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Trends In Snacking Among U.S. Children

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ABSTRACT Nationally representative surveys of food intake in U.S. children show large increases in snacking between the 1989–91 to 1994–98 and 1994–98 to 2003–06 periods. Childhood snacking trends are moving toward three snacks per day, and more than 27 percent of children's daily calories are coming from snacks. The largest increases have been in salty snacks and candy. Desserts and sweetened beverages remain the major sources of calories from snacks.

There has been little systematic examination of recent eating patterns and longer-term trends, including those for childhood snacking. 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 show increased food consumption related to the snacking habit.[1,2] More frequent snacking has been positively associated with body weight in children.[1] Other epidemiological and intervention studies in children and adolescents have linked a more even distribution of food consumed throughout the day with lower body mass index (BMI).[1,3,4] 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 energy-dense snacks have been linked with a decreased satiating (feeling of fullness) effect[7,8] Greater intake of salty snacks and sweetened caloric beverages and increased portion sizes of snacks have been observed as potential contributors to daily food consumption.[9,10] Consequently, these may play an important role in childhood obesity. This study is focused on more recent dynamics of snacking in all of its dimensions.

In this study, current snacking patterns and key foods consumed during childhood were examined along with long-term trends in snacking behavior across four nationally representative surveys of food intake in U.S. children over the past three decades. Among our most important findings is an increase in the number of snacking events in the past decade. The largest increases in snacking events have been in salty snack and candy consumption; however, desserts and sweetened beverages remain the major sources of calories from snacks.

Study Data And Methods

SURVEY DESIGN AND SAMPLE We selected 31,337 children and adolescents, ages 2–18, 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); 8,621 from the 1994–1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII98); and 7,337 from the joint U.S. Department of Agriculture (USDA)–National Health and Nutrition Examination Surveys (NHANES03–06). More details are presented elsewhere.[11–13]

It is important to note that the methodology used in NHANES is based on earlier CSFII methodologies. This is the first set of surveys that fully integrated the USDA and NHANES dietary data

collection systems.[14] The USDA Food Composition tables and methods of coding and probing were used.

DIETARY RECORDS Dietary intake in the NFCS and in the CSFII89 was collected over three consecutive days using a single interviewer-administered twenty-four-hour recall. The CSFII98 consisted of interviewer-administered twenty-four-hour recalls on two nonconsecutive days (three to ten days apart). NHANES03–06 was based on two nonconsecutive days of twenty-four-hour dietary recall data (the day-one interview was conducted by trained dietary interviewers in the Mobile Examination Center, and the day two interview was conducted by telephone three to ten days after the first interview). For children younger than age twelve, information was obtained from the child's caregiver. For comparability, only the first two days of dietary intake from each survey are included.

SNACK CONSUMPTION Snacks and meals were self-defined in each survey, as was the time when each eating occasion began; they are comparable with a second publication on adults.[15] We combined snack events consumed in a fifteen-minute period as a single snacking occasion. Subjects who had snacks on any day were deemed "snackers." Contributions to daily intake in subjects who snacked on both days were averaged. A large number of people reported consuming snack food at a meal (for example, chips with lunch). We changed these reports of snacking to a meal if food consumed during a meal was defined as a snack food. In the NFCS77, the CSFII89–91, and the CSFII94–98, we found eating occasions defined as "other" or "no answer." If a child was not reported to have had three meals, those missing occasions were recoded as meals according to the eating time. The remaining missing eating occasions were considered as snacks. We established three principal meals, if possible, and then we studied the snacking behavior outside them, in all years surveyed. Our approach represents a conservative definition of *snacking*.

FOOD GROUPING SYSTEM The University of North Carolina–Chapel Hill approach begins with USDA food groupings and breaks them down into more detailed food groupings in a systematic method.[16] We have linked all foods from each of the USDA surveys together so that comparable food compositions, Latin binomial names, and nutrient compositions are used for each food, because major changes in numbering and measurement quality have occurred over time. The food grouping system has been described elsewhere.[17] The amount of energy provided by each food group for all individuals was calculated and then divided by the total energy from snacking. Food groupings contributing the most to snacking calories are reported.

Consumption of 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 percent of all reported foods in 2003–06 versus 0 percent 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: ages 2–6, ages 7–12, and ages 13–18. Differences testing, by a student's t-test (which allows the use of a small number of measurements to estimate what may be true of the whole population), used STATA, version 10, a type of data analysis and statistical software, to weight the results and control standard errors for sample design effects. We used survey commands to account for survey design, weighting, and clustering. A p (probability) value of 0.01 was set for statistical significance. (A p value of less than 0.05 is considered statistically significant—that is, not likely to be due to chance alone.)

Study Results

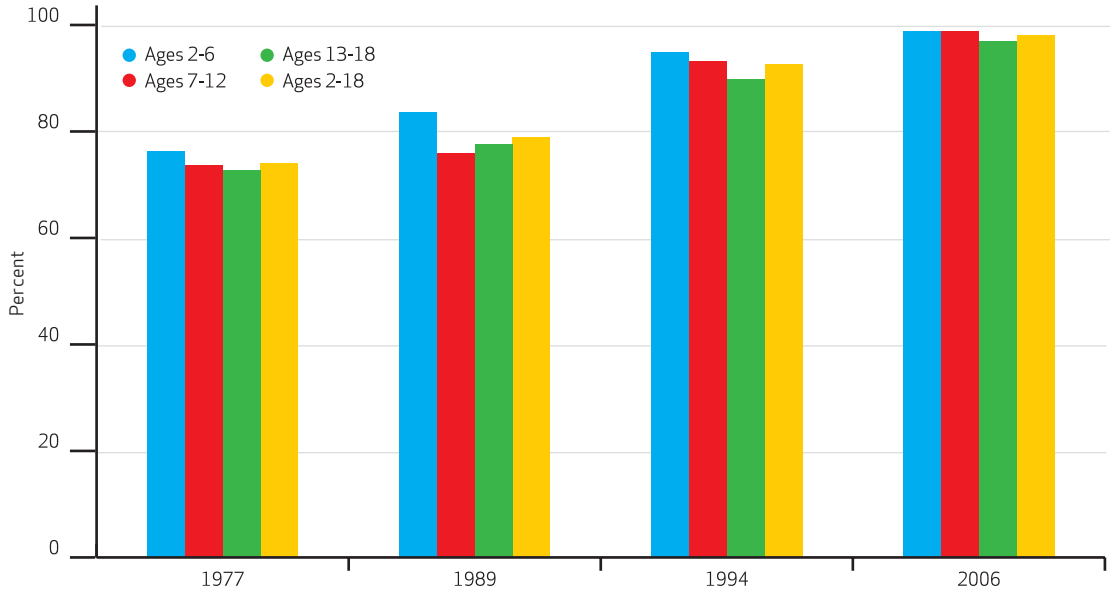
CHARACTERISTICS OF SNACKERS The percentages of children consuming snacks by sociodemographic characteristics were always higher than 97 percent for each category in 2003–06. We identified males, non-Hispanic whites, with high household income level (greater than 350 percent of the federal poverty level) and education (high school diploma or higher) as the categories with slightly higher percentages of snackers (unreported results).

DYNAMIC CHANGES IN SNACKING BEHAVIOR Daily snacking among children has increased markedly over the periods studied (Exhibit 1). The prevalence of snackers among all children (ages 2–18) increased from 74 percent in 1977–78 to 98 percent in 2003–06. 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 HABITS OVER TIME Significant changes in snacking behavior were observed for all children from 1977–78 to 2003–06 (around 1.11 more snacks per day). Children ages 2–6 accounted for the highest number of snacks per day and the largest increment from 1977 to 2006 (approximately 1.41 events more). The latest increment in number of snacks per day has been linked with a small decline in calories per snacking event; however, the increased energy per snack from 1977 to 2006 was still significant. Grams consumed per snack event increased significantly from 1977 to 2003 in all age groups

EXHIBIT 1

Percentage Of U.S. Children Consuming Snacks Over A Two-Day Period, Selected Years 1977–2006



SOURCE Content based on authors' assessments. **NOTE** Percentage of children consuming snacks on day 1 of interview, day 2 of interview, or both.

(around 50 grams more per snack). The changes in grams consumed per snack from 1994 to 2003 were not significant except for children ages 13–18 (around 76 grams more). Regarding the total energy intake coming from snacks, we observed that all children consumed approximately 168 more calories a day from snacking from 1977 to 2006 (Appendix Exhibit 1).[18]

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

TRENDS IN ENERGY DENSITY AND FOOD SOURCES Within each age group, snacking energy density maintained its trends over the periods covered (Exhibit 3). For children ages 7–12 and 13–18, the energy density of beverages from snacks and meals showed a significant decreased trend over the periods studied.

Important shifts in the major snacking sources from 1977 to 2006 are shown in Exhibit 4. Although consumption of desserts decreased in 2003–06, they remained the main contributors to snacking calories in 2006. The second main source of snacking energy was salty snacks, which experienced the largest increase in the past three decades. Consumption of candy 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. Consumption of sweetened beverages showed little change over this period but was found to be the third-highest contributor to snacking energy in 2006.

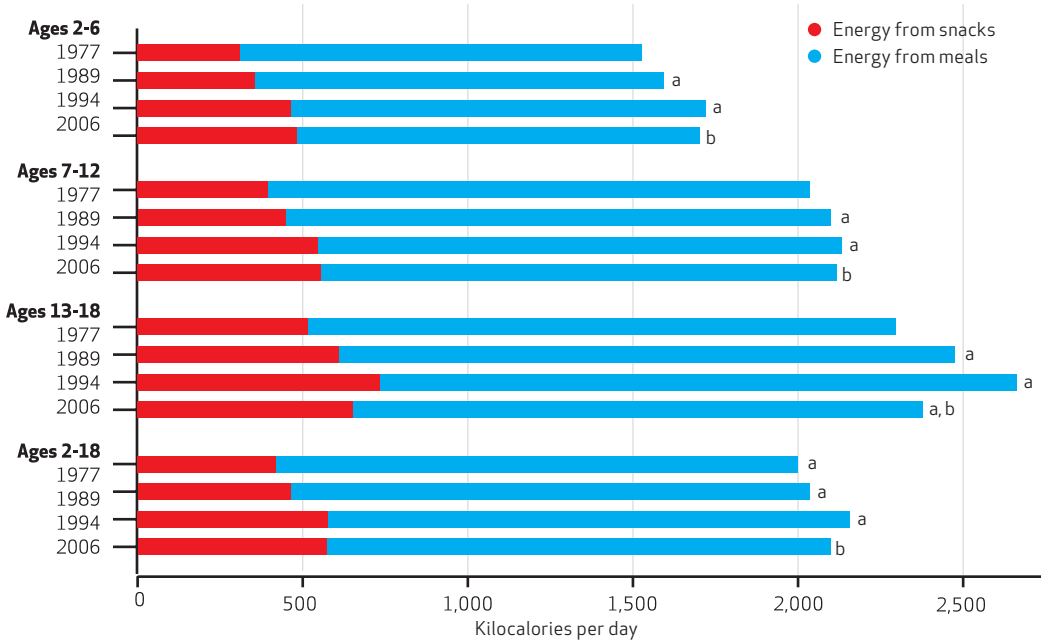
Discussion

This study has documented important increases in snacking behavior across all child age groups during the past three decades. Children in the United States, especially the young, are consuming almost three snacks per day, and snacking accounted for up to 27 percent of children's 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 toward consuming more salty snacks and candy 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 percent and 23 percent, respectively, in 1996.[19,20]

EXHIBIT 2

Contribution Of Snacking To Total Daily Energy Intake, By Year And Age Group, Selected Years 1977–2006



SOURCE Content based on authors' assessments. **NOTES** Red bars represent the percentage of energy from snacks. Standard errors for the total kilocalories for snacking are found in Appendix Exhibit 1, as in Note 18 in text. [a] Significant differences in snacking kilocalories from the previous year (student's t-test; $p < 0.01$). [b] Significant differences in snacking kilocalories between 1977–78 and 2003–06 (student's t-test; $p < 0.01$).

These studies also reported an increased trend in the total calories coming from snacks and in 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.

ENERGY DENSITY Some important key issues related to the energy intake showed interesting trends over the years studied. First, the energy density of snacks was 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 found 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 from 1994–98 to 2003–06, consistent with earlier studies.[22] However, without further research, it is unclear whether 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 the intake of energy-dense salty snacks and candy 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 the major snacking source, consistent with previous work.[20] However, the smaller, less representative Bogalusa Heart Study found decreasing grams consumed from fruit juices and fruit, desserts, and candy from 1973 to 1994 in ten-year-olds.[25]

INCONSISTENT DEFINITIONS 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 snack foods but consumed with a meal were recoded as meals. We also combined all snack food consumed within fifteen minutes as one snacking event. A small proportion of food 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

EXHIBIT 3

Trends In Energy Density Of Meals And Snacking Occasions In U.S. Children Ages 2–18, Selected Years 1977–2006

	Energy density (kcal/gram)[a]			
Age group/eating occasion	**1977–78**	**1989–91**	**1994–96**	**2003–06**
Ages 2–6				
Total snacking	1.34	1.59[b]	1.34[c]	1.28[c]
Total meals	1.15	1.15	1.15	1.17
Snacking food	2.76	2.86	2.55[b,c]	2.54[b,c]
Meal food	1.91	1.90	1.90	1.96
Snacking beverages	0.48	0.47	0.48	0.47
Meal 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[b,d]
Snacking food	2.78	2.68	2.78	2.79
Meal food	1.93	1.99	2.02[b]	2.09[b,c,d]
Snacking beverages	0.47	0.42[b]	0.43[b]	0.42[b]
Meal beverages	0.50	0.48[b]	0.46[b]	0.45[b,c]
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
Meal food	1.96	2.07[b]	2.05[b]	2.16[b,c,d]
Snacking beverages	0.43	0.40[b]	0.40[b]	0.40[b]
Meal beverages	0.46	0.42[b]	0.41[b]	0.40[b]
Ages 2–18				
Total snacking	1.34	1.49[b]	1.35[c]	1.34[c]
Total meals	1.19	1.19	1.18	1.21[b,d]
Snacking food	2.80	2.83	2.73	2.78
Meal food	1.94	1.99[b]	1.99[b]	2.08[b,c,d]
Snacking beverages	0.46	0.43[b]	0.44[b]	0.43[b]
Meal beverages	0.48	0.46[b]	0.45[b]	0.44[b,c,d]

SOURCE Content based on authors' assessments. [a]Total snacking and total meals combine food plus beverages. [b]Significantly different from 1977–78 (student's t-test, $p < 0.01$). [c]Significantly different from 1989–91 (student's t-test, $p < 0.01$). [d]Significantly different from 1994–96 (student's t-test, $p < 0.01$).

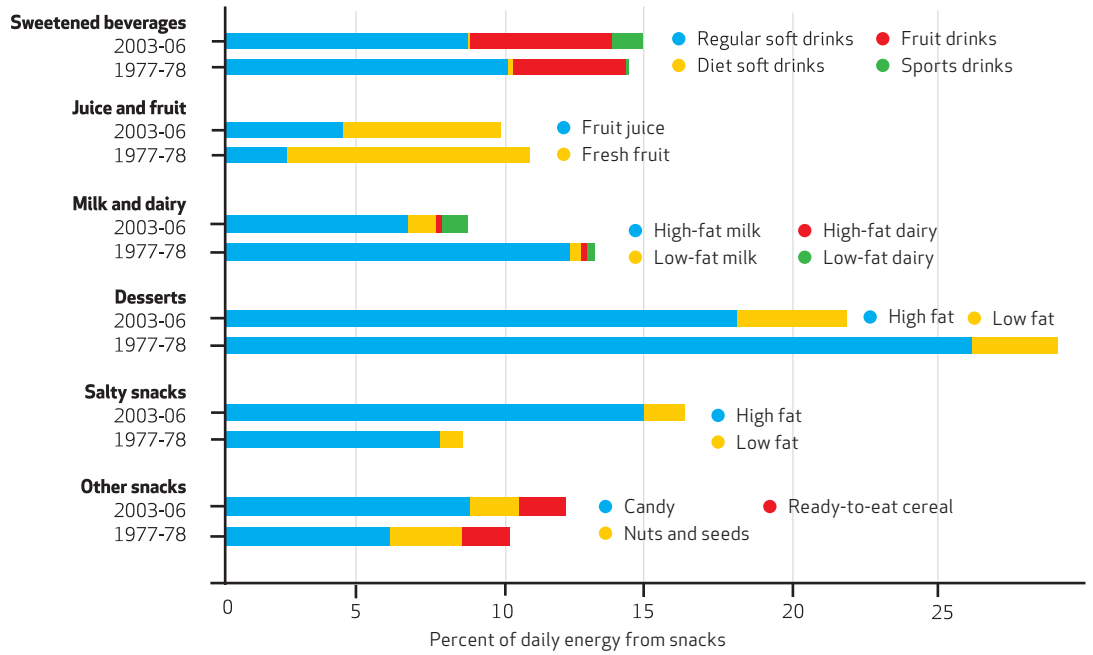
and then study snacking outside of meals for all years surveyed. Different researchers have defined *snacks* according to the name identified by the respondent, time of day, or type of food. Snacking foods have even been counted as single eating occasions within a unique time interval.[26–28] Although there is no current consensus about 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 SNACKING SURVEYED 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 was different from the other days and probably represented underestimates of snacking. The NFCS78 and CSFII89 reported that only 4 percent of subjects had snacks on day three, and this last day is suspected to be greatly underreported.[19]

OTHER LIMITATIONS Other limitations inherent in this study are related to the use of different surveys. Changes in surveys from the 1980s to the 1990s have been important, although subsequent changes in the number of passes and probes have been much smaller. As with all USDA surveys, the NHANES03–06 methodology is the same as that of the CSFII developed by the USDA, since the surveys were merged with the USDA taking the lead on the diet component.[14] This was the reason for adding the second day of dietary record for NHANES beginning in 2003. Unfortunately, no bridging study between the 1980s and 1990s nor between the 1990 and 2003–2006 survey methods exists, as was undertaken earlier by the USDA.[29] The University of North Carolina–Chapel Hill food grouping system developed by this team was used to link different foods coded and collected in the first survey with the foods consumed in the last peri-

EXHIBIT 4

Proportion Of Snacking Calories From Food Groupings In U.S. Children Ages 2–18, Selected Years 1977–2006



SOURCE: Content based on authors' assessments. **NOTES** The University of North Carolina–Chapel Hill food grouping system was used to select the main food groupings. Desserts include cakes, cookies, pies, bars, ice cream, and gelatin desserts. Salty snacks include crackers, chips, popcorn, and pretzels. High-fat desserts and salty snacks were defined as those with more than 5 grams of fat per 100 grams of food.

ods, ensuring consistently high-quality estimates of nutrient values over time.[16]

CONCLUSION Our findings suggest that children ages 2–18 are experiencing important increases in snacking behavior and are moving toward a consumption pattern of three meals plus three snacks per day. This raises the question of whether the physiological basis for eating is becoming dysregulated, as our children are moving toward constant eating. ■

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NOTES

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