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Research report

Differences in food supplies of U.S. households with and without overweight individuals

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ABSTRACT

Household food supplies of families with at least one child 12 years or younger ($n = 100$) were inventoried in order to describe its nutrient content and compare food supplies of families with and without overweight individuals (i.e., healthy vs. overweight mothers; healthy vs. overweight fathers; healthy vs. overweight child[ren]). Nutrient adequacy ratios (NAR) for carbohydrate, dietary fiber, calcium, iron, total fat, and saturated fat were approximately one indicating amounts available per 2000 calories approximately equaled the Daily Value. NARs for protein, sugar, vitamin A, vitamin C, and sodium exceeded one and cholesterol NAR was less than one. Households were similar in number of household members, days until they planned to grocery shop again, and total days of meals and snacks to be served from household food supplies until the next grocery shopping trip. Frozen vegetables contributed significantly greater amounts of calories, carbohydrates, fat, and protein and meat supplied significantly more fat and protein in households with overweight fathers than in households with healthy weight fathers. In households with an overweight child, grains supplied significantly more protein and carbohydrate than in comparison households. Encouraging healthful changes to the home food supply may result in improvements in dietary intake and overall weight status.

Introduction

Obesity is a pervasive and significant public health problem throughout the United States. During the last several decades, body weight has increased dramatically (Mei et al., 1998; Ogden et al., 2006). This increase in obesity has not been restricted to adults; it is a growing problem across all age and racial groups as well as both genders.

As weight increases, health suffers. Overweight and obesity increase the risk for cardiovascular disease, type 2 diabetes, certain cancers, osteoarthritis, and pulmonary conditions (e.g., asthma, obstructive sleep apnea). Although these diseases typically occur in adulthood, overweight and obese children commonly experience health problems, such as hypertension, hypercholesterolemia, insulin resistance, and impaired glucose tolerance, which set the stage for premature development of degenerative diseases (American Academy of Pediatrics, 2003; Freedman, Dietz, Srinivasan, & Berenson, 1999). In addition, obese children experience psychological stress in the form of social stigmatization and depression (Davison & Birch, 2001; Schwimmer, Burwinkle, & Varni, 2003; Strauss, 2000). Recently, poor diet and physical inactivity leading to overweight were named as the second most common cause of death in the United States, just behind tobacco use (Mokdad, Marks, Stroup, & Gerberding, 2004).

At the most basic level, obesity is caused by an excess of calorie intake in comparison to calorie output. Numerous factors, including environmental and genetic factors, promote this calorie imbalance and lead to the development of obesity (French, Lin, & Guthrie, 2003; French, Story, & Jeffrey, 2001; Hill, Goldberg, Russell, & Peters, 1998). The rapid increase in obesity during the last few decades cannot be explained solely by genetic factors; environments that promote obesity-favoring behaviors clearly are at the root of the epidemic (Brinkley, Eales, & Jekanowski, 2000; Golan & Crow, 2004; Hill, Wyatt, Reed, & Peters, 2003).

Reciprocal determinism, a construct of the Social Cognitive Theory, posits that a person's characteristics, behavior, and the environment within which the behavior is performed simultaneously influence each other (Baranowski, Perry, & Parcel, 2002). Currently, little is known about the interaction of food behaviors and environments—including the home food environment even though it provides 72% of the food, by weight, consumed by Americans and provides 93% of the food consumed by those who prepare most meals at home (Carlson, Kinsey, & Nadav, 2002). The effect of the household food supply on dietary intake was demonstrated when British researchers using grocery receipts and food diaries found that fat and calorie intake were strongly correlated ($r = 0.77$) with the content of foods purchased (Ransley

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et al., 2003, 2001). Similarly, when food group availability in the home was explored in American households using grocery receipts, researchers found that the greatest percent of the food dollar was spent on protein-rich foods—foods that are often high in fat and calories (Cullen et al., 2007).

If household food supplies do not support healthful eating, it is unlikely families will be able to manage their weight and avoid obesity-related diseases. Although evidence indicates that the family environment is an important influencer of the dietary behaviors of children and teens (Crockett & Sims, 1995; Patrick & Nicklas, 2005; Shepherd et al., 2006; Story, Neumark-Sztainer, & French, 2002), currently little is known about the relationship between body weight and household food supplies. Indeed, only three studies published more than two decades ago explored home food inventories in the U.S. (Coates, Jeffery, & Wing, 1978; Sanjur et al., 1979; Terry & Beck, 1985) and a more recent study using grocery receipts to estimate fat and energy availability in British households (Ransley et al., 2003, 2001) could be located. An increased understanding of household food supplies could inform the development of nutrition interventions targeting food selection and food shopping practices (Ransley et al., 2003). The purposes of this research were to inventory household food supplies of families with young children and describe its calorie and nutrient content, variations in content by food group, and compare food supply content of families with and without overweight individuals.

Methods

This cross-sectional study was part of a larger multi-faceted study described elsewhere (Maurer & Byrd-Bredbenner, 2007). Data collection began in October 2006 and concluded in March 2007. The authors' Institutional Review Board approved the research protocol. All participants signed an informed consent prior to participation.

Sample recruitment

Study participants were recruited via word-of-mouth and announcements sent to community, religious, civic, and school-based parent groups as well as workplaces. Eligible participants were those who were mothers with at least one child 12 years or younger; married or living with a domestic partner, and food secure (all household members had access at all times to enough food for an active, healthy life). In addition, neither the participant nor her partner was employed in a health-related profession. Only mothers who had the major responsibility for household meal planning, grocery shopping, and meal preparation, and ate dinner at home with most family members present at least three times weekly were eligible.

Of the 318 individuals responding to the announcement, 149 met the eligibility requirements. Invitations were issued on a first-come-first-serve basis until 100 individuals agreed to participate. Participants were ineligible primarily because they did not have a child aged 12 years or younger and/or they did not hold the major responsibility for meal planning, grocery shopping, and/or meal preparation in their households. Participants were compensated $150 for their participation in the larger multi-faceted cross-sectional study; the household food inventory portion of the study accounted for about 40% of the effort required by participants.

Measures

A survey type questionnaire was used to collect data regarding participants' demographic characteristics, including hours of paid employment weekly, education level of the participant and her partner/spouse, as well as age, gender, height, and weight data for each household member. In regards to dinner meal behaviors, participants were asked to indicate how often (answer choices: almost never, 1–2 times weekly, 3–5 times weekly, almost everyday) family members go out to dinner, dinner was mostly prepared at home, and dinner at home was mostly take-out food or prepared food delivered by a restaurant. Additional data collected included when they planned to go on their next major grocery shopping trip and family members who usually ate meals (i.e., breakfast, lunch, and dinner) and snacks from home food supplies.

A team of trained researchers inventoried all foods in participating households except alcoholic beverages, commercially prepared baby food, infant formula, pet foods, bottled water, refrigerated leftovers, foods of minimal nutrient content (e.g., vinegar, baking powder, baking soda, salt, pepper, herbs, spices, extracts, cooking spray, non-caloric sweeteners, gum, coffee and tea [except packaged beverages containing caloric sweeteners]), condiments typically used in small quantities per serving (e.g., ketchup, mustard, mayonnaise, horseradish, soy sauce, hot sauce), and bulk supplies of sugar, flour, and fats (e.g., oils, shortening, butter, margarine). Inventories were taken using commercial nutrient analysis software modified for this study (i.e., FoodWorks, Long Valley, NJ) to use handheld barcode scanners and access two large databases (>10,000 foods) linking Universal Product Codes (UPCs) and nutrient data (i.e., Gladson Interactive, Lisle, IL; FoodFacts.com, Edison, NJ). These databases supplied the nutrient data for foods with standard UPCs. Foods in households that had standard UPCs and Nutrition Facts labels, but did not exist in the commercial database, were added to the database during the inventory. U.S. Department of Agriculture (USDA) Standard Reference (U.S. Department of Agriculture, 2006), USDA Food and Nutrient Database for Dietary Studies (U.S. Department of Agriculture, 2004), or Nutrition Facts labels were used for foods that lacked standard UPCs (e.g., those with retailer assigned UPCs like raw meats) or had no UPC (e.g., raw produce, homemade foods, foods sold as fund-raisers). During data cleaning, any nutrient content values missing from the commercial database were either obtained from the food manufacturer's website or imputed by researchers trained in food composition data using nutrient data from the USDA Standard Reference (U.S. Department of Agriculture, 2006) or USDA Food and Nutrient Database for Dietary Studies (U.S. Department of Agriculture, 2004). Thus, complete nutrient and calorie data were available for all foods. The methodology for the home audit is described in detail elsewhere (Byrd-Bredbenner & Bredbenner, 2007).

All household visits were scheduled at times convenient to the study participants. Participants were instructed not change their food buying habits (e.g., shopping day, food items purchased, etc.) in any way before the visit.

Data analysis

Body Mass Index (BMI) was computed for each family member using height and weight data. Gender-specific growth charts were used to determine the BMI percentile for the participants' children aged 2–18 years (National Center for Health Statistics & Centers for Disease Control, 2000). Children less than 2 years were excluded from BMI assessments because BMI growth charts are not available for this age group.

The time (in days) that would elapse between the date of the home inventory and the next planned major grocery shopping trip was determined for each household. In addition, the total days of meals (breakfasts, lunches, and dinners) and snacks to be served from home food supplies to household members age 2 years and older until the date of the next major grocery shopping trip were computed. Using procedures modeled on those described by

Ransley et al. (2003), an adult equivalent adjustment figure for meals and snacks for children ages 2–12 years was calculated to reflect their lower calorie needs in comparison to adults. In specific, the MyPyramid food intake pattern calorie levels for sedentary and moderately active children age 2–12 years were averaged and expressed as a percentage of the 2000 calorie level used for adults (U.S. Department of Agriculture & Center for Nutrition Policy and Promotion, 2005); the derived adult equivalent adjustment figure was 0.73. Meals and snacks for children age 13 and over were considered equivalent to adult meals. Total adult equivalents of meals and snacks to be served from home food stores until the next major grocery shopping trip were weighted by the average calorie contribution of meals and snacks (i.e., 18.4% breakfast, 24.1% lunch, 36.5% dinner, 21.1% snacks (Cutler, Glaeser, & Shapiro, 2003) based on the 1994–1996 Continuing Survey of Food Intake.

Calories, protein, fat, saturated fat, carbohydrate, sugar, sodium, fiber, vitamin A, vitamin C, calcium, and iron content of foods in each household were summed to determine the total quantities on hand. To permit comparisons across nutrients, expression of total calories and nutrients were standardized to quantities of days available at 100% of the Daily Value for age 4 years and older (Kurtzweil, 1993; Yates, 2006). For instance, households having 30,000 mg of calcium in their food inventory had 30 days of calcium at 100% of the Daily Value available (30,000 mg of calcium/1000 mg Daily Value for calcium). In the case of sugar, which has no Daily Value, 50 g (i.e., 10% of energy in a 2000-calorie diet) was used as a proxy for the Daily Value (World Health Organization & Food and Agriculture Organization of the United Nations, 2003). The nutrient adequacy ratio (NAR) developed by Guthrie and Scheer (1981) was adapted to describe the nutrient adequacy of the household food supply. NAR was calculated by dividing the number of days available at 100% of the Daily Value for a nutrient by the days of total calories available at 100% of the Daily Value (note that the Daily Value for calories was set at 2000). An NAR of one indicates that calories are supplying nutrients in recommended amounts. Values less than one indicate the nutrient is present in less than recommended amounts whereas values exceeding one indicate the nutrient is present in amounts greater than the Daily Value.

To explore differences in sources of macronutrients, each food was coded according to food group. The major food groups were grains (subgroups = dry grains [e.g., rice, pasta, bread], breakfast cereals, sweet baked goods, and grain snacks [e.g., pretzels, crackers]); fruits and vegetables (subgroups = fresh, thermally processed [e.g., canned, jarred], frozen, and dried); dairy (subgroups = dairy desserts [e.g., ice cream, pudding] and non-dessert dairy [e.g., cheese, fluid milk]); meat (subgroups = fresh, thermally processed, frozen, and nuts/nut butters); high added sugar foods (e.g., candy, sugar-sweetened soft drinks, drink mixes, pudding, frozen desserts); calorie-free beverages; packaged entrees containing a mixture of food groups (e.g., pizza, potpies); and salty/fatty snacks (e.g., corn chips, cheese curls). When a significant difference was noted in the NAR of a major food group, the subgroups for the food group were examined to determine if differences existed between households. To determine the contribution of food groups to nutrients in the household food supply, NARs for food groups and subgroups were calculated in the same manner as described above; that is the number of days available at 100% of the Daily Value for a nutrient supplied by a food group or subgroup were divided by the days of total calories available in the household food supply at 100% of the Daily Value.

To determine which individuals had a high or healthy BMI, standard parameters were used (Centers for Disease Control and Prevention, 2007). That is, adults with a BMI greater than 25 and children at or above the BMI 95th percentile were coded as overweight (high BMI households) whereas all others were assigned to the healthy weight group (healthy BMI households). Students' *t*-test was used to compare high and healthy BMI households when data met the assumptions of this test (i.e., were normally distributed and had equal variances), otherwise the Mann–Whitney *U* test was used (SAS Institute, 1995). These variables were tested to determine how household weight groups (i.e., healthy vs. high BMI mothers, healthy vs. high BMI fathers, and healthy vs. high BMI child/ren) differed: demographic characteristics, time until the next planned grocery shopping trip, number of meals and snacks to be served from home food supplies before the next planned grocery shopping trip, frequency of eating dinner from home food stores, and NARs of household food supplies. Significance level was set at $p < 0.05$.

Results

The overall sample was 91% white (2% Black, 6% Hispanic, 1% mixed race) and had a mean age of 37.9 ± 5.1 standard deviation

Table 1
BMI, household characteristics, and dinner behaviors.

Characteristic	Maternal, BMI < 25 (n = 55), mean ± S.D.	Maternal, BMI > 25 (n = 45), mean ± S.D.	Paternal, BMI < 25 (n = 34), mean ± S.D.	Paternal, BMI > 25 (n = 66), mean ± S.D.	Child 2–18 years, BMI < 95th tile (n = 69), mean ± S.D.	Child 2–18 years, BMI > 95th tile (n = 26), mean ± S.D.
BMI[A]	21.54 ± 1.78[B,Ca]	30.72 ± 4.78[a]†	22.74 ± 1.63[b]	28.68 ± 3.19[b]†	42.92 ± 25.43[c]	80.91 ± 15.28[c]†
Household size (individuals age 2 years and older)	4.07 ± 0.98	4.44 ± 1.08	4.18 ± 1.24	4.27 ± 0.92	4.33 ± 1.01	4.39 ± 0.75
Days until the next major grocery shopping trip	4.27 ± 2.81	4.87 ± 3.84†	4.77 ± 3.77	4.42 ± 3.07	4.80 ± 3.51	4.27 ± 2.88
Total days of weighted adult equivalent meals and snacks to be served to family members age 2 years and older from household food stores until next major grocery shopping trip	12.87 ± 9.90	17.2 ± 15.89†	16.45 ± 15.63	14.00 ± 11.56†	15.8 ± 13.86	14.06 ± 11.37
Dinner behaviors						
Frequency family eats dinner together[D]	3.67 ± 0.55	3.58 ± 0.62	3.59 ± 0.61	3.65 ± 0.57	3.58 ± 0.63	3.73 ± 0.45
Frequency family dinners at home are prepared from household food stores[D]	3.66 ± 0.55	3.71 ± 0.51	3.59 ± 0.61	3.73 ± 0.48	3.71 ± 0.55	3.62 ± 0.50
Frequency family dinners at home are take-out or restaurant prepared foods[D]	1.44 ± 0.50	1.44 ± 0.55	1.41 ± 0.50	1.46 ± 0.53	1.38 ± 0.49	1.58 ± 0.58
Frequency family eats dinner out[D]	1.55 ± 0.54	1.47 ± 0.51	1.56 ± 0.56	1.49 ± 0.50	1.54 ± 0.53	1.39 ± 0.50

[A] Values for children are BMI percentiles.
[B] Comparisons between high and healthy BMI households were conducted using *t*-tests for data that were normally distributed and had equal variances. If data were not normally distributed and/or had heterogeneous variances, the Mann–Whitney *U* test was used († indicates this test was used).
[C] Means sharing a common lowercase superscript are significantly different: $^{a}p < 0.0001$†; $^{b}p = 0.0001$†; $^{c}p = 0.0001$†.
[D] Possible score range 1–4 (1 = almost never, 2 = 1–2 times weekly, 3 = 3–4 times weekly, 4 = almost everyday).

Table 2
Nutrient adequacy ratio (100% Daily Value of nutrient available per 2000 calories available) of the household nutrient supply[A,B].

Food component	Maternal, BMI < 25 (n = 55), mean ± S.D.[C]	Maternal, BMI > 25 (n = 45), mean ± S.D.	Paternal, BMI < 25 (n = 34), mean ± S.D.	Paternal, BMI > 25 (n = 66), mean ± S.D.	Child 2–18 years, BMI < 95th tile (n = 69), mean ± S.D.	Child 2–18 years, BMI > 95th tile (n = 26), mean ± S.D.
Calories[D]	106.58 ± 57.68[E]	133.53 ± 85.21	129.77 ± 85.10	113.01 ± 64.67	124.14 ± 66.11	109.38[a] ± 90.69[F,a]†
Total fat	0.98 ± 0.21	0.99 ± 0.21	0.97 ± 0.21	1.00 ± 0.21	1.02 ± 0.21[b]	0.92 ± 0.18[b]
Saturated fat	0.89 ± 0.26	1.00 ± 0.44	0.92 ± 0.42	0.95 ± 0.32	0.99 ± 0.36[c]	0.82 ± 0.20[c]†
Cholesterol	0.58 ± 0.31	0.65 ± 0.29	0.58 ± 0.38	0.62 ± 0.26	0.63 ± 0.32	0.56 ± 0.24
Sodium	1.24 ± 0.31	1.28 ± 0.38	1.23 ± 0.34	1.28 ± 0.34	1.27 ± 0.31	1.28 ± 0.41
Carbohydrate	0.95 ± 0.14	0.97 ± 0.13	0.98 ± 0.13	0.95 ± 0.14	0.94 ± 0.14[d]	0.99 ± 0.11
Dietary fiber	1.00 ± 0.33	0.97 ± 0.39	0.99 ± 0.44	0.98 ± 0.31	0.95 ± 0.31	1.07 ± 0.44
Sugar	1.98 ± 0.50	2.07 ± 0.67	2.10 ± 0.60	1.99 ± 0.57	2.05 ± 0.56	2.00 ± 0.63
Protein	1.50 ± 0.32	1.49 ± 0.27	1.47 ± 0.33	1.51 ± 0.28	1.51 ± 0.30	1.47 ± 0.28
Vitamin A	1.52 ± 1.57	1.23 ± 0.64	1.20 ± 0.60	1.48 ± 1.47	1.34 ± 0.72	1.63 ± 2.14
Vitamin C	1.59 ± 0.79	1.55 ± 1.39	1.60 ± 1.58	1.56 ± 0.74	1.65 ± 1.23	1.43 ± 0.70
Calcium	0.87 ± 0.28	0.96 ± 0.63	1.01 ± 0.61	0.86 ± 0.38	0.96 ± 0.50	0.78 ± 0.21
Iron	1.00 ± 0.26	0.99 ± 0.28	0.98 ± 0.27	1.00 ± 0.27	0.97 ± 0.27	1.05 ± 0.22

[A] Includes all foods available except alcoholic beverages, commercially prepared baby food, infant formula, pet foods, bottled water, refrigerated leftovers, foods of minimal nutrient content (e.g., vinegar, baking powder, baking soda, salt, pepper, herbs, spices, extracts, cooking spray, non-caloric sweeteners, gum, coffee and tea [except packaged beverages containing caloric sweeteners]), condiments typically used in small quantities (e.g., ketchup, mustard, mayonnaise, horseradish, soy sauce, hot sauce), and bulk supplies of sugar (e.g., white, brown), flour, and fats (e.g., oils, shortening, butter, margarine).
[B] Daily Values: calories = 2000; total fat = 65 g; saturated fat = 22.75 g (calculated as 35% total fat); cholesterol = 300 mg; sodium = 2400 mg; carbohydrate = 300 g; sugar calculated as 10% of calories; dietary fiber = 25 g; protein = 50 g; vitamin A = 5000 IU; vitamin C = 60 mg; calcium = 1000 mg; iron = 18 mg.
[C] S.D.: standard deviation
[D] NAR for calories calculated by dividing total calories by 2000 calories, the Daily Value for calories.
[E] Students' *t*-test was used to compare high and healthy BMI households when data met the assumptions of this test (i.e., were normally distributed and had equal variances), otherwise the Mann–Whitney *U* test was used († indicates this test was used).
[F] Means sharing a common lowercase superscript are significantly different: [a]$p < 0.03$†; [b]$p < 0.04$; [c]$p < 0.03$†.

(S.D.). Overall, both mothers and their spouse/partner were well educated with all but 4% having some college and 67% had completed at least a university level baccalaureate degree. As expected, based on the study design, the BMI and BMI percentiles between comparison households were significantly different (Table 1). There were no significant differences between high maternal or paternal BMI households and comparison households with respect to most demographic (data not shown) and shopping or dining patterns. However, in high maternal BMI households, a lower percent of mothers and fathers had completed a university level baccalaureate degree compared to healthy maternal BMI households. There were no significant differences between high child and healthy child BMI households for demographic characteristics, shopping or dining patterns, or maternal and paternal BMI. In regards to dinner meal behaviors, no differences existed in any dinner meal behavior between high and healthy maternal BMI households, high and healthy paternal BMI households, and high and healthy child BMI households.

As shown in Table 2, the NARs for total fat, saturated fat, carbohydrate, dietary fiber, calcium, and iron were approximately one (i.e., 78–107%). The NAR for sugar, protein, vitamin A, vitamin C, and sodium exceeded one (i.e., 120–210%). In contrast, the NAR for cholesterol was less than one (i.e., 56–65%).

NARs in high maternal and paternal BMI households were similar to comparison households for all nutrients. However, contributions by food group did differ (Table 3). Fruits and vegetables provided significantly more carbohydrate in high paternal BMI households than in comparison households. Specifically, frozen vegetables, which included primarily frozen vegetables in a sauce and frozen potatoes (e.g., tater tots, french fries), contributed significantly greater amounts of calories, protein, total fat, carbohydrates, and sugar, in households with

Table 3
Differences in nutrient adequacy ratios (NARs) between households with high BMI and healthy BMI mothers, fathers, and child/ren for calories and energy yielding nutrients by food group.

Major food group[a], *food subgroup*	Calories	Protein	Total fat	Saturated fat	Carbohydrate	Sugar
Dairy (all)	[Child/ren ($p < 0.04$)†][b,c]					
Grains		Child/ren ($p < 0.02$)			Child/ren ($p < 0.02$)	
Fruits and vegetables					*Father* ($p < 0.0034$)†	
Frozen	*Father* ($p < 0.0005$)†	*Father* ($p < 0.004$)†	*Father* ($p < 0.002$)†		*Father* ($p < 0.0001$)†	*Father* ($p < 0.02$)†
Meat	[Child/ren ($p < 0.05$)†]	Father ($p < 0.003$)†	Father ($p < 0.006$)†	Father ($p < 0.002$)†		
Fresh	*Father* ($p < 0.02$)†	*Father* ($p < 0.004$)†	*Father* ($p < 0.002$)†	*Father* ($p < 0.003$)†		
Frozen			*Father* ($p < 0.04$)†	*Father* ($p < 0.04$)†		

[a] Only major food groups for which a significant difference between households with high BMI mothers (n = 45) and healthy BMI mothers (n = 55), high BMI fathers (n = 66) and healthy BMI fathers (n = 34), or high BMI percentile child/ren (n = 26) and healthy BMI percentile child/ren (n = 69) are included in the table. Food subgroup data are included only for those groups that had significant differences in the major food group and when significant differences occurred in a subgroup.
[b] Students' *t*-test was used to compare high and healthy BMI households when data met the assumptions of this test (i.e., were normally distributed and had equal variances), otherwise the Mann–Whitney *U* test was used († indicates this test was used).
[c] Households with an high BMI family member had significantly higher NARs than comparison households (i.e., high BMI mothers were compared with healthy BMI mothers; high BMI fathers were compared with healthy BMI fathers; high BMI percentile children were compared with healthy BMI percentile children) of the food constituent(s) listed in the table except in the case of values appearing in brackets, in which case high BMI households had lower values.

high BMI fathers than in comparison households. In addition, meat supplied significantly more protein, total fat, and saturated fat in households with high BMI fathers. Fresh and frozen meat, in particular, tended to supply significantly more calories, protein, saturated fat, and total fat in these households.

In high child BMI households, the NAR for calories and total and saturated fat were significantly lower than comparison households. In high child BMI households, high quality protein foods (i.e., dairy and meats) provided significantly fewer calories and grains had significantly higher NARs for protein and carbohydrates.

Discussion

This study describes the home food supplies in households with and without high BMI family members. Home food supplies provide nearly three-quarters of the food consumed by Americans and, in this study, it is likely closer to the 93% reported by 'home cookers' (Carlson et al., 2002) because these families ate meals that were mostly prepared at home and seldom ate in restaurants or purchased take-out food. Regardless of weight status, households tended to be similar demographically. In addition, dinner meal behaviors were similar, and the number of days until they planned to grocery shop again, family size, and total days of weighted adult equivalent meals and snacks to be provided from household food supplies until the next planned grocery shopping trip were not significantly different. Thus, differences in household food supplies do not appear to be due to differences in frequency of food shopping, frequency of eating at home, or family size.

Overall, the food supplies in the sampled households are nutrient dense, given that most NARs were approximately equal to or greater than one. Regardless of family member weight status, households had a greater supply of protein, sugar, vitamin A, vitamin C, and sodium per 2000 calories than recommended by the Daily Values. Although the household protein supply is not excessive, many protein-rich foods are also high in fat, saturated fat, and cholesterol—for these reasons, a reduction in protein-rich foods of animal origin should be considered.

The trends seen in this study for higher calorie, fat, and carbohydrate availability in high maternal BMI households suggest that body weight status may be directly related to the home food supply. Indeed, a recent study reported that British households comprised of primarily overweight individuals purchased more fat and calories per adult per day than households comprised mostly of lean individuals (Ransley et al., 2003). In addition, food behaviors (i.e., nutrient intakes) of family members are significantly related suggesting that parental eating behaviors and modeling affect the healthfulness of their children's life long eating habits (Gattshall, Shoup, Marshall, Crane, & Estabrooks, 2008; Melanson, 2008; Nguyen, Larson, Johnson, & Goran, 1996; Savage, Fisher, & Birch, 2007; Vauthier, Lluch, Lecompte, & Herbeth, 1996). Improvements in the calorie supply level and nutrient profile of home food supplies could translate into positive dietary changes and healthier body weights of family members. Thus, the individual in families who is primarily responsible for food shopping and meal preparation—the family food supply gatekeeper—likely should be the target of nutrition promotion and communication interventions designed to improve the quality of the household food supply.

It has long been said that people eat food, not nutrients. Thus, for health advice to be most meaningful to consumers, it likely needs to be expressed in terms of food. The nutrient data examined by food group in this study provides insight into the types of changes that could aid family food supply gatekeepers in improving their household food supplies and, possibly, in achieving healthy weights. In specific, families, especially those with high BMI individuals, could benefit from interventions that help them choose foods lower in fat, especially meats and frozen vegetables. For instance, opportunities to learn to read food labels to identify healthier options, recognize and prepare leaner meat cuts without sacrificing convenience or flavor, and choose reduced-fat foods could help households trim calorie and fat availability while preserving the availability of key minerals supplied by meat and vegetable products, such as iron and vitamins C and A. Food supply gatekeepers from families with high BMI children also may profit from guidance on carbohydrate sources and availability and value of dairy products as calcium sources.

Evaluating the NAR of household food supplies is a novel way to assess the nutritional quality of the food families have on hand and its relationship to body weight. The data collection methodology used in this study avoided the errors of self-report commonly documented in dietary surveys. The methodology also accounted for a broader array of home food availability than studies using only grocery receipts, which typically capture only supermarket purchases and do not include food gifts, home food production, and purchases from convenience stores, home food delivery services, and fund-raising efforts (e.g., Girl Scout cookies).

The study findings are informative and statistically significantly, however they must be considered in light of the limitations. The generalizability of this study is limited by its small sample size of self-selected families who live in a single northeastern state and have specifically defined demographic characteristics. Because dietary intake of participants was beyond the scope of this study, it is not known how the household food supplies were divided among family members and the direct relationship of specific food groups on body weight. In addition, it is not known how the activity levels of families differed. Another limitation is that no allowance was made for the inedible portion of household food stores, wasted food, and food shared with visitors and thus, values might overestimate the actual nutrient availability of household food stores. However, even within these limitations, food availability from household budget studies correlate closely with overall dietary intake (Serra-Majem et al., 2005) and consumption from some food categories such as fruits and vegetables (Naska et al., 2006; Serra-Majem et al., 2005). Another limitation is that BMI was calculated from self-reported weight and height data provided by mothers for all family members; hence BMI values likely are underestimates and should be viewed with caution because, as others have reported, height tends to be overestimated and weight underestimated (Gorber, Tremblay, Moher, & Gorber, 2007; Scholtens et al., 2007). Nonetheless, nearly half of mothers and two-thirds of fathers had BMIs exceeding 25 and at least one child in one-quarter of all households with children 2–18 years had a BMI at or above the 95th percentile, a prevalence of overweight similar to those reported for the general American population (Ogden et al., 2006).

Conclusion

This study augments the few studies currently available on home food supplies (Bryant & Stevens, 2006; Coates et al., 1978; Ransley et al., 2003, 2001). In addition, it provides insights into home food availability that may have important implications for nutrition interventions aimed at ameliorating the obesity epidemic. Because foods available in the household constitute a significant portion of the foods families consume (Carlson et al., 2002) and because food availability is associated with dietary intake (Kratt, Reynolds, & Shewchuk, 2000), it follows that changes to the home food supply could result in significant changes in dietary quality. Thus, future studies should investigate why these differences exist, how food supplies are correlated with food intake, and how to effect change in household food supplies and evaluate how alterations in home food supplies affect diet quality and body weight.

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