

Turning point for US diets? Recessionary effects or behavioral shifts in foods purchased and consumed^{1–3}

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ABSTRACT

Background: In the past decade, the United States has seen declining energy intakes and plateauing obesity levels.

Objective: We examined whether these observed trends suggest a longer-term shift in dietary and health behavior that is independent of adverse economic conditions.

Design: We used nationally representative cross-sectional surveys on intake and longitudinal household food purchase data along with random-effects models to address this question. Data included individuals in NHANES 2003–2004 to 2009–2010 (children: $n = 13,422$; adults: $n = 10,791$) and households from the 2000–2011 Nielsen Homescan Panel (households with children: $n = 57,298$; households with adults only: $n = 108,932$).

Results: In both data sets, we showed that children decreased their calories the most. Even after we controlled for important socioeconomic factors, caloric purchases fell significantly from 2003 to 2011 ($P < 0.001$), particularly for households with children. The Great Recession was associated with small increases in caloric purchases, in which a 1–percentage point increase in unemployment in the local market was associated with a $1.6\text{--}4.1\text{-kcal} \cdot \text{capita}^{-1} \cdot \text{d}^{-1}$ ($P < 0.001$) increase in total calories purchased. Results also indicated shifts in caloric purchases were driven more by declines in caloric purchases from beverages than food.

Conclusions: US consumers have exhibited changes in intake and purchasing behavior since 2003 that were independent from changing economic conditions linked with the Great Recession or food prices. Public health efforts in the past decade may have contributed to this trend. *Am J Clin Nutr* 2014;99:609–16.

INTRODUCTION

Nationally representative data have shown that, over the last decade, obesity has either declined or leveled off for low-income preschoolers and stagnated for children and adults (1–4). Our growing understanding of the energy gap (ie, the difference in energy-intake expenditure required to achieve different body weight outcomes in individuals and populations) includes estimates of an average reduction of 41 kcal/d to stop rising obesity rates in children and an average reduction of 120 kcal/d to meet the Healthy People 2010 obesity-reduction goals (5–7). Energy-balance shifts needed for adults are much greater (5, 7). Currently, there has been little evidence of meaningful improvements in energy expenditures (8–12), which has suggested that shifts in food purchases and consumption have occurred.

Typically, studies that have looked at dietary change in the United States have relied on cross-sectional nationally repre-

sentative data from the NHANES. Various studies, including a recent study on shifts in energy intake and diet composition for US adults (13), have shown that the mean energy intake has decreased significantly since 2003–2004. However, reasons for the apparent decrease in energy intake are uncertain, and there are gaps in what we can say about what might be responsible for the observed dietary shifts.

A major challenge in elucidating what might be causing these dietary shifts is that there were a number of significant events that could have affected food and beverage purchases and consumption choices since 2003–2004. These events included the Great Recession (from December 2007 to June 2009) (14) and continued economic stagnation along with food-price increases (15–17). Some researchers have contended that people exhibit better health behaviors during economic downturns (18–20), whereas other researchers have shown the opposite effect (21). Other authors have noted a greater awareness and health focus toward obesity from marketers, food retailers, and manufacturers (22–25). However, it is unclear how the apparent turning point in obesity prevalence and energy intake (26) in the United States might be related to the Great Recession or shifts in dietary behavior.

We addressed this challenge and sought to answer the following key question: Does the reduction in energy intake and leveling off and decline in obesity suggest a longer-term shift in dietary and health behavior that is independent of a turbulent economic period? With the use of unique longitudinal data and methods, we modeled changes in household food purchases to separate out time trends in purchases of overall calories as well as calories from foods and beverages. These models allowed us to control for unemployment levels and food prices at the market level over time as well as household characteristics such as household composition, education, income, and race-ethnicity. We combined this method with an analysis of NHANES dietary

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² Supported by the Robert Wood Johnson Foundation (grant 70017) and the NIH (R01DK098072 and CPC 5 R24 HD050924).

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Received August 6, 2013. Accepted for publication December 30, 2013.

First published online January 15, 2014; doi: 10.3945/ajcn.113.072892.

intake trends for adults and children as well as at-home compared with away-from-home food purchases to provide a full picture of dietary shifts in the United States. Ultimately, we were able to examine food and beverage intakes and purchase trends in the context of major economic and sociodemographic changes and examined differential trends by race-ethnic groups.

SUBJECTS AND METHODS

See Supplementary Figure 1 under “Supplemental data” in the online issue for an overview of data sources included.

Dietary intake by US individuals

Dietary intake data

We used nationally representative surveys from the dietary intake interview section of NHANES 2003–2004 (children: $n = 3554$; adults: $n = 2449$) 2005–2006 (children: $n = 3778$; adults: $n = 2482$), 2007–2008 (children: $n = 2966$; adults: $n = 2820$), and 2009–2010 (children: $n = 3124$; adults: $n = 3038$). The surveys were multistage, stratified-area probability samples of the US population, and all surveys used the same USDA food-composition data to create caloric intake profiles (27–36). To examine trends over time from surveys with different collection methods on days 1 and 2, we used only the first day’s data (a single, 24-h dietary recall on the basis of interviews) collected from each individual and used appropriate weights and adjustments for the sample design provided.

Sources of dietary intake

To provide a full picture of dietary shifts in the United States and compare across data sources, we classified each food and beverage reported consumed by source as store or other. Foods and beverages that came from a store were obtained from grocery stores, supermarkets, convenience stores, or drug stores and were prepared either at the store or in the home. Foods and beverages obtained away from home (eg, fast food, vending food, from Meals on Wheels, soup kitchens, other community-feeding programs, or residential facilities, and foods eaten at someone else’s home, received as gifts, and from other miscellaneous sources) were termed other.

Dietary intake analyses

Mean daily energy intakes were estimated for each survey period. Differences in energy intakes were examined by source, sex, race-ethnicity (non-Hispanic whites, non-Hispanic blacks, and Mexican Americans), family income on the basis of the federal poverty income ratio (gross) by using 3 categories of poverty income ratio (ie, $\leq 130\%$, 131–185%, and $> 185\%$ of the poverty income ratio), and the education level of the household reference person (less than high school, high school or equivalent, or some college). Mexican Americans had to be used because the NHANES first adequately surveyed all Hispanics in 2007–2010 (37).

Food and beverage purchases by US households

Household food and beverage purchase data

We compiled household-quarter-level data on consumer packaged goods (CPG) foods and beverages purchased in terms

of calories. The Nielsen Homescan (38) is a commercial data set that contains information on products with barcodes that households purchased per shopping episode that was acquired from scanners provided to participants. Households were sampled from 76 markets (52 metropolitan and 24 nonmetropolitan areas) and weighted to be nationally representative with 35,000–65,000 households that provided ≥ 10 mo data/y from 2000 to 2011. Nielsen Homescan data provide detailed information about each CPG purchase (from grocery, drug, mass-merchandise, club, supercenter, and convenience stores), including the date of shopping episode, number of units or packages, total weight, and total amount paid for each product (35, 39). To this information, we merged Nutrition Facts Panel data from a variety of sources including the Mintel Global New Product Database (40) by barcode and year to allow for the measurement of the caloric content (35). Data also included household characteristics such as the household composition [numbers of men, women, boys (aged 2–6, 7–11, and 12–18 y old), and girls (aged 2–6, 7–11, and 12–18 y old)], age of the head of household, education of the head of household (less than high school, high school or equivalent, or some college), household income, market, and quarter. In this article, we used data from 2,376,436 household-quarter observations (35, 39) comprised of households with children ≤ 18 y old ($n = 602,389$ household-quarter observations from 57,298 unique households) and households with adults only ($n = 1,774,047$ household-quarter observations from 108,932 unique households).

Unemployment as an economic indicator

In accordance with past work by economists (21), we used market- and quarter-specific unemployment rates that were relevant to each household in the Homescan database as a proxy for the economic landscape. This method allowed us to account for the environment in which people made decisions, received wages and income, and experienced financial instability or uncertainty without introducing endogeneity. With the use of monthly unemployment data from the 2000–2011 Bureau of Labor Statistics’ Local Area Unemployment Statistics (41), we derived the average quarterly unemployment rate for each of the 76 markets in the Homescan database.

Household food and beverage purchase analyses

Unadjusted trends in CPG food and beverage purchases. With the use of 2000–2011 data, we calculated weighted but unadjusted descriptive results on trends in CPG food and beverage purchases for all households, households with children, and households with adults only.

Determination of the contribution of recessionary effects compared with time trends. We included important economic, sociodemographic, and year measures in our estimation models to estimate the recessionary compared with time trends on CPG food and beverage purchases. We followed the basic economic framework of household decision making for understanding caloric purchase decisions (42–46) and used maximum-likelihood random-effects (multilevel) models with clustering at the household. See Supplemental Material 1 under “Supplemental data” in the online issue for a detailed presented of the model. In the final model, we included market-quarter level unemployment interacted with year and race-ethnicity. The large number of interaction

terms in our models made it difficult to interpret the effect of any single variable. Therefore, we present the marginal effects of the year (relative to 2000), a 1-percentage point increase in the market-level unemployment rate, and race-ethnicity (relative to non-Hispanic whites). We estimated models separately for foods compared with beverages and by household type (with children compared with adults only).

Statistical methods

To test for statistical differences between years by using NHANES data, we used independent 2-sample *t* tests with $P \leq 0.01$ set for statistical significance. For all CPG purchase analyses, we denoted significance when $P \leq 0.001$ because of the large sample size. All analyses were conducted with Stata 12.0 software (StataCorp LP) (47).

RESULTS

Changes in individual dietary intakes in the United States

Trends in dietary intake

For children 2–18 y old and adults ≥ 19 y old, the annualized daily decreases in energy intake between 2003–2004 and 2009–2010 are shown in **Figure 1**, A and B. Annualized declines in calories from beverages were relatively larger for both children and adults given that beverages constituted a smaller proportion of total calories.

See Supplemental Tables 1 and 2 under “Supplemental data” in the online issue for detailed race-ethnic and socioeconomic differences for children and adults, respectively. The total energy intake decreased significantly for US children from 2003–2004 to 2009–2010, and the largest annualized decreases came from Mexican American children (–47 kcal/d), children from low-income families (–45 kcal/d), and children whose household head had a high school education (–51 kcal/d). Notably, no significant declines were observed from 2003–2004 to 2009–2010 in adolescents (12–18 y of age), non-Hispanic blacks, and

children whose household head had less than a high school education. Trends in intakes of foods paralleled trends in total energy intakes; in 12–18-y-olds, non-Hispanic blacks, and children whose head of household has less than a high school education, no changes were observed in energy intakes from foods. Meanwhile, reported intakes from beverages decreased significantly from 2003–2004 to 2009–2010 for all subpopulations (see Supplemental Table 2 under “Supplemental data” in the online issue).

For adults, in contrast to observed trends in children, there were few significant declines in the total energy intake (see Supplemental Table 2 under “Supplemental data” in the online issue). The only significant declines were in Mexican Americans, women, and individuals with some college education. Individuals with a high school education reported significantly lower daily calories from foods in 2009–2010 than in 2003–2004. Meanwhile, men, high-income adults and Mexican Americans had significant declines in energy intakes from beverages from 2003–2004 to 2009–2010 (see Supplemental Table 3 under “Supplemental data” in the online issue).

Trends in dietary intake by source

Calories from stores comprised 67–71% of total calories consumed in children and adults from 2003 to 2011. In children, the percentage of kilocalories per day reported as having been obtained from stores was slightly lower in 2005–2006 than in 2003–2004 but was not statistically significant (**Figure 2A**). In adults, the percentage of kilocalories per day reported to have been obtained from other sources was also lower in 2009–2010 than in 2003–2004 and 2005–2006 (**Figure 2B**) but was not statistically significant. See Supplemental Table 3 under “Supplemental data” in the online issue for a presentation of race-ethnic changes for children and adults, for which we showed that there was little change in sources in black children, whereas white children had decreased their calories from other sources in 2007–2008 and 2009–2010 than in 2003–2004, and Mexican American children

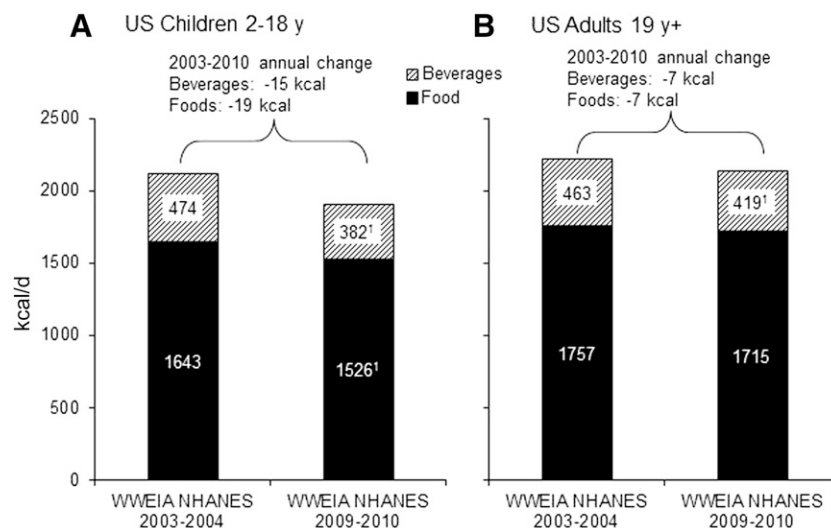


FIGURE 1. Calories per day from foods and beverages, 2003–2010. Sources: WWEIA NHANES 2003–2004 (children: $n = 3554$; adults: $n = 2449$) and 2009–2010 (children: $n = 3124$; adults: $n = 3038$). The analysis was weighted to be nationally representative and accounts for the complex survey design. The statistical difference between years was assessed by using independent 2-sample *t* tests. ¹Significantly different from 2003–2004, $P \leq 0.01$. WWEIA, What We Eat in America.

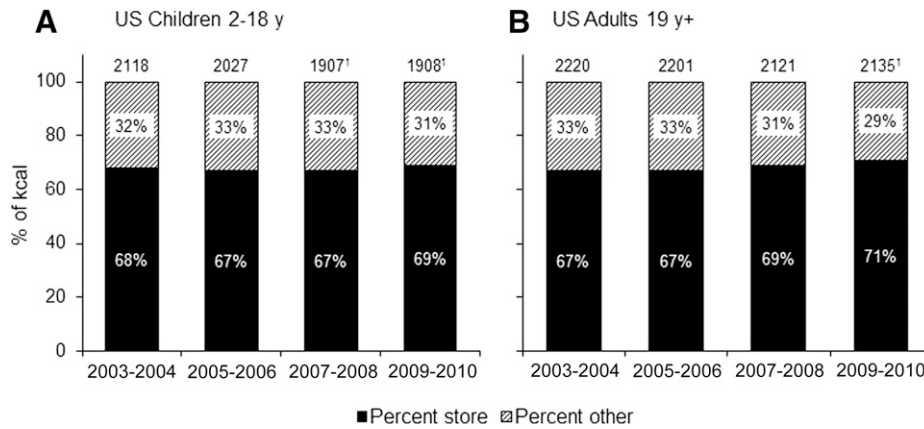


FIGURE 2. Calories per day from stores and other food sources, 2003–2010. Sources: What We Eat in America NHANES 2003–2004 (children: $n = 3554$; adults: $n = 2449$) and 2009–2010 (children: $n = 3124$; adults: $n = 3038$). The analysis was weighted to be nationally representative and accounts for the complex survey design. The statistical difference between years was assessed by using independent 2-sample t tests. [†]Significantly different from 2003–2004, $P \leq 0.01$.

had decreased their calories from stores in all time periods than in 2003–2004. In contrast, black and Mexican American adults showed little change in sources, whereas white adults showed decreased calories from other sources in 2009–2010 than in 2003–2004 and 2005–2006.

Changes in CPG food and beverage purchases by US households

Unadjusted trends in CPG food and beverage purchases

With the use of 2000–2011 Nielsen Homescan data, we showed that daily per capita food and beverage purchases fell over time for both households with children and households with

adults only (Figure 3, A and B). Because of varying caloric requirements, households with children purchased significantly fewer kilocalories per capita per day. More importantly, these trends showed that, since 2003, the annualized decrease in calories purchased from both CPG foods and beverages was significant for households with children, and the decline accelerated during the Great Recession period (Figure 3A). This decline appears to have occurred later for adults (Figure 3B). In Figure 3, we also show that, although absolute decreases in calories from foods were larger, relative declines in caloric purchases were larger for beverages than foods.

Since 2003, households with children consistently purchased fewer calories than in 2000 ($P < 0.001$) (see Supplemental Table

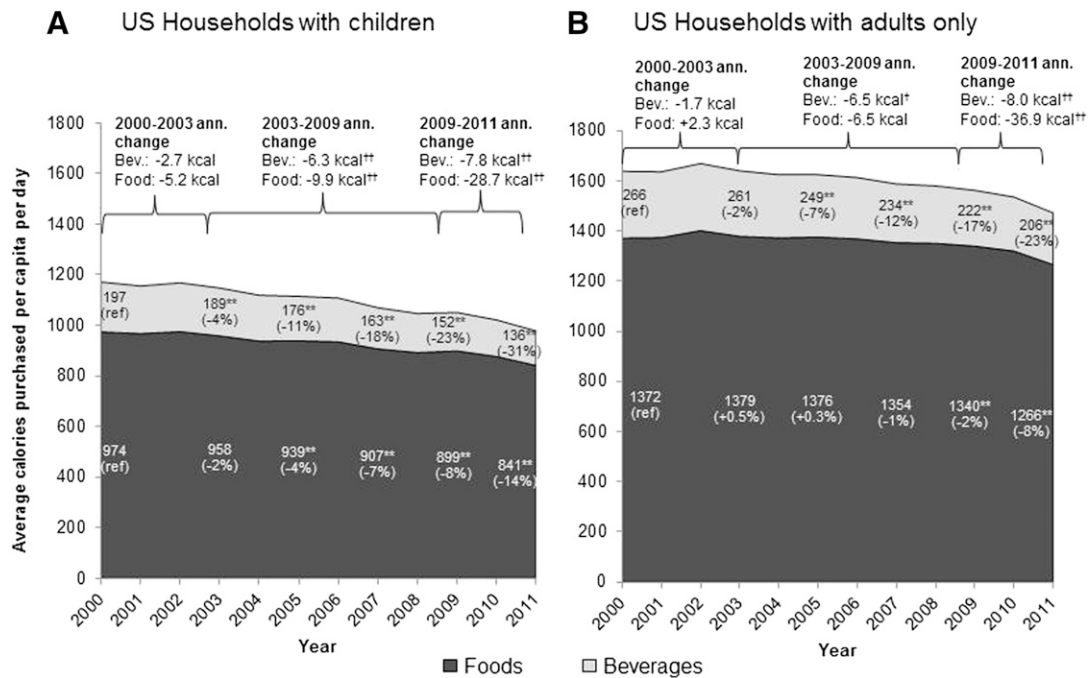


FIGURE 3. Unadjusted daily per capita calories purchased from CPG foods and beverages, 2000–2011. Source: Nielsen Homescan 2000–2011 (2,376,436 household-quarter observations). The analysis was weighted to be nationally representative. The statistical difference between years was assessed by using independent 2-sample t tests. ***Significant difference compared with 2000, $*P \leq 0.01$, $**P \leq 0.001$; [†], ^{††} significant difference compared with the 2000–2003 ann. change, [†] $P \leq 0.01$, ^{††} $P \leq 0.001$. ann., annualized; Bev., beverages; CPG, consumer packaged goods.

4 under “Supplemental data” in the online issue). Meanwhile, for households with adults only, this outcome did not happen consistently until around 2006. In addition, non-Hispanic white households purchased more calories across the 2000–2011 period than other races-ethnicities did, followed by Hispanic households (*see* Supplemental Figure 2 under “Supplemental data” in the online issue). Also, white households began purchasing significantly fewer calories starting in 2005 (compared with in 2000), whereas Hispanic and black households began that decline in 2001. Changes over time in other non-Hispanic households appeared dramatic, but these changes were not different from 2000 until 2009.

Determination of the contribution of time trends compared with recessionary effects

Marginal effect estimates of the year, unemployment rate, and race-ethnicity derived from the random-effects model for households with children and households with adults alone are shown in **Tables 1** and **2**, respectively. *See* Supplemental Table 5 under “Supplemental data” in the online issue for a presentation of results for all households combined (key marginal effects are shown in panel A, and the full set of coefficients is shown in panel B).

We showed that marginal effects of the recession proxied by the unemployment rate were positively associated with calories purchased, whereby a 1–percentage point increase in unemployment in the local market was associated with a $4.1\text{-kcal} \cdot \text{capita}^{-1} \cdot \text{d}^{-1}$ increase in total CPG purchases in households with children and a $1.6\text{-kcal} \cdot \text{capita}^{-1} \cdot \text{d}^{-1}$ increase in households with adults only.

Overall, there were much more significant year trends not explained by any household or market-level unemployment or price changes, and year trends became significant starting in 2003. Year effects were particularly strong for households with children (*see* Supplemental Figure 3A under “Supplemental data” in the online issue) than households with adults only (*see* Supplemental Figure 3B under “Supplemental data” in the online issue). In addition, marginal effect estimates showed that the year trends became consistently significant earlier for beverages than foods.

Last, marginal effect estimates of race-ethnicity showed that non-Hispanic black, Hispanic, and other households with children purchased significantly fewer calories from both foods and beverages than did non-Hispanic white households with children over the 2000–2011 period. However, when we looked at these race-ethnic differences over time, we showed that the gap has been decreasing since 2008 (*see* Supplemental Figure 4, A and B, under “Supplemental data” in the online issue).

DISCUSSION

Food purchases and dietary intake declines in the 2003–2011 period were consistent with trends in obesity that indicated either no increase or decreases in obesity on the basis of age, race-ethnic, or sex groupings. With the use of food and beverage purchase and NHANES data, this study showed that shifts in food purchase and eating behaviors that began in 2003 and have been accelerating were independent of the Great Recession or

TABLE 1

Marginal effect of year, unemployment, and race-ethnicity on average consumer packaged goods food and beverage purchases from random-effects models, in households with children¹

	Foods	Beverages	Foods and beverages
	$\text{cal} \cdot \text{capita}^{-1} \cdot \text{d}^{-1}$	$\text{cal} \cdot \text{capita}^{-1} \cdot \text{d}^{-1}$	$\text{cal} \cdot \text{capita}^{-1} \cdot \text{d}^{-1}$
Year (relative to 2000)			
2001	2.88 ± 4.79 ²	−12.25 ± 1.13**	−9.50 ± 5.42
2002	−8.20 ± 5.95	−12.84 ± 1.42**	−20.32 ± 6.73*
2003	−29.83 ± 6.19**	−17.24 ± 1.49**	−45.76 ± 7.00**
2004	−53.44 ± 6.07**	−26.76 ± 1.46**	−80.34 ± 6.87**
2005	−68.81 ± 5.94**	−35.46 ± 1.45**	−105.99 ± 6.72**
2006	−68.64 ± 5.70**	−40.88 ± 1.41**	−110.70 ± 6.45**
2007	−109.85 ± 5.73**	−55.79 ± 1.41**	−168.05 ± 6.49**
2008	−144.46 ± 6.20**	−68.83 ± 1.52**	−215.01 ± 7.01**
2009	−168.08 ± 5.55**	−77.02 ± 1.35**	−244.20 ± 6.28**
2010	−220.32 ± 5.29**	−89.40 ± 1.27**	−309.98 ± 5.99**
2011	−276.89 ± 5.20**	−98.91 ± 1.07**	−376.78 ± 5.89**
One–percentage point increase in unemployment	3.83 ± 0.75**	−0.02 ± 0.18	4.05 ± 0.85**
Race-ethnicity (relative to non-Hispanic white)			
Hispanic	−49.58 ± 4.09**	−3.51 ± 1.03*	−51.11 ± 4.25**
Non-Hispanic black	−92.29 ± 4.32**	−14.08 ± 1.13**	−104.21 ± 4.89**
Non-Hispanic other	−60.30 ± 4.75**	−6.44 ± 1.18**	−68.37 ± 5.02**
Joint significance ³			
Unemployment and year (df = 23)	1783.67**	2600.74**	2362.65**
Unemployment and race-ethnicity (df = 7)	141.53**	67.30**	137.83**
Race-ethnicity and year (df = 47)	1128.96**	1428.39**	1395.03**

¹ Modeled by using a maximum-likelihood random-effects model controlled for household composition, income, household head’s age and education, race-ethnicity, market, seasonality, and year and market-level price and includes interactions between market and year, unemployment and year, unemployment and race-ethnicity, and race-ethnicity and year. All models included 602,389 observations from 57,298 unique households (for an average of 10.5 quarters of observations per household). ** $P \leq 0.001$; * $P \leq 0.01$.

² Coefficient ± SE (all such values).

³ Joint significance values were calculated by using the Wald test of joint significance.

TABLE 2

Marginal effect of year, unemployment, and race-ethnicity on average CPG food and beverage purchases from random-effects models in households with adults only¹

	Foods	Beverages	Foods and beverages
	<i>cal · capita⁻¹ · d⁻¹</i>	<i>cal · capita⁻¹ · d⁻¹</i>	<i>cal · capita⁻¹ · d⁻¹</i>
Year (relative to 2000)			
2001	16.11 ± 4.52 ² **	-5.93 ± 1.13**	9.85 ± 5.01
2002	6.04 ± 5.70	-6.01 ± 1.45**	1.00 ± 6.33
2003	-15.37 ± 5.96*	-9.18 ± 1.52**	-22.74 ± 6.61**
2004	-42.20 ± 5.83**	-19.23 ± 1.49**	-60.69 ± 6.46**
2005	-41.58 ± 5.68**	-27.09 ± 1.47**	-69.14 ± 6.30**
2006	-66.68 ± 5.41**	-38.24 ± 1.42**	-105.03 ± 6.01**
2007	-100.90 ± 5.48**	-49.26 ± 1.43**	-152.24 ± 6.09**
2008	-120.55 ± 6.05**	-64.57 ± 1.57**	-185.94 ± 6.72**
2009	-150.12 ± 5.67**	-74.28 ± 1.47**	-222.04 ± 6.29**
2010	-215.49 ± 5.56**	-86.91 ± 1.43**	-300.75 ± 6.18**
2011	-289.13 ± 5.53**	-96.76 ± 1.29**	-384.51 ± 6.14**
One-percentage point increase in unemployment	1.08 ± 0.63	0.42 ± 0.16*	1.64 ± 0.70
Race-ethnicity (relative to non-Hispanic white)			
Hispanic	-23.35 ± 5.47**	-2.02 ± 1.42	-24.84 ± 6.11**
Non-Hispanic black	-88.35 ± 5.27**	-5.36 ± 1.40**	-93.65 ± 5.92**
Non-Hispanic other	-42.36 ± 5.20**	-7.63 ± 1.34**	-49.47 ± 5.80**
Joint significance ³			
Unemployment and year (df = 23)	4661.78**	5823.84**	6534.73**
Unemployment and race-ethnicity (df = 7)	169.78**	35.13**	152.00**
Race-ethnicity and year (df = 47)	2031.02**	2236.19**	2601.45**

¹ Modeled by using a maximum-likelihood random-effects model controlled for household composition, income, household head's age and education, race-ethnicity, market, seasonality, and year and market-level price and includes interactions between market and year, unemployment and year, unemployment and race-ethnicity, and race-ethnicity and year. Models accounted for clustering at the household level and included 1,774,047 observations from 108,932 unique households (for an average of 16.3 quarters of observations per household). ** $P \leq 0.001$; * $P \leq 0.01$. CPG, consumer packaged goods.

² Coefficient ± SE (all such values).

³ Joint significance values were calculated by using the Wald test of joint significance.

food prices. In both dietary intake household purchase data, we showed that children or households with children have been decreasing their calories the most. Moreover, in both data sources, we showed that, although absolute caloric reductions from foods were larger, relative caloric reductions from beverages were higher. Household purchase data also suggested that changes in calories purchased from beverages started occurring earlier than for food.

Our results suggested that media coverage, discussions, and actions in the United States that focused on obesity and the role of sugar-sweetened beverages may have played a role in this set of changes; a recent article showed a decrease in calories from sugar-sweetened beverages in children and adults since 1999 (48). The significant revision of the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) packages toward one significantly less obesogenic might have played an added role in infants and preschoolers (49, 50). Similarly, many school systems began to shift toward a more-healthy school feeding program before the initiation of new national school feeding programs and policies (51–53).

It is possible that some of these changes might also have been partly attributed to changes by food manufacturers and retailers. There have been some voluntary efforts by manufacturers to reduce the caloric contents of their products (54). Large global and national brands have also started to change their product formulations and portfolios for the United States over time, particularly in the beverage category in which they reduced the energy density of beverages sold (55). Several retailers have also made public announcements, eg, Walmart has pledged to address US obesity by reducing the calories of products sold at their

stores, including the reformulation of its Great Value products (56). Safeway's SimplyNutrition push to sell a healthier mix of products and reformulate its store-brand products is another example (57). Until rigorous evaluations of such efforts by food manufacturers and retailers occur, it remains unclear what changes will actually happen and what their impacts will be. The small positive association between unemployment and CPG calories purchased also deserves additional investigation, and a related article showed evidence that this association could have been because, during challenging economic times, people ate out less (and, thus, bought more foods from stores for home consumption), and people shifted toward cheaper store-brand alternatives that were, on average, more calorically dense (SW Ng, DK Guilkey, BM Popkin, unpublished observations, 2013).

Unfortunately, because we could control only for economic factors, we can only speculate on the cause of these changes. We expected that, because these noted trends started in 2002, they potentially represented consumer behavior shifts; however, the more-recent acceleration may also have included food industry and retailer changes as well. Furthermore, it is not possible to know if these are permanent or temporary shifts or whether they are subpopulation specific. The length of decline, and because these changes began to emerge and have been sustained since 2003, suggested a long-lasting shift in consumer attitudes and behavior overall, but the closing gap between non-Hispanic black, Hispanic, and non-Hispanic white households since 2007–2008 (see Supplemental Figure 4 under "Supplemental data" in the online issue) may indicate that this behavior shift might be temporary for certain races-ethnicities.

Our results of an annualized decline of ~36–44 kcal/d in caloric purchases did not readily translate to equivalent declines in caloric intake because we are aware of food waste in what we purchase (58). In addition, the Nielsen Homescan purchase data did not include nonstore sources of foods (eg, food service) or random-weight products (eg, bulk nuts, loose fruit and vegetables, and deli meats) and, thus, were limited to CPG purchases. Despite these differences between household CPG purchase data and individual diet intake measures, trends from these 2 types of data were comparable, which lent support to our findings. When we looked at individual intake data, we showed that children's annualized decline of 35 kcal/d was close to the estimated average energy gap of 41 kcal/d to prevent weight increases but was still far from the needed reduction of 120 kcal/d to achieve Healthy People 2010 goals (5). At the same time, note that, for most US children, the decline brought energy intakes down to comparable intakes observed in 1989–1991 (59).

This work has only considered (sub)population averages in calories consumed or purchased and has yet to delve into where along the distribution and in whom the largest changes may be occurring. We are addressing these aspects in ongoing work by using the National Cancer Institute method (60) to estimate usual intakes with corrections for misreporting of dietary intake in the NHANES (unpublished data).

In addition, this study focused on energy intake because of its direct relation with obesity and did not look at diet quality. Although our findings appeared promising from an energy intake standpoint, this result did not mean that the overall quality of US diets has improved because both children and adults still consume too-much excess solid fats and added sugars (36, 61, 62). Therefore, it is important that future work expands on changes in other key macronutrients and micronutrients, particularly solid fats and added sugars. In addition, in related research, we have documented significant shifts toward noncaloric sweeteners, particularly in beverages (63), whereby it is still unclear what the health implications shifts might be.

In conclusion, our results show that overall caloric intake and purchases have declined, and the decline was disproportionately from beverages and stronger in children. In addition, the changes appear to represent at least short-term behavioral trends. These results fit readily with the observed obesity trends and offer evidence that current and continued efforts by both the public and private sectors can further affect obesity levels. At a minimum, we show that the leveling off of obesity relates to important caloric purchase and intake shifts and provided promise for additional changes if we systematically address ways to improve our food supply, purchase, and eating patterns.

We thank Phil Bardsley, Donna Miles, and Izabela Annis for exceptional work with data management and programming, Frances L Dancy for administrative assistance, and Tom Swasey for assistance with graphics.

The authors' responsibilities were as follows—SWN: was involved in the study design and data analyses and interpretation and wrote the manuscript; MMS: contributed to the data analysis and interpretation and writing of the manuscript; and BMP: led in manuscript conceptualization and interpretation and contributed to the writing of the manuscript. None of the authors had a conflict of interest.

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