "junk food" (Blake & Bisogni, 2003). Despite these findings, the relationship of a HESS with the foods and beverages a mother makes available at home, and how this is associated with her child's dietary intake has not been investigated.

Therefore, the primary purpose of this study was to determine the association of a healthy-eater self-schema in a community-based sample of adult mothers with maternal and preschool-aged children's dietary intake and home food availability. A cross-sectional descriptive design was used to test the following hypotheses: (1) a HESS in mothers would be positively associated with fruits and vegetables (cups), and negatively associated with saturated fat and added sugar (grams) in maternal diets; (2) mothers with a HESS would have more healthy foods and less unhealthy foods available at home; and (3) a mother's HESS would be associated with her child's dietary intake mediated through her own dietary intake and home food availability.

Methods

Sample

A convenience sample of 124 mothers was recruited to participate in this study. To be eligible to participate, both mother and child had to meet all inclusion criteria. Mothers had to be English-speaking, 18 years of age or older, and self-identified as the mother and primary caregiver for a child between the ages of 2 and 5 years old. Mothers were excluded if they were receiving psychotherapy or medication treatment for an eating disorder, currently following a medically-prescribed diet, or currently pregnant (all based on self-report). Children were included if they were between the ages of 2 and 5 years old. Children were excluded if they had an identified severe cognitive or physical disability, an underlying medical or genetic etiology of obesity, or if they were currently following a medically-prescribed diet (based on mother's report). Mothers were recruited from community centers, a large community public market, public libraries, and 20 preschools in urban and suburban areas of a city in upstate NY, via printed flyers, social media, and in-person recruitment.

A total of 26 mothers reported having multiple children between the ages of 2 and 5. In these instances, the mothers were screened for eligibility, and then a random number generator was used to select a child for participation. The mother then completed measures based on the randomly selected child.

Procedures

During the initial contact, a structured screening interview to determine eligibility was administered. For mothers eligible and interested in participating, a convenient time and place for data collection was arranged. The study design and protocol were approved by the University Research Subjects Review Board. Written informed consent and permission from mothers to weigh and measure their child was obtained from all participants. Once consent was provided, the surveys were administered in a fixed order with the HESS questionnaire given first to prevent the effects of priming by other measures (Bargh & Chartrand, 2000). All participants were offered the option of having the questions read aloud and recorded by the data collector.

Data were collected in an individual face-to-face session (n=110). However, for a total of 14 mothers, the protocol was administered in small groups of either 3 (n=2 groups) or 4 mothers (n=2 groups). In several cases, mothers were unable to complete all measures during the face-to-face meeting due to time constraints. In those cases, the investigator either called the participant to complete the questionnaires over the phone (n=2), or the participant completed the questionnaires independently (following instruction for completion), after which the investigator collected the questionnaires (n=12). In the instances in which the investigator picked up the questionnaires, she reviewed each questionnaire for completeness with the participant present.

Heights and weights were measured on each participant using a calibrated stadiometer and digital scale. Mothers and children were weighed without shoes and in light clothing by the investigator after completion of the questionnaires. In the instances discussed above, the investigator weighed and measured the mothers and children prior to picking up the remaining questionnaires. Each participant was given a choice of $10 cash or a $10 gift card after completion of the study protocol.

Study Design and Measures

This was a cross-sectional descriptive study. All participants met with the data collector to complete the following questionnaires:

HESS questionnaire—A close-ended self-schema scale consisting of 10 traits or phrases, rated on two 11-point scales for self-descriptiveness and importance, respectively, was used. Of note, the importance scale referred to how important each phrase was “to the image you have of yourself, regardless of whether or not the trait describes you” (Markus, 1977). Three key phrases related to healthy-eating, which have been used in all previous HESS studies (Allom & Mullan, 2012; Holub, Haney, & Roelse, 2012; Kendzierski & Costello, 2004; Noureddine & Stein, 2009), were embedded in the measure. These key phrases were: “healthy eater,” “eats in a nutritious manner,” and “careful about what I eat”. Seven additional positively valenced filler items unrelated to the domain of eating/food were included to decrease transparency of the study purpose (e.g. friendly, caring, someone who sets goals, and creative). In keeping with previous research on self-schemas (Banting, Dimmock, & Lay, 2009; Estabrooks & Courneya, 1997; Kendzierski, 1988; Kendzierski, 1990; Kendzierski & Whitaker, 1997; Markus, 1977; Markus, Hamill, & Sentis, 1987;

Markus, Smith, & Moreland, 1985; Stein & Corte, 2007; Stein & Corte, 2008; Yin & Boyd, 2000), participants were classified as having a HESS if they rated at least two of the three key phrases on the extreme high end of the scales (points 8–11) for both self-descriptiveness and importance.

Validity of this methodology of concurrent endorsement of traits as both highly self-descriptive and highly important (points 8–11 on the scales) to determine availability of a self-schema, has been supported by studies that have found predicted information processing and behavioral differences between schematics and non-schematics in diverse domains (Banting, Dimmock, & Lay, 2009; Estabrooks & Courneya, 1997; Kendzierski, 1988; Kendzierski, 1990; Kendzierski & Whitaker, 1997; Markus, 1977; Markus, Hamill, & Sentis, 1987; Markus, Smith, & Moreland, 1985; Stein & Corte, 2007; Stein & Corte, 2008; Yin & Boyd, 2000). Validity of the HESS measure has also been supported by theoretically consistent behavioral differences in eating behaviors in college students and middle-aged adults (Allom & Mullan, 2012; Holub, Haney, & Roelse, 2012; Kendzierski & Costello, 2004; Noureddine & Stein, 2009). The HESS measure and the separate self-descriptiveness and importance scales have demonstrated high internal consistency, ranging from 0.89 to 0.93 (Allom & Mullan, 2012; Holub, Haney, & Roelse, 2012; Noureddine & Stein, 2009). In the present study, the Cronbach's alpha was 0.89 for self-descriptiveness and 0.87 for importance.

Block Fat/Sugar/Fruit/Vegetable (FSFV) screener—Block Fat/Sugar/Fruit/Vegetable (FSFV) screener was used to assess maternal dietary intake (Lalonde, et al., 2008). This measure is derived from the larger Block 2005 Food Frequency Questionnaire (FFQ), which is the most recent version of the extensively used Block FFQs (Block, et al., 1986; Block, Coyle, Hartman, & Scoppa, 1994; Block, Woods, Potosky, Clifford, 1990; Boucher, et al., 2006; Mares-Perlman, et al., 1993; Subar, et al., 2001) and estimates a wide variety of nutrients and food groups based on National Health and Nutrition Examination Survey (NHANES) 1999–2002 dietary recall data and the USDA Food and Nutrient Database for Dietary Studies. The FSFV screener captured the key outcome variables in this study and has demonstrated validity and reliability with adult samples (Lalonde, et al., 2008).

The screener is composed of 55 questions and is designed to provide average daily estimates of saturated fat (grams), added sugar (grams), fruits (cups), and vegetables (cups) for adults over the past year. Questions address the frequency of food intake (how many days per week). Responses are recorded on a 6-point scale ranging from 1 (none or less than 1 day per week) to 6 (every day). For 39 of the items, participants indicate how much of a specific food or drink they consume in a given day using a 3-point scale describing portion size. Test-retest correlations for this screener have been good, ranging from 0.56 to 0.74, with a mean correlation of 0.66 (Lalonde, et al., 2008). Predictive and construct validity have been established by comparing the FSFV screener to the Block 2005 FFQ and to 24-hour dietary recalls, in which significant correlations were found for all nutrient categories (Lalonde, et al., 2008). The FSFV screener has been used in recent studies with multiethnic adult women (Serafica, Lane, & Ceria-Ulep, 2013; Sternfeld, et al., 2009; Tucker, et al., 2013).

The 2007 Block Kids Food Screener (BKFS)—The 2007 Block Kids Food Screener (BKFS) was used to assess child dietary intake. This screener consists of 41 items, and is designed to assess the dietary intake of multiple nutrients and food groups in children aged 2 through 17. The BKFS was developed and revised from the validated full-length 2004 Block Kids FFQ (Cullen, Watson, & Zakeri, 2008; Marshall, et al., 2008). The BKFS asks a mother (or older child) about the frequency and quantity of foods and beverages her child consumed over the past week, from which it provides estimates of average daily servings of fruit (cups), vegetables (cups), saturated fat (grams), added sugar (teaspoons), and other nutrients not addressed in this study. Responses are recorded on a 6-point scale, ranging from 1 (none last week) to 6 (every day last week). Participants are also asked to indicate the portion sizes of all items on a 3-point scale.

Similar to the adult screener, the food list for the BKFS was developed based on the NHANES 2001–2004 dietary data and is linked to the USDA Food and Nutrient Database for Dietary Studies (Hunsberger, O'Malley, Block, & Norris, 2012; Nutrition Quest, 2004). The screener was initially validated by comparing results to 24-hour dietary recalls, in which de-attenuated correlations between the two instruments were acceptable, ranging from 0.48 to 0.88 (Hunsberger, O'Malley, Block, & Norris, 2012). Test-retest reliability was also tested, with an acceptable correlation of 0.73 (Garcia-Dominic, et al., 2012). The screener has been used in studies with ethnically and socioeconomically diverse children (Choumenkovitch, et al., 2012; Cohen, Kraak, Choumenkovitch, Hyatt, & Economos, 2014; Garcia-Dominic, et al., 2012; Murashima, Hoerr, Hughes, & Kaplowitz, 2011).

Home Food Availability—Two subscales from the Home Environment Survey (HES) were used to assess home food availability (Gattshall, Shoup, Marshall, Crane, & Estabrooks, 2008). The HES was designed to assess aspects of the home environment that influence a child's eating and physical activity habits. The two scales used in this study were (1) Fruit/Vegetable Availability and (2) Fat/Sweet Availability. Mothers were asked how often they had certain fruits, vegetables, and fats/sweets in their house over the past 30 days, with responses ranging from 0 (never) to 4 (always). The survey included 27 fruits and vegetables, and 14 fats/sweets. An average summary score was calculated for each scale.

The fruit and vegetable availability and fats/sweets availability scales have demonstrated acceptable internal consistency (0.84; 0.80), inter-rater reliability (0.60; 0.67), and test-retest reliability (0.82; 0.80) (Gattshall, Shoup, Marshall, Crane, & Estabrooks, 2008). In the present study, the Cronbach's alpha was 0.79 for the availability of fruits and vegetables and 0.78 for the availability of fats/sweets. The HES has been used in studies with ethnically diverse preschool and school-aged children (Gattshall, Shoup, Marshall, Crane, & Estabrooks, 2008; Ostbye, et al., 2013).

Demographic data—Demographic data on both the mother and child were collected. This included age (mother and child), race/ethnicity, mother's education level, income, employment status, receipt of public assistance, marital status, and number of children. Heights and weights were measured and BMIs (weight in kg/height in m^2) were calculated for all mothers and children.

Statistical analysis

Data were analyzed using SPSS, version 21. All variables were assessed for normality. Because maternal and child dietary intake of vegetables, saturated fat, and added sugar were positively skewed with several outliers, these variables were winsorized with symmetrical replacement prior to analyses. Pearson correlation coefficients were examined between all continuous variables, and point-biserial correlation coefficients were used to examine associations between the dichotomous HESS variable and other continuous variables.

To determine the association between maternal HESS and the dietary intake of mothers and home food availability, two groups were formed based on maternal HESS status (healthy-eater schematics and non-schematics). In all models, maternal race/ethnicity and maternal level of education (as a proxy for socioeconomic status) were entered as covariates. The first set of multiple linear regression analyses were performed to test the association of maternal HESS (present/absent) and maternal intake of (1) fruits, (2) vegetables, (3) saturated fat, and (4) added sugar, and the second set of regressions tested the associations between maternal HESS and home food availability of (1) fruits and vegetables and (2) fats and sweets.

The association between a maternal HESS and child intake of fruits, vegetables, saturated fats, and added sugar, mediated by maternal dietary intake and home food availability, was tested by multiple linear regression and multiple mediation analyses. In all models, child age and gender were entered as covariates in addition to maternal race/ethnicity and maternal education. In the regression analyses, maternal dietary intake and home food availability were used to predict child intake of (1) fruits, (2) vegetables, (3) saturated fat, and (4) added sugar. Then multiple mediation analyses were conducted to test possible indirect effects of maternal intake and home food availability on the relationship between HESS and child dietary intake.

These analyses were conducted using a specialized SPSS macro (“PROCESS”) developed by Preacher and Hayes (Preacher & Hayes, 2008) for mediation analyses with multiple mediators, using the bootstrapping technique. Bootstrapping is a nonparametric resampling procedure that involves repeatedly sampling with replacement from the original dataset, estimating the indirect effects from each sample, and yielding a 95% confidence interval for the total and specific indirect effects (Preacher & Hayes, 2008). The multiple mediation analyses provided the total effect of maternal HESS on child dietary intake, and the direct and indirect effects of maternal HESS on child dietary intake through maternal dietary intake and home food availability. Mediation was confirmed if the indirect effect was significantly different than the null, meaning that the bootstrapped confidence interval did not include zero.

Results

Sample characteristics

Table 1 displays the demographic characteristics of the 124 mothers and children in this sample. The mean age of mothers was 34 years (SD: 5.2) with a range of 22 to 51 years of age. The mothers were predominantly white, well-educated, and married. Among the children, the mean age was 3.4 years (SD: 1) with a range of 2 to 5, and the majority

attended daycare. The mean BMI of mothers was 27.97, with 57% in the overweight or obese category (based on CDC parameters: BMI ≥24.9), and the mean BMI-percentile-for-age-and-gender of the children was 56.76, with 24% in the overweight or obese category (≥85th percentile).

Fifty-two percent (n=65) of the mothers rated the healthy-eater key phrases as highly descriptive and important to their self-image, indicating that they had a HESS. A very small percentage of mothers (3%; n=4) had a non-healthy-eater self-schema, meaning that they rated 2 of the 3 key phrases as not very self-descriptive (points 1–4), but also rated these phrases as very important to their self-image (points 8–11). A slightly larger percentage (14%; n=17) of mothers were aschematic for healthy eating, meaning that they rated the key phrases in the middle of the scale (points 5–7) for self-descriptiveness and also rated them as not very important to their self-image (points 1–7). The remainder of the sample (31%; n=38) was non-classifiable, meaning they did not fit into one of the above categories. For home food availability, the range of fruit and vegetable availability was 1.54 to 3.83 (possible scores ranged from 0 to 4), with a mean of 2.53 (SD: 0.49), while the range of fat and sweet availability was 0.29 to 3.57 (possible scores ranged from 0 to 4), with a mean of 1.89 (SD: 0.63). Tables 2 and 3 show the means, medians, and ranges for average daily intake of fruit, vegetables, saturated fat, and added sugar for mothers and children.

Correlations between HESS, maternal dietary intake, home food availability, and child dietary intake

As shown in Table 4, mother and child dietary intake of fruits, vegetables, saturated fat, and added sugar were all significantly correlated, with correlation coefficients ranging from 0.26 (fruit) to 0.61 (added sugar). Moderate correlations were noted between home food availability and child dietary variables, with the largest correlations between home availability of fruits and vegetables and child intake of fruits, and home availability of fats and sweets and child intake of saturated fats and added sugar.

The association of HESS with maternal dietary intake and home food availability

HESS was significantly positively associated with maternal fruit and vegetable intake, and inversely associated with added sugar intake, after controlling for maternal education and race/ethnicity (See Table 5). HESS was not significantly associated with home food availability of fruits and vegetables or fats and sweets.

The association of maternal dietary intake, home food availability, and child dietary intake

Child consumption of fruits, vegetables, saturated fat, and added sugar were consistently associated with maternal intake of the same food groups. Notably, after adjusting for the covariates, maternal intake of saturated fat and added sugar explained 29% and 20% of

variance in child intake of these foods, respectively. Home food availability was also associated with child consumption of fruits, saturated fat, and added sugar. (See Table 6).

The association between maternal HESS and child dietary intake through maternal dietary intake and home food availability

Multiple mediation analyses were conducted to test possible mediation effects of maternal dietary intake and home food availability on the relationship between HESS and child dietary intake. The indirect effects, in the form of unstandardized regression coefficients, are reported for each model, based on 5,000 bootstrapped samples (see Table 7).

In the first model, child fruit intake was the dependent variable, maternal HESS was the independent variable, and maternal intake of fruits and home availability of fruits and vegetables were entered as simultaneous mediators. The total effect, meaning the effect of HESS on child fruit intake without any of the mediators in the model was (B = 0.1361, p = 0.37). The direct effect, meaning the effect of HESS on child fruit intake, controlling for the mediators, was (B = 0.0505, p = 0.73) (not shown in table). Confirming previous results from regression analyses, there was not a significant total effect of HESS on child fruit intake. However, mediation can occur in the absence of a total effect (Preacher & Hayes, 2008). Examination of each mediator separately revealed that the 95% bootstrapped CI surrounding the indirect effect of maternal fruit intake was significant, indicating that maternal fruit intake mediated the relationship between HESS and child fruit intake (Table 7). Results indicate that children of mothers with a HESS consumed 0.09 more cups of fruit daily on average than children of mothers without a HESS, through maternal fruit intake.

In the second model, the total and direct effects of HESS on child vegetable intake were (B = −0.0481, p = 0.48) and (B = −0.0967, p = 0.13) respectively. Confirming previous results, the insignificant total effect of HESS on child vegetable intake indicates that HESS did not directly affect child vegetable intake. However, the 95% bootstrapped CI surrounding the indirect effect of maternal vegetable intake was significant, indicating that maternal vegetable intake does mediate the relationship between HESS and child vegetable intake. This finding indicates that children of mothers with a HESS consumed on average 0.05 more cups of vegetables daily than children of mothers without a HESS, through maternal vegetable intake.

In the third model, the total and direct effects of HESS on child saturated fat intake were (B = −.9639, p = 0.32) and (B = −0.2406, p = 0.75) respectively. The 95% CIs for the two mediator variables contain zero. These results indicate that maternal HESS did not directly affect child saturated fat intake, nor did maternal intake of saturated fat or home food availability of fats and sweets mediate the relationship between HESS and child saturated fat intake.

In the final model, the total and direct effects of HESS on child added sugar intake were (B = 0.2197, p = 0.69) and (B = .9418, p = 0.048) respectively. The non-significant total effect confirmed that HESS did not affect child added sugar intake (without taking into account any mediators). In this model, a significant direct effect was seen, meaning that HESS

affected child added sugar intake through one (or more) of the mediators. An examination of the specific indirect effects indicated that only maternal intake of added sugar was a mediator, as its 95% CI was significant. This finding indicates that children of mothers with a HESS consumed 0.57 teaspoons less of added sugar daily than children of mothers without a HESS, through maternal added sugar intake.

Discussion

The primary purpose of this study was to determine the extent to which a community-based sample of mothers defined themselves in terms of healthy eating and to test the main hypothesis that a mother's HESS would influence her child's dietary intake through her own dietary intake and home food availability. Consistent with our predictions, results showed that mothers with a HESS consumed significantly more fruits and vegetables, and less added sugar than mothers without a HESS. Furthermore, the presence of a maternal HESS was indirectly associated with a child's consumption of fruits, vegetables, and added sugar through maternal intake of these foods. Although home food availability of fruits and vegetables and fats and sweets was associated with child dietary intake of fruits, saturated fat, and added sugar, it was not associated with a maternal HESS.

Regarding dietary intake, this sample of mothers generally reported a pattern of dietary intake that was healthier than similarly-aged females nationwide (Chanmugam, et al., 2003; Corwin, Hartman, Maczuga, & Graubard, 2006; National Cancer Institute, 2015), but fell short of meeting daily intake recommendations (Krauss, et al., 2000). For example, the mothers consumed less saturated fat (Chanmugam, et al., 2003; Corwin, Hartman, Maczuga, & Graubard, 2006) and added sugar (National Cancer Institute, 2015) than other adults nationwide, but they still consumed more grams of saturated fat and added sugar than the recommended daily intakes (Krauss, et al., 2000). Not surprisingly given mothers' intake patterns, the children in this sample also consumed a diet comparable or healthier than similarly-aged children nationally (Ervin & Ogden, 2013; Johnson, et al., 2009; National Cancer Institute, 2015). In general, the children met the dietary recommendations falling short only with vegetable intake (Nicklas & Johnson, 2004).

Maternal HESS was associated with maternal dietary intake

The hypothesis that maternal HESS would be associated with maternal dietary intake was partially confirmed, with the exception of saturated fat intake. The results showed a positive association between HESS and maternal intake of fruits and vegetables, and a negative association between HESS and added sugar. These findings add to a growing body of HESS research, supporting the proposition that adults who claim healthy eating as an important part of their self-definition behave in ways consistent with their self-definition. As individuals become highly invested in healthy eating, and they accumulate experience related to healthy eating, they develop a healthy-eating self-schema, which is both a product of healthy eating behaviors and a stabilizer of these behaviors over time (Markus, 1977).

Mothers with a HESS reported consuming one-half cup more fruits and one-third cup more vegetables daily compared to mothers without a HESS. In addition, mothers with a HESS

consumed 14.5 grams less added sugar daily compared to mothers without a HESS. The size of the effect of HESS on dietary intake was consistent with other health-related self-schemas on health behaviors (Allom; Banting, Dimmock, & Lay, 2009). Additionally, the effects of HESS on dietary intake are comparable to other individual level determinants of dietary intake, such as knowledge of recommended servings, self-efficacy, taste preferences, and habit strength (Brug, de Vet, de Nooijer, & Verplanken, 2006; Krebs-Smith, et al., 1995; Watters, Satia, & Galanko, 2007).

While the relationship between HESS and saturated fat intake in mothers was in the expected direction, the association was not significant, which is consistent with the findings of one previous HESS study (Kendzierski & Costello, 2004). Kendzierski & Costello (2004) suggested two plausible explanations for the lack of difference between healthy-eater schematics and non-schematics in regards to saturated fat intake. First, in their sample, both groups did very well at meeting the dietary guideline for saturated fat intake, so it was plausible that a floor effect occurred. Second, all of their participants were female, and the authors suggested that females were more likely to diet than males, and when dieting, they may be more likely to restrict intake of animal products (which are high in saturated fat) as a means to reduce fat intake.

It is doubtful that a floor effect occurred in the present study, as there was significant variability in saturated fat intake among the mothers. The lack of difference in saturated fat intake among healthy-eater schematics and non-schematics in the present study may have been due to mothers dieting by restricting intake of animal products in an effort to reduce fat intake. However, neither study asked participants about their dieting status, so this explanation cannot be tested. Though evidence suggests that a large proportion of adult women have reported limiting calories and/or fat intake as a means to control weight (Bish, Blanck, Serdula, Marcus, & Kohl, 2005; Fayet, Petocz, & Samman, 2012; Kruger, Galuska, Serdula, & Jones, 2004; Malinauskas, et al., 2006). Given the consistency of results across studies for other food groups, understanding the lack of association between HESS and saturated fat warrants future examination.

Maternal HESS was not associated with home food availability

The fact that home food availability of fruits/vegetables and fats/sweets was not associated with HESS status was perplexing. It was postulated that healthy-eater schematics would have more fruits and vegetables and less fats and sugar available in their home, as a potential strategy to ensure healthy eating behaviors. One explanation for the lack of association could be the fact that mothers were reporting all foods available in their homes, which may have included foods that they might not consume.

Studies have shown that fathers tend to have less healthy eating practices than mothers, specifically less fruit and vegetable intake (Berge, et al., 2012), and more fast-food (Berge, et al., 2012; McIntosh, et al., 2011). Therefore, if a father frequently has less healthy foods in the house, such as potato chips, a woman would indicate that potato chips are frequently available, despite the fact that she may not consume them personally. The majority of women in this sample were married, which gives credence to the explanation that foods may

be available in the home that are not solely reflective of a woman's dietary intake or personal food choices. Additionally, it is plausible that mothers may possess different personal eating schemas versus family food provider schemas. As noted in Blake & Bisogni (2003), a mother may make personal food choices based on the importance of health, yet make family food choices based on their desire to avoid conflict and accommodate the preferences of other family members. Understanding the complex relationship between these constructs is an area requiring further research.

Lastly, social desirability may have influenced mothers reporting, such that mothers reported more availability of fruits and vegetables and less availably of fats and sweets than they actually had in their home. Measurement of home food availability commonly consists of checklists, which are easy for participants to complete, but may be influenced by social desirability. Other home food inventories, which may not be as influenced by social desirability, are time-consuming and potentially inconvenient for participants. Further research is needed on methods to assess home food availability that improve accuracy while simultaneously decreasing participant burden.

Maternal HESS was indirectly associated with child dietary intake through maternal dietary intake

In this sample, maternal intake of fruits, vegetables, saturated fat, and added sugar was associated with child intake of the same foods. Additionally, the availability of fruits and vegetables at home was associated with child intake of fruits, while the availability of fats and sweets was associated with child intake of saturated fat and added sugar. These results are consistent with previous studies which have shown strong associations between maternal and child dietary intake (Cooke, et al., 2003; Fisk, et al., 2011; Hart, Raynor, Jelalian, & Drotar, 2010; Hoerr, Lee, Schiffman, Horodynski, & McKelvey, 2006; Miller, Moore, & Kral, 2011; Papas, et al., 2009; Vereecken, Keukelier, & Maes, 2004) and home food availability and child dietary intake (Busick, Brooks, Pernecky, Dawson, & Petzoldt, 2008; Spurrier, et al., 2008; Wyse, et al., 2011).

The hypothesis that maternal HESS would impact child dietary intake mediated through maternal dietary intake and home food availability was partially supported as maternal HESS was associated with child intake of fruits, vegetables, and added sugar through maternal intake of the same foods. Having a HESS influenced the foods a mother consumed, which in turn influenced the foods her child consumed. For example, children of mothers with a HESS consumed almost one-tenth of a cup more fruit and one-half teaspoon less added sugar daily on average than children of mothers without a HESS, through maternal dietary intake. Considering the dietary recommendations for preschool-aged children (aged 2 to 3) to consume 1 cup of fruit and no more than 4 teaspoons of added sugar daily (Nicklas & Johnson, 2004), the improvements in child dietary intake fueled by maternal HESS are meaningful. Over the course of one week, children of mothers with a HESS would consume almost three-quarters of a cup more fruit and 3.5 less teaspoons of sugar than children of mothers without a HESS.

As described above, home food availability was associated with child dietary intake, but it was not associated with maternal HESS. Consequently a mediation effect between maternal HESS and child dietary intake was not seen through home food availability.

Limitations

This study extends self-schema theory by showing that a mother's identity related to healthy eating was associated not only with her own dietary intake, but also the dietary intake of her child. Despite this novel finding, there were several limitations in this study. First, the results of this study cannot be generalized to the entire population of mothers and children because the sample of participants came from an urban area in Western New York State, and consequently the findings may not be generalizable to women and children living in other regions of the United States. Additionally, this was a convenience sample recruited from preschools, libraries, and community venues, which limited representation of minority women and women of lower socio-economic status. However, attempts were made to recruit a diverse sample, including recruiting at various low-income preschools and a large local public market. Furthermore, this was a correlational study, so although the results show that maternal HESS is associated with maternal, and consequently child dietary intake, causality cannot be inferred.

Second, the HESS measure has been used primarily with white participants. Though one previous HESS study did use the measure with a more diverse population, it has not been specifically validated in non-white participants. Therefore, it is unknown if the measure truly captured a healthy-eater self-schema in minority mothers, or if this concept is defined in the same manner among all women. Future studies should aim to increase understanding of the meaning and self-relevance of healthy eating from the perspective of minority mothers.

Third, although validated Block food screeners were used to determine estimated daily intake of food groups, a mother may not have been able to accurately recall all the foods and beverages she or her child consumed. Additionally, although the screeners included commonly consumed foods and beverages based on national dietary recall data, it is possible that the foods and beverages a mother or her child typically consume were not included on the screener, and therefore not factored into the daily estimated intakes. Despite these widely recognized limitations (Rutishauser, 2005), food frequency questionnaires provide a practical and standardized method of obtaining dietary information from a large number of individuals.

Conclusion and implications

This study provides foundational evidence that a mother's HESS is positively associated with her diet, which is subsequently associated with aspects of her child's diet. This finding has implications for the development of an intervention focused on creating or enhancing a mother's HESS as a means to promote healthy dietary intake in mothers and their preschool-aged children.

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Table 1

Demographic characteristics of mothers and children (N=124)

	N	%
Mothers		
Race/Ethnicity		
White	91	73%
Non-White	33	27%
Education		
Less than college	32	26%
Undergraduate degree or above	92	74%
Employment Status		
Yes	73	59%
Public Assistance		
Yes	31	25%
Marital Status		
Single	27	22%
Married	92	74%
Other	5	4%
Children		
Male	59	48%
Attends daycare/preschool		
Yes	77	62%
Number of children in home		
1	28	23%
2	63	51%
≥3	32	26%

Table 2

Maternal Dietary Intake (N=124)

Maternal Dietary Intake	Mean (SD)	Median	Range
Fruits (cups)	1.66 (1.05)	1.54	0 – 5
Vegetables (cups)	1.5 (0.97)	1.34	0 – 6.3
Saturated fat (grams)	18.1 (9.4)	16.3	1.4 – 65.3
Added sugar (grams)	39.1 (49.3)	21.7	0 – 294.3

Table 3

Child Dietary Intake (N=124)

Child Dietary Intake	Mean (SD)	Median	Range
Fruits (cups)	1.7 (0.89)	1.6	0.18 – 5.1
Vegetables (cups)	0.55 (0.42)	0.48	0.007 – 2.6
Saturated fat (grams)	13.95 (8.7)	12.3	3.9 – 65.8
Added sugar (tsps)	4.3 (4.1)	3.4	0.46 – 27.9

Note: Sugar intake was reported in different units for mothers (grams) and children (teaspoons).

Table 4

Correlations between Healthy Eater Self-Schema, maternal dietary intake, home food availability, and child dietary

Variable	1	2	3	4	5	6	7	8	9	10	11
1. HESS	—										
2. Mom Fruits	.25**	—									
3. Mom Vegetables	.21*	.48**	—								
4. Mom Sat Fat	−.04	.14	.4**	—							
5. Mom Added Sugar	−.17	−.03	.00	.44**	—						
6. HFA Fruits & Vege	−.04	.23**	.29**	.16	.26**	—					
7. HFA Fats & Sweets	−.16	.03	−.04	.32**	.4**	.4**	—				
8. Child Fruits	.08	.26**	.24**	.25**	.28**	.42**	.2*	—			
9. Child Vegetables	−.09	.07	.36**	.39**	.35**	.32**	.14	.36**	—		
10. Child Sat Fat	−.11	−.03	.2*	.58**	.48**	.32**	.5**	.26**	.47**	—	
11. Child Added Sugar	−.01	.04	.08	.37**	.61**	.28**	.41**	.27**	.34**	.55**	—

HFA: Home Food Availability

Note: All correlations are Pearson *r* values, except those involving the HESS, which are point biserial correlations

** $p < 0.01$

* $p < 0.05$

Table 5

Relationship between Healthy Eater Self-Schema and maternal dietary intake and home food availability

Variables	*B(SE)*	B	R^2
Maternal Fruit			
HESS	.55 (.19)	.26*	.066
Maternal Vegetables			
HESS	.31 (.16)	.17*a	.028
Maternal Sat Fat			
HESS	−.67 (1.6)	−.04	.002
Maternal Sugar			
HESS	−14.5 (6.6)	−.18*	.03
HFA Fruit & Vege			
HESS	−.014 (.09)	−.02	.00
HFA Fats & Sweets			
HESS	−.155 (.11)	−.12	.015

Models adjusted for maternal education and race/ethnicity

HFA = Home Food Availability

*p<.05.

*a p = .057

Table 6

Relationship between maternal dietary intake, home food availability, and child dietary intake

Variables	*B(SE)*	B	R^2
Child Fruit			
Maternal Fruit	.17 (.07)	.198*	.066
HFA Fruit & Vege	.47 (.15)	.26*	.055
Child Vegetables			
Maternal Vege	.14 (.04)	.35*	.156
HFA Fruit & Vege	.12 (.07)	.16	.018
Child Sat Fat			
Maternal Sat Fat	.31 (.05)	.46*	.289
HFA Fats & Sweets	2.4 (.62)	.28*	.065
Child Added Sugar			
Maternal Added Sugar	.04 (.01)	.44*	.198
HFA Fats & Sweets	.8 (.4)	.15*	.018

Models adjusted for maternal education, race/ethnicity, child age and gender

HFA = Home Food Availability

* $p<.05$.

Table 7

The effect of maternal Healthy Eater Self-Schema on child dietary intake through maternal dietary intake and home food availability

	CHILD FRUIT Effect (95% CI)	**CHILD VEGE Effect (95% CI)**	**CHILD SAT FAT Effect (95% CI)**	**CHILD ADD SUG Effect (95% CI)**
Maternal intake of same foods	.0894 (.0032 – .2520)*	.0495 (.0027 – .1330)*	−.3030 (−1.5564 – .5954)	−.5737 (−1.2083 – −.1794)*
Home food availability	−.0038 (−.0955 – .0895)	−.0009 (−.0313 – .0189)	−.4203 (−1.2511 – .0565)	−.1484 (−.5616 – .0133)

*95% bootstrapped bias-corrected CI does not contain zero, therefore there is a significant effect