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Trends in Snacking Among U.S. Children

Abstract

Nationally representative surveys of food intake in US children show large snacking increases between the 1989–91 to 1994–98 and 1994–98 to 2003–06 periods. Childhood snacking trends are moving toward three snacks per day with over 27% of daily calories coming from snacks. The largest increases have been in salty snack and candy consumption, while desserts and sweetened beverages remain the major sources of calories from snacks.

Keywords

Snacking trends; U.S. dietary surveys; children; energy intake; energy density

INTRODUCTION

There has been little systematic examination of recent eating patterns and longer term trends, including those for childhood snacking. Reductions in energy intake are an important point of intervention for programs and policies at all levels.

The rise of childhood obesity coincides with a reported increase in daily snacking and a decline in the consumption of three principal meals. Population based studies showed increased energy intake related to the snacking habit (1,2), and more frequent snacking has been positively associated to body weight in children (1). However, other epidemiological and intervention studies in children and adolescents have linked a more even distribution of the energy intake throughout the day with lower body mass index (1,3,4) and most cross-sectional studies, after adjusting for body weight, have found that obese children do not eat more than lean children (5).

Snacks are readily available to all children and adolescents in several environments (6), and high energy dense snacks have been linked with a decreased satiating (feeling of fullness) effect (7,8). Greater intake of salty snacks, sweetened caloric beverages and increased portion sizes of snacks have been observed as potential contributors to the daily energy intake (9,10), and consequently, may play an important role in childhood obesity. This study is focused on more recent dynamics of snacking in all its dimensions.

Current snacking patterns and key foods during childhood were examined along with long-term trends in snacking behavior across four nationally representative surveys of food intake in US children over the last three decades. Our major results are an increase in the number of snacking events in the past decade, a finding that the largest increases have been in salty snack and candy consumption, while desserts and sweetened beverages remain the major sources of calories from snacks.

SUBJECTS AND METHODS

Survey design and sample

We selected 31,337 children and adolescents, aged 2 to 18 years from four nationally representative surveys of food intake in the U.S. population: 12,231 respondents from the 1977–1978 Nationwide Food Consumption Survey (NFCS77); 3,148 from the 1989–1991

Continuing Survey of Food Intake by Individuals (CSFII89); 8621 from the 1994–1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII98) and 7,337 from the joint USDA-National Health and Nutrition Examination Surveys [NHANES 2003–2004 and NHANES 2005–2006 (NHANES03–06)]. More details are presented elsewhere (11–13).

It is important to note that the methodology utilized in the National Health and Nutrition Examination Surveys 2003–06 is based on earlier Continuing Survey of Food Intake by Individuals (CSFII) methodologies and is the first set of surveys that fully integrated the USDA and the National Health and Nutrition Examination Surveys dietary data collection systems (14). The USDA Food Composition tables, methods of coding and probing were utilized.

Dietary records

Dietary intake in the Nationwide Food Consumption Survey 1977–78 and in the Continuing Survey of Food Intake by Individuals 1989–91 was collected over 3 consecutive days using a single interviewer-administered 24-hour recall. The Continuing Survey of Food Intake by Individuals 1994–98 consisted of interviewer-administered 24-hour recalls on 2 nonconsecutive days (3–10 days apart). The National Health and Nutrition Examination Surveys 03–06 surveys were based on two nonconsecutive days of 24-hour dietary recall data (day 1 interview is conducted by trained dietary interviewers in the Mobile Examination Center (MEC) and day 2 interview is collected by telephone 3 to 10 days following the MEC interview). For children younger than 12 years, information was obtained from the child's caregiver. For comparability, the first two days of dietary intake from each survey have been included.

Snack Consumption

Snacks and meals were self-defined in each survey as well as the time when each eating occasion began and are comparable with a second publication on adults (15). We combined snacks events consumed in a 15-m period in a single snacking occasion. Snackers were considered as those subjects who had snacks on any day (day 1, day 2 or both). Contributions to daily intake in subjects who snacked on both days were averaged. A large number of people reported consuming snacks at a meal (e.g., chips with a lunch). We changed these snack foods to meal if a food within a meal was defined as a snack. In the Nationwide Food Consumption Survey 77, the Continuing Survey of Food Intake by Individuals 89–91 and the Continuing Survey of Food Intake by Individuals 94–98 we found eating occasions defined as “other” or “no answer.” If a child did not have 3 meals, those missing occasions were recoded as meals according to the eating time. The remaining eating occasions were assigned to meals if the person did not eat 3 meals. The remaining missing eating occasions were considered as snacks. We have set 3 principal meals, if possible, and then we have studied the snacking behavior outside them, in all the years surveyed. Our approach represents a conservative definition of snacking.

UNC-CH food grouping system

The University of North Carolina at Chapel Hill approach begins with USDA food groupings and breaks them down into further more detailed food groupings in a systematic method termed (16). We have linked all foods from each of the USDA surveys together so comparable food composition, Latin binomial names and nutrient compositions are used for each food as major changes in numbering and measurement quality have occurred over time. The UNC-CH food grouping system has been previously described (17). The amount of energy provided by each UNC-CH food group for all individuals was calculated and then divided by the total energy from snacking. Those food groups contributing the most to the snacking calories are reported.

Water as a beverage was collected differently across the surveys. Plain water was added as a food item in 2003, accounting for up to 5 % of all the reported foods in 2003/06 versus 0 % in all the other previous surveys. To ensure comparability water as a food item was deleted in all years.

Statistical analysis

Individuals were stratified by age: 2–6 years old, 7–12 years old and 13–18 years old. Differences testing, by a Student's *t* test, used STATA, version 10 (18), to weight the results and control standard errors for sample design effects. We used survey commands to account for survey design, weighting, and clustering (18). A *P* value ≤ 0.01 was set for statistical significance.

RESULTS

Characteristics of snackers

The percentages of children consuming snacks by sociodemographic characteristics were always higher than 97% for each category in 2003–06. We identified males, non-Hispanic whites, with high household's income level ($>350\%$ national poverty level) and education (\geq high school diploma) as the categories with slightly higher percents of snackers (unreported results).

Dynamic changes in snacking behavior over the past 3 decades

Daily snacking among children has increased markedly over the periods covered as shown in the Exhibit 1. The prevalence of snackers among all the children (2–18 years old) increased from 74% in 1977–78 to 98% in 2003–06 over a two-day period (% of snackers in day 1, day 2 or both). The percentage of snackers on both day 1 and 2 for the same period and age group increased from 48% to 78% (unreported results). The percent of children who snacked once (day 1 or day 2 but not both) decreased over this period (from 26% in 77–78 to 20% in 03–06, unreported results). Major increases were observed from 1989 to 1994 and from 1994 to 2006. We found small differences in percentages of snacking among the age groups for each survey.

Increases in snacking habit over time

Significant changes in snacking behavior were observed for all the children from 1977–78 to 2003–06 (around 1.11 more snacks per day). Children 2 to 6 years old accounted for the highest amount of snacks per day and the largest increment from 1977 to 2006 (approximately 1.41 events more). While the latest increment in number of snacks per day has been linked with a small decline in calories per snacking event, the increased energy per snack from 1977 to 2006 was still significant. The grams consumed per snack event increased significantly from 1977 to 2003 in all the age groups (around 50 grams per snack more for all the children aged 2 to 18 years). The changes in grams consumed per snack from 1994 to 2003 were not significant except for the 13- to 18-year-olds (around 76 grams more). Regarding the total energy intake coming from snacks, we observed that all the children increased the number of snacking calories from 1977 to 2006, approximately 168 calories per day more (Exhibit 2).

From 1977–78 to 2003–05, the percent of snacking calories increased to 27% in all children, aged 2–18 years (Exhibit 3). Regarding the daily energy intake, children increased their caloric intake 113 calories more per day from 1977 to 2006. The largest increase was found among the children aged 2 to 6 years old, who consumed 182 calories more per day.

Snacking food: trends in energy density and food sources

Within each age group, the snacking energy density showed maintained trends over the periods covered (Exhibit 4). For children aged 7- to 12 and 13- to 18, the energy density of beverages from snacks and meal showed a significant decreased trend over the periods studied.

Important shifts in the major snacking sources from 1977 to 2006 are shown in the Exhibit 5. Although desserts decreased in 2003–06, they remained as the main contributors to snacking calories in 2006. The second main source of snacking energy was salty snacks (chips, crackers, etc.), which experienced the largest increase in the past 3 decades. Candies and fruit drinks also increased over the periods covered. We observed an important shift from higher intake of fresh fruit in 1977 to more frequent consumption of fruit juice in 2006. Sweetened beverages showed little change over this period, but was found to be the top third contributor to snacking energy in 2006.

DISCUSSION

This study has documented important increases in snacking behavior across all child age groups during the last three decades. Children in the U.S., especially the young, are consuming almost 3 snacks per day, and snacking accounted for up to 27% of the daily caloric intake in 2006. Our results showed major rises in snacking prevalence and caloric intake from 1989–91 to 1994–98 and again from 1994–98 to 2003–06. Important shifts towards more salty snacks and candies have been reported, although sweetened beverages and desserts remained the major snacking sources.

Previous studies in children and young adults found that the contribution of snacking to the total energy intake accounted for up to 25% and 23% respectively in 1996 (19,20). These studies also reported an increased trend in the total calories coming from snacks, and the total number of snacking occasions. Our results are consistent with trends from previous research, except for the important jump in snacking behavior in this decade.

Some important key issues related to the energy intake showed interesting trends over the years studied. First, the energy density of snacks were constant over the years studied. Other findings in young adults reported an increasing trend until 1996(20). Additional components of the increased energy intake from snacking are the grams and calories consumed per snack event (21). We reported increased portion sizes of snacks in terms of grams; however, because of the increased intake of caloric beverages, there was a small decrease in calories per snack in the 1994–98 to 2003–06 periods, consistent with earlier studies (22). However, without further research, it is unclear if this most recent period represents a shift toward lower portion sizes, or just the combination of more smaller snacks and more caloric beverages overall. Furthermore, there is minimal evidence on the health effects of these snacking changes (23, 24).

This study found a meaningful increase in intake of energy dense salty snacks and candies as sources of snacking energy. Also, children are consuming more beverages, such as fruit drinks, sport drinks and fruit juice, while decreasing fruit as a snacking source. Desserts remained as the major snacking source (cookies, cakes, etc.), consistent with previous works (20). However, the smaller less representative Bogalusa Heart Study found in children aged 10 years old decreasing grams consumed from fruit juices and fruit, desserts and candies from 1973 to 1994 (25).

These results may differ because snack and meal definitions have not been clearly established. In our study, we defined snacks as eating occasions outside meals. Foods defined as snacks, but consumed with a meal were recoded as meals. We also combined all the snacks consumed

within 15 minutes as one snacking event. A small proportion of foods with missing designations of eating occasions were assigned first to meals, and the remaining were considered as snacks (there was a small effect of a shift in prevalence of less than a tenth of a decimal place). This conservative definition allowed us to define three principal meals and then study snacking outside of meals for all the years surveyed. Different authors have defined snacks according to the name identified by the respondent, time of day, type of food, or even snacking foods have been counted as single eating occasions within a unique time interval (26–28). Although there is no current consensus about snacks and meal definitions, our approach may be more linked to the way we understand the metabolic consequences of foods eaten together at one short period occasion.

Days of intake surveyed may also be influencing disparities between studies. To be consistent, we used two days of intake to create comparable measurements over time. This allowed us to have a closer approximation of usual intake. Further, we found that the third day of snacking data for the two earlier studies were different, and probably represent underestimates of snacking. The Nationwide Food Consumption Survey 77–78 and the Continuing Survey of Food Intake by Individuals 89 reported that only 4% of subjects had snacks on day 3 and this last day is suspected to be greatly underreported (19).

Other limitations inherent to this study are related to the use of different surveys. Changes from the 80's to the 90's have been important, although subsequent changes in the number of passes and probes have been much smaller. As with all USDA surveys, the National Health and Nutrition Examination Surveys 2003–2006 methodology is the same as the Continuing Survey of Food Intake by Individuals developed by USDA since the surveys were merged with USDA in the lead on the diet component (14). This was the reason for adding the second day of dietary record for the National Health and Nutrition Examination Surveys beginning in 2003. Unfortunately no bridging study between the 1980's and 1990's nor between the 1990 and 2003–6 surveys methods exists as was undertaken earlier by USDA (29). The UNC-CH food grouping system developed by this UNC team was used to link different foods coded and collected in the first survey with the foods consumed in the last periods, ensuring consistently high-quality estimates of nutrient values over time (16).

In conclusion, our findings suggest that children of all ages from 2 to 18 are experiencing important increases in snacking behaviors and are moving toward a consumption pattern of 3 meals plus 3 snacks per day. This issue questions whether the physiological basis for eating is being dysfunctional as our children are moving toward constant eating.

NOTES

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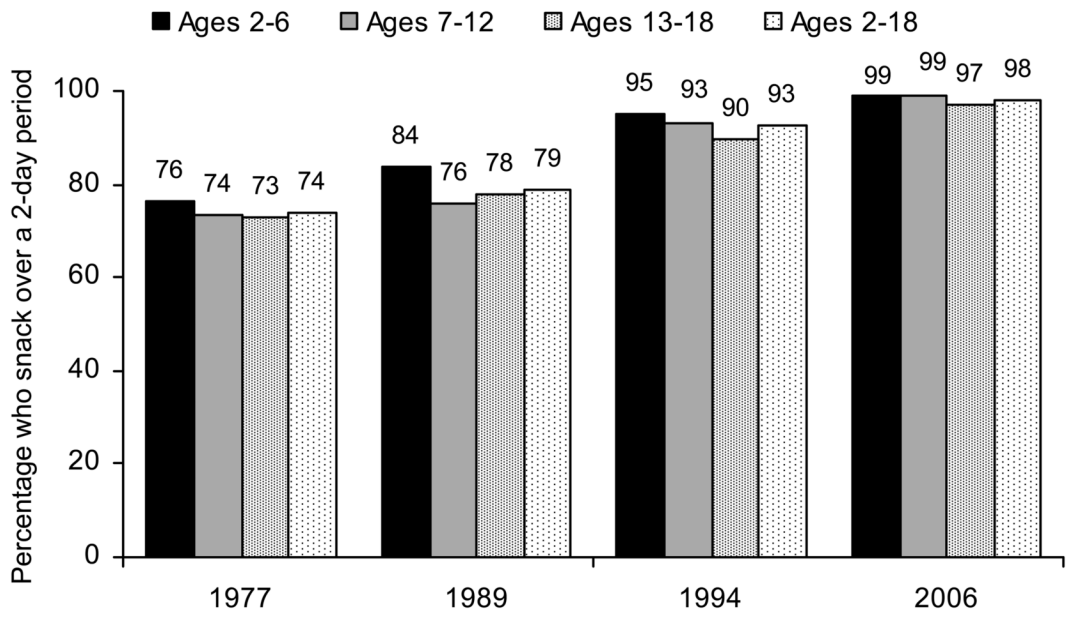


EXHIBIT 1. Percent of U.S. children consuming snacks over a 2-day period (% of snackers on day 1, day 2 or both)
 SOURCE: Content based on authors' assessments.

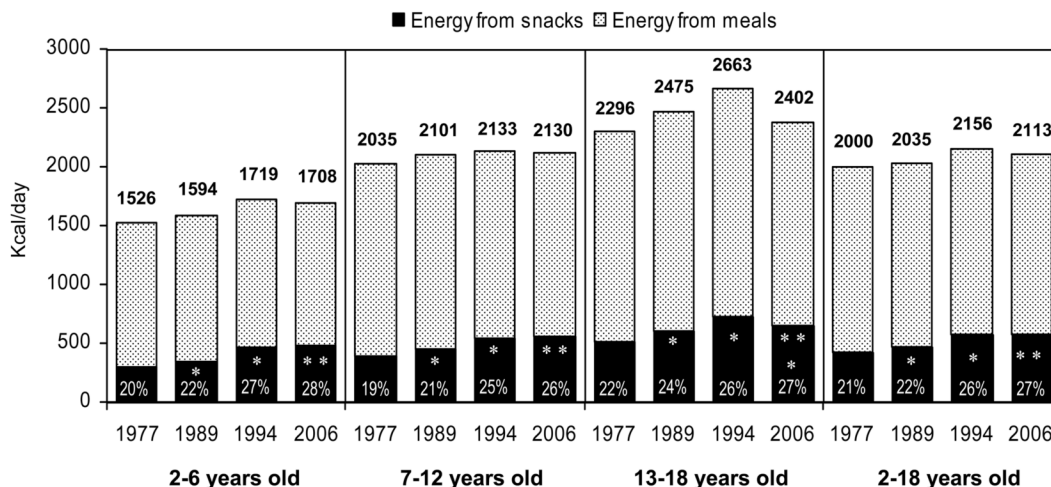


EXHIBIT 3. Contribution of snacking to total daily energy intake by year and age group. Numbers above bars represent total caloric intake per day among snackers. Solid bars in the bottom represent the percent of energy from snacks

SOURCE: Content based on authors' assessments.

Notes: *Significantly different from the previous year, $P < 0.01$ (Student's t test). **Significantly different between 1977–78 and 2003–06, $P < 0.01$ (Student's t test). Standard errors for the total kcal for snacking are found in Exhibit 2.

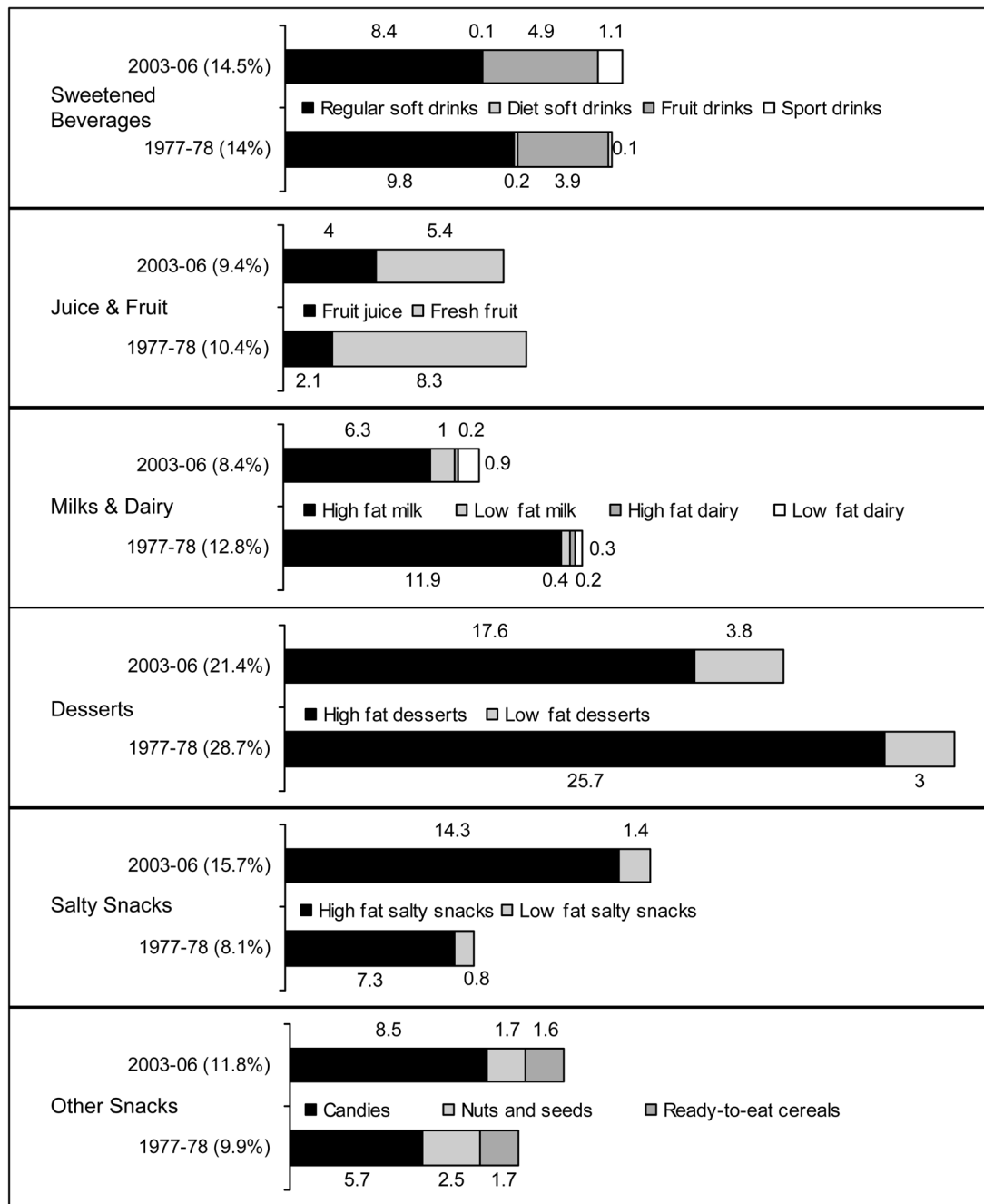


EXHIBIT 5. The proportion of snacking calories from food groups in U.S. children aged 2–18 years old. Colored bars represent percents of energy from snacking energy intake. The UNC-CH Food Grouping System was used to select the main food groups. Desserts include cakes, cookies, pies, bars, ice creams and gelatin desserts. High fat desserts were defined as those with more than 5 grams of fat per 100 grams of food. Salty snacks include crackers, chips, pop corns and pretzels. High fat salty snacks were defined as those with more than 5 grams of fat per 100 grams of food
 SOURCE: Content based on authors' assessments.

Mean number of snacks per day, kilocalories and grams consumed per snacking occasion by US children from the 1977–78, 1989–91, 1994–98 and 2003–06 surveys by age group¹.

EXHIBIT 2

	1977–1978	1989–1991	1994–1998	2003–2006
Ages 2–6 years				
Snacks/day	1.34 ± 90.04	1.59 ± 0.06 ^a	2.34 ± 0.04 ^{ab}	2.75 ± 0.05 ^{abc}
Kcal/snack (% from food) ²	135 ± 2.93 (47)	167 ± 4.56 ^a (59)	181 ± 2.66 ^{ab} (72)	173 ± 3.62 ^a (76)
Grams/snack (% from food) ³	126 ± 2.88 (38)	137 ± 3.91 (49)	159 ± 2.53 ^{ab} (62)	155 ± 3.79 ^{ab} (66)
Total kcal from snacks	310 ± 5.3	356 ± 5.3 ^a	465 ± 6.8 ^{ab}	491 ± 8.9 ^{ab}
Ages 7–12 years				
Snacks/day	1.18 ± 0.03	1.35 ± 0.08	1.99 ± 0.04 ^{ab}	2.28 ± 0.03 ^{abc}
Kcal/snack (% from food) ²	178 ± 4.25 (47)	205 ± 8.84 ^a (56)	239 ± 5.56 ^{ab} (71)	232 ± 4.22 ^{ab} (75)
Grams/snack (% from food) ³	155 ± 3.77 (38)	172 ± 9.39 (47)	198 ± 5.15 ^a (60)	195 ± 5.08 ^a (65)
Total kcal from snacks	395 ± 7.2	448 ± 13.9 ^a	547 ± 13.1 ^{ab}	568 ± 12.4 ^{ab}
Ages 13–18 years				
Snacks/day	1.20 ± 0.03	1.38 ± 0.04 ^a	1.89 ± 0.05 ^{ab}	2.09 ± 0.04 ^{abc}
Kcal/snack (% from food) ²	23 ± 5.74 (45)	263 ± 9.04 ^a (49)	306 ± 8.65 ^{ab} (61)	271 ± 4.29 ^{ac} (65)
Grams/snack (% from food) ³	209 ± 5.03 (32)	248 ± 6.15 ^a (38)	322 ± 11.89 ^{ab} (50)	285 ± 6.38 ^{abc} (56)
Total kcal from snacks	515 ± 9.5	609 ± 27.6 ^a	734 ± 29.2 ^{ab}	674 ± 14.8 ^a
Ages 2–18 years				
Snacks/day	1.23 ± 0.03	1.44 ± 0.04 ^a	2.07 ± 0.03 ^{ab}	2.34 ± 0.02 ^{abc}
Kcal/snack (% from food) ²	185 ± 3.71 (45)	210 ± 3.92 ^a (55)	241 ± 4.43 ^{ab} (68)	231 ± 2.58 ^{ab} (72)
Grams/snack (% from food) ³	169 ± 3.36 (35)	183 ± 4.00 ^a (45)	224 ± 4.90 ^{ab} (57)	219 ± 4.06 ^{ab} (62)
Total kcal from snacks	418 ± 6.0	463 ± 14.2 ^a	576 ± 12.0 ^{ab}	586 ± 8.0 ^{ab}

SOURCE: Content based on authors' assessments.

¹Notes: All estimates are mean ± S.E. Data were obtained from those individuals who reported any snack over a 2 day period (d1, d2 or both).

²% Energy from food was calculated dividing the energy from foods by the total energy (food plus beverages) *100.

³% Grams from food was calculated dividing the grams from foods by the total grams (food plus beverages) *100.

^aSignificantly different from 1977–78. $P < 0.01$ (Student's *t* test).

^bSignificantly different from 1989–91. $P < 0.01$ (Student's *t* test).

^cSignificantly different from 1994–96. $P < 0.01$ (Student's *t* test).

EXHIBIT 4

Trends in energy density of meals and snacking occasions in U.S. children aged 2–18 years old.

	ENERGY DENSITY (kcal/gram) *			
	1977–78	1989–91	1994–96	2003–06
Ages 2–6				
Total snacking	1.34	1.59 ^a	1.34 ^b	1.28 ^b
Total meals	1.15	1.15	1.15	1.17
Snacking food	2.76	2.86	2.55 ^{a,b}	2.54 ^{a,b}
Meals food	1.91	1.90	1.90	1.96
Snacking beverages	0.48	0.47	0.48	0.47
Meals beverages	0.49	0.48	0.48	0.49
Ages 7–12				
Total snacking	1.42	1.56	1.48	1.42
Total meals	1.21	1.22	1.20	1.25 ^{a,c}
Snacking food	2.78	2.68	2.78	2.79
Meals food	1.93	1.99	2.02 ^a	2.09 ^{a,b,c}
Snacking beverages	0.47	0.42 ^a	0.43 ^a	0.42 ^a
Meals beverages	0.50	0.48 ^a	0.46 ^a	0.45 ^{a,b}
Ages 13–18				
Total snacking	1.28	1.30	1.23	1.32
Total meals	1.20	1.20	1.18	1.21
Snacking food	2.84	3.00	2.87	2.96
Meals food	1.96	2.07 ^a	2.05 ^a	2.16 ^{a,b,c}
Snacking beverages	0.43	0.40 ^a	0.40 ^a	0.40 ^a
Meals beverages	0.46	0.42 ^a	0.41 ^a	0.40 ^a
Ages 2–18				
Total snacking	1.34	1.49 ^a	1.35 ^b	1.34 ^b
Total meals	1.19	1.19	1.18	1.21 ^{a,c}
Snacking food	2.80	2.83	2.73	2.78
Meals food	1.94	1.99 ^a	1.99 ^a	2.08 ^{a,b,c}
Snacking beverages	0.46	0.43 ^a	0.44 ^a	0.43 ^a
Meals beverages	0.48	0.46 ^a	0.45 ^a	0.44 ^{a,b,c}

SOURCE: Content based on authors' assessments.

* Notes: Total snacking and total meals combine food plus beverages.

^aSignificantly different from 1977–78. P<0.01 (Student's t test).^bSignificantly different from 1989–91. P<0.01 (Student's t test).^cSignificantly different from 1994–96. P<0.01 (Student's t test).