
U.S. Teens and the Nutrient Contribution and Differences of Their Selected Meal Patterns

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We examined the nutrient contribution of foods consumed at breakfast, brunch, lunch, dinner, and snacks, as well as the types of foods consumed on those occasions, by adolescents ($n=1,310$) participating in the 1989-91 Continuing Survey of Food Intakes by Individuals. Descriptive statistics were generated, using weights and taking into account sample design effects, to examine the consistency of their meal patterns: Consistent, moderately consistent, and inconsistent. Results showed that for individuals with an inconsistent meal pattern, dinner provided half of the day's energy and total snacks provided over one-fifth, an equivalent of one meal for others. Most nutrients studied (fat, protein, calcium, and iron) followed the same pattern as energy. Age differences were noted: 15- to 18-year-olds were more likely to have inconsistent patterns. The types of foods consumed also differed by meal pattern. Both increasing the consistency in the number of meals consumed, as well as improving food-selection behaviors, may serve as possible interventions to improve the diets of adolescents.

Adolescence is a period of great transitions. Nutrient requirements are increased from childhood because of physical growth, and behaviors acquired during this period persist into adulthood (1,11,17,22). While many subsets of adolescents engage in behaviors that have wide public health attention, some adolescents may also follow pathways of poor food choices and reduced physical activity—both of which can also have deleterious effects on health (10,25). Among the health consequences of following these pathways have been rapid increases in obesity and adult-onset diabetes (13,23,26). Members of this age group are influenced strongly by their peers, the media, and family situation and less by their knowledge of risky behaviors (6,21,22).

Skipping meals is a common practice among adolescents: about 20 percent do not eat breakfast, and about half as many do not eat lunch (3,5,10,18,19). Skipping meals may lead to more snacking; for those who do not view skipping meals as a method of weight loss, snacks often compensate for missed calories and other key nutrients. The literature indicates that, on average, most children and adolescents average four eating occasions a day, with an upper range of 13 occasions among Mexican children who consumed as much as 45 percent of their energy from snacks (4,7,8). Research on the meal patterns of U.S. adolescents showed that most consume at least two meals (plus or minus snacks) on a consistent basis while some follow a highly inconsistent meal pattern: one meal and/or snacks all day (18).

Compared with adolescents with inconsistent meal patterns, those with consistent meal patterns consumed a diet that was adequate in calories and more nutrient dense (with respect to calcium, iron, vitamin E, and fiber) (11). Our study examines in more detail the types of food consumed by adolescents at each eating occasion and the nutrient contributions provided by each eating occasion to adolescents' total daily intakes. This study is unique: we examine snacking behaviors by using a nationally representative sample, and we determine the nutrient contributions of snacks. Previous studies have examined only the nutrient density of meals versus snacks without considering their contribution to the total diet, or previous studies have used very small samples to examine this research question (2,16).

Methods

Survey Design

Food consumption data were provided by the 1989-91 Continuing Survey of Food Intakes by Individuals (CSFII), a survey conducted by the U.S. Department of Agriculture's Agriculture Research Service. A nationally representative sample was collected by using a multistage, stratified sample design of the 48 coterminous States and Washington, DC. Data were collected in four waves during each year: one in each season, between April 1989 and May 1991. In each wave, a different sample of participants was selected. The total number of participants in all age groups sampled was 15,192.

Dietary data were collected for each individual in selected households. Using a 24-hour recall and two 1-day food records, individuals reported 3 consecutive days of intake. The female head of the household reported dietary intake for individuals less than 12 years

old. We were interested in the eating patterns of adolescents, thus our analysis was restricted to 11- to 18-year-olds who reported 3 days of dietary intake (n=1,310). The classification of individuals into meal-pattern categories did not differ between 11- and 12-year-olds, and the differences in nutrient composition of reported intakes of 11- and 12-year-olds were similar in magnitude to the differences between 12- and 13-year-olds. Therefore, 11-year-olds were included in the analysis despite differences in methods of data collection for dietary intake.

Variables

Meal Patterns

Survey data include descriptors of eating occasion (breakfast, lunch, dinner, supper, snack, brunch, and extended consumption) as well as the time of day each food was consumed. To identify meal patterns, we first developed clear and invariable terminology for eating occasions: Breakfast, lunch, brunch, dinner, or snack. Respondents provided the name for each meal. When respondents reported consuming either supper or dinner, the eating occasion was designated as dinner; when the respondent reported consuming both supper and dinner, dinner was designated as lunch and supper designated as dinner. This categorization was based on analysis of the data, which indicated that dinner was consumed primarily as an evening meal (85 to 87 percent between 4 and 8 p.m.). When both supper and dinner were consumed, dinner was the midday meal (56 to 69 percent between 11 a.m. and 3 p.m.) and supper was the evening meal (70 to 81 percent between 4 and 8 p.m.). Eating occasions for 1.3 percent of foods were unknown or identified as extended consumption and therefore not included in our analysis.

Three meal-pattern categories were created based on their ability to provide

meaningful comparison of eating behaviors: Consistent, moderately consistent, and inconsistent. These categories are mutually exclusive and include all possible combinations of eating occasions. Respondents with a consistent meal pattern (n=538) consumed two or three meals (plus or minus snacks) on all 3 days of reported intake. Those with a moderately consistent meal pattern (n=726) consumed two or three meals (plus or minus snacks) on 2 of the 3 days of reported intake. And respondents with an inconsistent meal pattern (n=46) consumed only one meal (plus or minus snacks) or snacks only on all 3 days of reported intake.

Personal, Household, and Demographic Characteristics

Population characteristics available directly from the CSFII were age, gender, race, region of residence, supplement use, school attendance, educational and employment status of the female head of the household, income status, and household size. Our derived variables were consumption of school-based meals and single- versus dual-parent households. Respondents who reported consuming at least one school-based lunch per week were classified as consumers of school lunch. This method was repeated for school breakfast. Classification as a single- or dual-parent household was based on the presence of a male or female head of household or female and male heads of household, respectively.

Nutrient and Food-Grouping System

The nutrient database was provided by USDA Survey Nutrient Data Base, Release #7 and was developed for the 1991 CSFII. For this analysis, we used nutrient information provided as the total average intake or as the average percentage of the Recommended Dietary Allowances (RDA) for all nutrients (12) consumed over 3 days.

The age- and gender-appropriate RDA values were used to calculate the average percentage of the RDA consumed. Grams of food consumed at each eating occasion were calculated by using the University of North Carolina at Chapel Hill food-grouping system. This system disaggregates major USDA food groups into 56 more distinct nutrient-based groups based on the composition of fat and dietary fiber. The University of North Carolina at Chapel Hill's food-grouping system covered all foods that respondents reported eating (14,15).¹

Statistical Methods

We used Student's *t* test and a chi-square test to compare the socio-demographic characteristics among the groups based on their meal patterns. Statistical testing, however, was not performed on the proportion of the nutrients or the grams of food contributed by each meal. To do so would have required many comparisons, resulting in our having to use a very stringent *p* value. Hence our analysis is descriptive. The results provide estimates representative of the U.S. population in the coterminous 48 States. We weighted the statistics for nonresponse and corrected the standard errors for the complex multistage design. We used the STATA survey option that allows for the effects of the complex sample design (20).

Results

Sociodemographic Characteristics

Forty-one percent of the adolescents had consistent meal patterns; only 4 percent had inconsistent meal patterns (table 1). The 15- to 18-year-olds were more likely to have inconsistent meal

¹This information is available upon request.

Table 1. Descriptive characteristics of 15- to 18-year-olds and their households, by meal-pattern category, 1989-91 CSFII

Sociodemographic characteristic	Meal pattern		
	Consistent	Moderately consistent	Inconsistent
Sample	538	726	46
		<i>Percent</i>	
Female	47.0	52.6 ¹	60.9 ^{1,2}
Black	14.1	19.0 ¹	23.9 ^{1,2}
Attends school	93.1	87.2 ¹	75.6 ¹
Single-parent household	27.3	31.4 ¹	34.8 ¹
Female head of household attended college	34.9	31.1 ¹	27.3 ^{1,2}
Female head of household has <12 years of education	26.9	31.1 ¹	31.8 ¹
Region			
Northeast	18.0	17.2	10.9 ^{1,2}
Midwest	30.9	26.5 ¹	28.3
South	31.2	35.4 ¹	34.8
West	19.9	20.9	26.1 ^{1,2}
		<i>Mean (± S.D.)</i>	
Percentage of poverty	329 (264)	326 (249)	330 (209)
Household size	4.7 (1.9)	4.2 (1.4) ³	4.2 (1.5) ^{3,4}

¹Significantly different from the consistent meal pattern, chi-square analysis, *p* < 0.05.

²Significantly different from moderately consistent meal pattern, chi-square analysis, *p* < 0.05.

³Significantly different from consistent meal pattern, weighted *t* test, *p* < 0.05.

⁴Significantly different from moderately consistent meal pattern, weighted *t* test, *p* < 0.05.

patterns. The consistent meal-pattern category had a higher percentage of respondents who were male, white, and who attended school. Adolescents with a consistent meal pattern were less likely to be from a single-parent household and more likely to be from a household in which the female head attended college. Neither the mean percentage of poverty nor years of education of the female head of household differed significantly by meal-pattern category.

Nutrient Profiles Based on Adolescents' Meal Pattern

Adolescents with a consistent or moderately consistent meal pattern consumed 37 to 38 percent of their total energy from dinner. For adoles-

cents in the inconsistent group, 43 percent of their total energy was consumed at dinner. Even more important is the difference in the role of snacks in their diet. Snacks comprised about 23 percent of the total day's energy for those following an inconsistent meal pattern but only 11 to 16 percent for those following the other two meal patterns. In total, the dinner meal and total snacks together provided more than two-thirds of the day's total energy for adolescents with an inconsistent meal pattern.

Differences by age group were noted (figs. 1 and 3). For instance, 11- to 14-year-olds in the inconsistent group obtained 24 percent of energy from lunch while older adolescents in the same group obtained 9 percent of

Figure 1. Distribution of energy obtained, by meal-pattern groups of 11- to 18-year-olds, 1989-91 CSFII

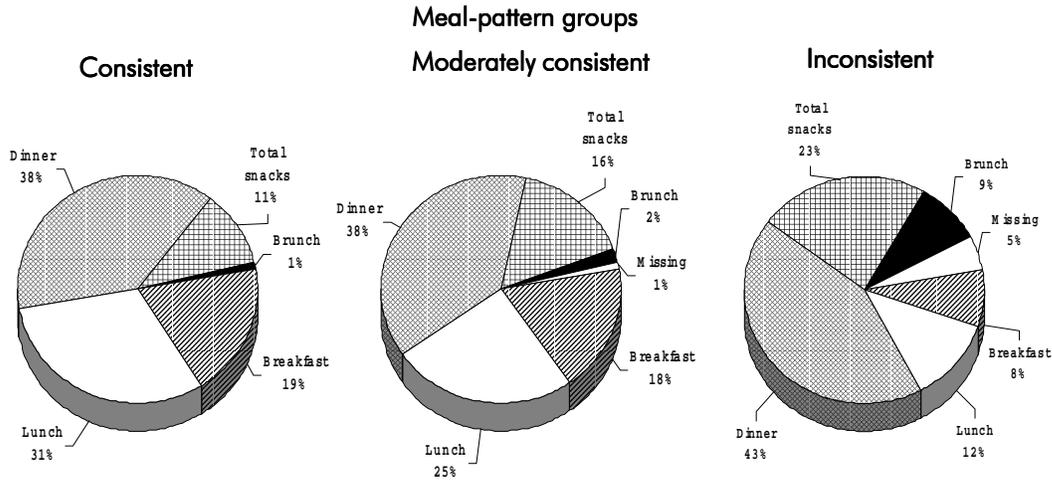


Figure 2. Distribution of energy obtained, by meal-pattern groups of 11- to 14-year-olds, 1989-91 CSFII

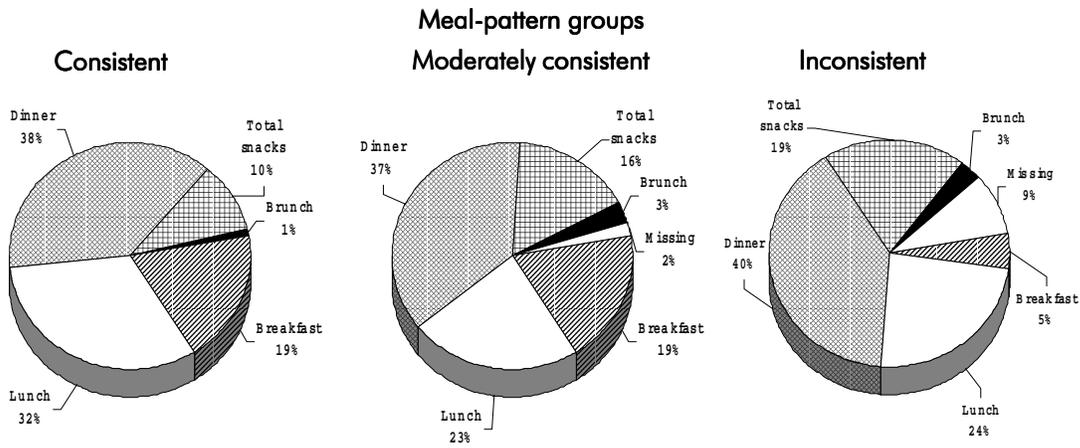
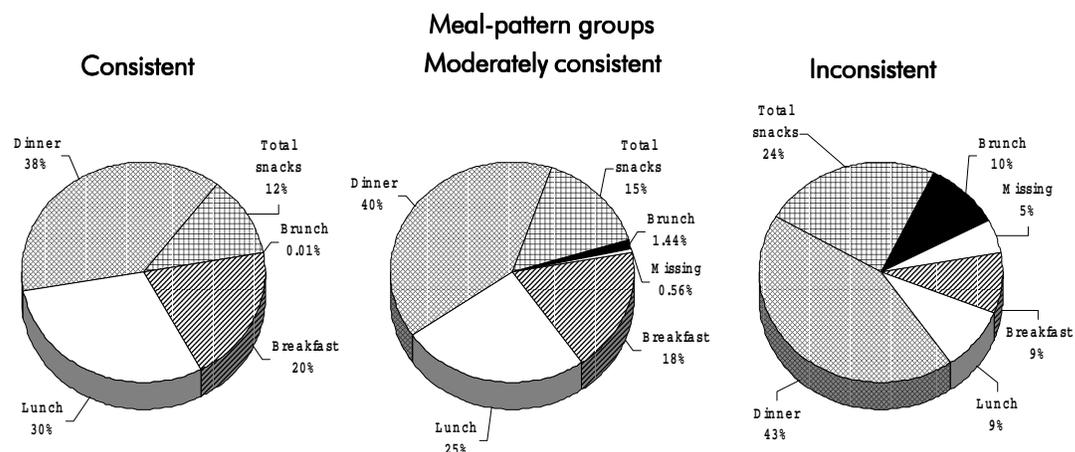


Figure 3. Distribution of energy obtained, by meal-pattern groups of 15- to 18-year-olds, 1989-91 CSFII



energy from lunch. For 11- to 14-year-olds with inconsistent meal patterns, breakfast provided 5 percent of energy, compared with almost twice that amount for the older adolescents. Brunch was more common for older adolescents with inconsistent meal patterns. Among older adolescents (15- to 18-year-olds) following an inconsistent meal pattern, dinner and snacks were far more important than they were for younger adolescents (11- to 14-year-olds).

Most nutrients follow the same pattern as that for energy (table 2). Breakfast provided the same proportion of nutrients for adolescents with consistent and moderately consistent meal patterns; whereas, lunch appeared to have lower proportions of fat, protein, carbohydrates, calcium, fiber, and sodium for adolescents with moderately consistent meal patterns. The proportions of nutrients from brunch were very low (no more than 3.5 percent) for adolescents with the consistent and moderately consistent meal patterns but closer to 10 percent for their counterparts with inconsistent meal patterns. Dinner provided similar proportions of nutrients for all three groups.

For adolescents with inconsistent meal patterns, the proportion of nutrients provided by total snacks was nearly double the nutrients provided to adolescents with consistent meal patterns. The proportion of nutrients coming from snacks for the moderately consistent group falls between those of the other two groups.

Food Consumed Based on Adolescents' Meal Patterns

Interesting differences were noted in the types of foods consumed at each eating occasion across meal-pattern groups. At breakfast, adolescents with a consistent meal pattern, compared with adolescents in the other groups, had

higher per capita consumption of both low- and medium-fat milk, egg items, low-fiber breads, cooked and ready-to-eat cereals, high-fat desserts, and juices (fig. 4). In contrast, adolescents with moderate and inconsistent meal patterns consumed more soft drinks. At lunch, adolescents with consistent meal patterns consumed more milk and higher amounts of total poultry, high-fat desserts, vegetables, fruits, and high-fat grain-based mixed dishes (pizza and macaroni and cheese, etc.), compared with other adolescents (fig. 5). There was no difference in beef/pork consumption between adolescents with consistent and moderately consistent meal patterns, which were, however, higher than that for adolescents with inconsistent meal patterns. The inconsistent and consistent groups had the same quantity of high-fat potato consumption.

For dinner, teens with an inconsistent meal pattern had higher intakes of poultry, green/orange vegetables, high-fat grain-based mixed dishes, high-fat breads, and soft drinks and a lower intake of low- and medium-fat milk, soy and legumes, and fruits, compared with their other adolescent counterparts (fig. 6). In contrast, snacks for the inconsistent group contained more grams per capita of milk items, in particular medium-fat milk items (whole milk and milk shakes) and soft drinks than was the case for the consistent group (fig. 7). All three groups of adolescents had similar intakes of fruits, high-fat desserts, high-fat salty snack items (chips, salty crackers, etc.) and high-fat grain-based mixed dishes.

Patterns within each group revealed that the amount of soft drink consumed per capita at lunch, dinner, and total snacks was higher than the amount of milk consumed (figs. 4-7). High-fat, low-fiber bread is more commonly eaten at breakfast, compared with other bread options available. Low-fiber

In total, the dinner meal and total snacks together provided more than two-thirds of the day's total energy for adolescents with an inconsistent meal pattern.

Table 2. Proportion of nutrients provided by each meal among 11- to 18-year-olds, by meal-pattern consumption¹

Nutrient	Consistent meal pattern		Moderately consistent meal pattern		Inconsistent meal pattern	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Breakfast						
Energy	19.23	9.69	18.24	10.62	7.94	8.51
Fat	16.07	11.76	15.66	11.56	6.31	7.94
Saturated fat	17.92	12.87	17.03	12.20	7.67	8.79
Protein	17.27	9.95	16.15	10.60	9.63	11.86
Carbohydrate	21.95	10.28	20.81	11.93	8.70	9.38
Calcium	28.94	16.53	26.31	16.81	15.81	18.04
Cholesterol	23.35	20.16	21.35	20.82	10.46	17.45
Iron	29.24	17.26	27.47	19.01	19.72	25.64
Folate	39.11	19.16	35.90	22.16	22.66	25.07
Zinc	20.70	13.16	18.63	15.20	10.51	14.33
Fiber	14.68	10.40	16.51	13.05	7.92	12.93
Sodium	16.23	9.54	16.17	10.40	8.86	10.52
Brunch						
Energy	0.47	3.48	2.11	5.80	8.58	13.69
Fat	0.51	3.92	2.44	7.85	9.82	16.16
Saturated fat	0.58	3.93	2.47	7.88	9.07	15.41
Protein	0.45	3.16	2.05	6.84	7.02	11.39
Carbohydrate	0.46	3.60	2.04	5.39	7.97	12.99
Calcium	0.60	3.76	2.26	7.36	8.05	16.38
Cholesterol	0.39	2.88	3.50	12.84	7.97	12.93
Iron	0.36	2.52	2.12	6.87	8.00	12.84
Folate	0.40	2.69	2.41	7.76	9.30	16.49
Zinc	0.43	3.04	1.87	5.76	8.65	15.52
Fiber	0.57	5.12	2.13	6.84	8.14	15.44
Sodium	0.39	2.88	2.11	6.30	9.89	17.09
Lunch						
Energy	31.22	11.64	24.52	12.58	11.94	18.98
Fat	33.29	14.11	26.10	14.56	12.52	20.91
Saturated fat	32.43	14.53	26.33	15.62	11.94	19.99
Protein	30.46	12.04	24.69	14.14	10.32	18.14
Carbohydrate	30.03	12.02	23.48	12.39	12.39	19.05
Calcium	30.46	15.74	24.82	16.11	10.32	19.26
Cholesterol	26.65	14.67	22.49	17.68	10.41	18.49
Iron	26.36	12.03	21.56	13.00	9.54	16.59
Folate	22.88	12.70	19.90	14.38	8.88	18.33
Zinc	27.74	12.99	23.75	14.88	10.42	18.25
Fiber	33.16	15.87	25.26	14.25	12.65	22.14
Sodium	32.26	12.70	25.06	14.12	11.52	20.20

¹The percentage may not total to 100 for each nutrient because of rounding and the small percentage of foods with a missing eating-occasion classification.

(Continued)

Table 2. Proportion of nutrients provided by each meal among 11- to 18-year-olds, by meal-pattern consumption¹ (continued)

Nutrient	Consistent meal pattern		Moderately consistent meal pattern		Inconsistent meal pattern	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Dinner						
Energy	37.72	10.53	38.01	14.60	43.21	26.07
Fat	40.17	13.68	39.79	16.77	46.58	26.58
Saturated fat	38.54	14.52	37.87	17.10	44.04	28.06
Protein	45.23	12.33	45.90	16.52	55.07	25.52
Carbohydrate	33.61	10.92	33.92	14.65	37.49	26.89
Calcium	29.86	14.20	30.84	17.28	42.09	29.05
Cholesterol	43.29	18.86	40.97	20.76	49.50	28.39
Iron	36.81	12.84	37.00	17.46	44.53	30.34
Folate	29.93	13.59	30.53	16.87	38.64	26.11
Zinc	43.80	14.72	43.86	18.95	49.59	28.25
Fiber	41.84	15.89	41.61	18.22	46.14	27.62
Sodium	44.83	12.15	44.52	16.40	52.51	26.52
Total snacks						
Energy	10.92	9.69	15.50	13.74	23.16	19.02
Fat	9.65	10.06	14.40	15.01	21.41	20.34
Saturated fat	10.16	10.94	14.78	15.44	23.38	21.52
Protein	6.38	7.17	9.85	11.30	15.36	15.93
Carbohydrate	13.35	11.53	18.06	15.16	26.91	20.41
Calcium	9.71	11.97	14.24	15.90	19.52	17.71
Cholesterol	6.05	8.59	10.09	13.08	17.83	21.74
Iron	7.06	8.62	10.45	11.87	15.82	17.82
Folate	7.48	9.93	9.79	12.26	18.75	19.36
Zinc	7.09	8.33	10.53	11.81	17.37	17.92
Fiber	9.39	10.96	13.11	13.41	22.09	19.26
Sodium	6.12	6.92	10.74	13.18	14.26	14.47

¹The percentage may not total to 100 for each nutrient because of rounding and the small percentage of foods with a missing eating-occasion classification.

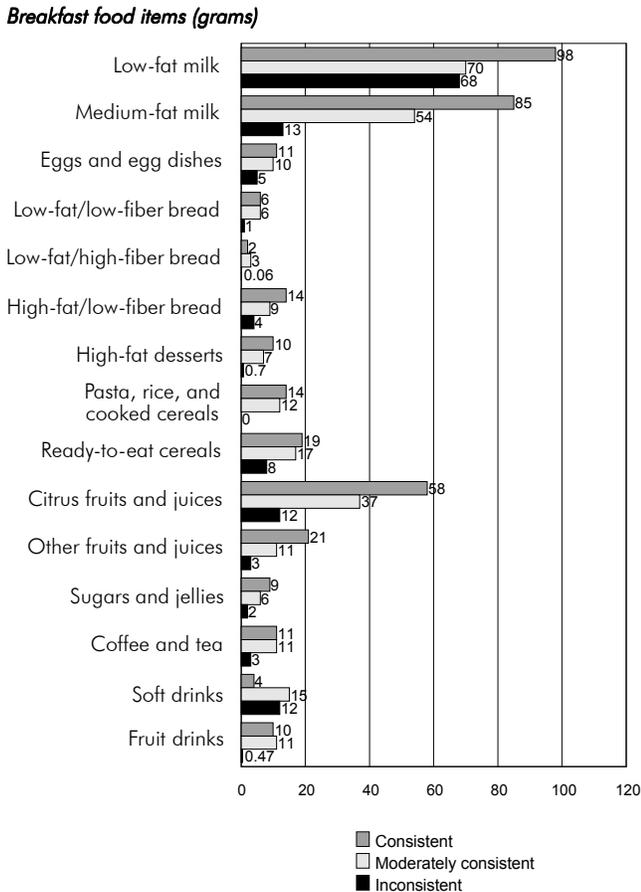
cereal is consumed more than high fiber, and citrus juices are consumed more than noncitrus juices or fruit drinks at breakfast. At lunch, medium fat beef/pork and poultry were eaten more than the low- or high-fat option. The grams per capita for luncheon meats was equally distributed among each fat option. In contrast to breakfast, the low-fat, low-fiber bread option and fruit drinks were eaten in greater amounts at lunch for the consistent and moderately consistent

groups. And for all three groups, there was a higher per capita consumption of the high-fat versus the low-fat of grain-based mixed dishes. The type of bread consumed at the dinner meal was similar to that seen at breakfast. And the higher fat version of grain-based meals was once again consumed more than the low-fat version at dinner for all three groups. Patterns within groups for the different types of foods consumed as snacks were similar.

Discussion

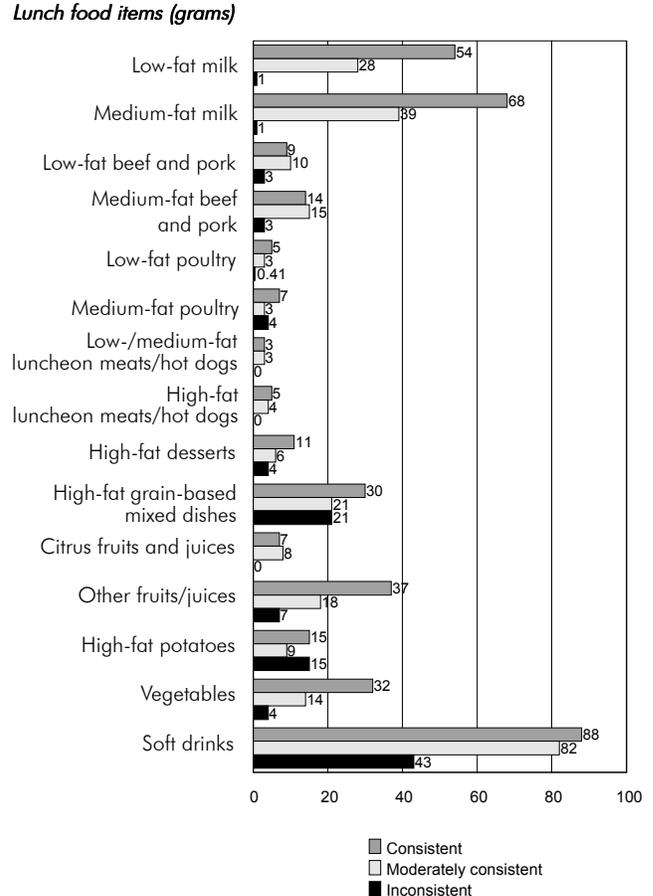
Dietary intake patterns of U.S. adolescents are poor. Skipping meals, excessive snacking, and consumption of excessive high-fat, poor nutritionally dense foods are many of the issues raised in the literature. However, few studies have used nationally representative samples to examine the meal and food patterns of U.S. adolescents. This study highlights the large variation in eating patterns among U.S. adolescents.

Figure 4. Grams consumed at breakfast by adolescents following a consistent, moderately consistent, or inconsistent meal pattern, by selected food groups¹



¹University of North Carolina at Chapel Hill food-grouping system.

Figure 5. Grams consumed at lunch by adolescents following a consistent, moderately consistent, or inconsistent meal pattern, by selected food groups¹



¹University of North Carolina at Chapel Hill food-grouping system.

In particular, we show that teens differ markedly by the proportion of food intake from each meal and the types of foods eaten, based on consistent, moderately consistent, or inconsistent meal patterns.

Regarding snacks, our results differ from the few published studies on this topic. Our study finds that snacks contribute much less to the total diet than reported previously. For most adolescents (97 percent), meals contribute, on average, 20 to 40 percent

of the total day's energy, compared with 10 to 15 percent contributed by snacks. One study has found that about 25 to 33 percent of the total day's energy comes from snacks (16). Other published studies have focused more on the frequency of snacking and the snack foods adolescents like to eat (4,5,8).

Our study shows that for all the adolescents, a higher proportion of the total day's intake of fat is consumed at dinner. Otherwise, meals and snacks

provide similar proportions of the other macronutrients. Our results regarding macronutrients offer a different view of examining macronutrient intake; others who have examined the nutrient density of meals and snacks have found that meals are higher in fat and lower in carbohydrates than are snacks (8).

The nutrient contribution of snacks is more significant for those adolescents following an inconsistent meal pattern, compared with adolescents following

Figure 6. Grams consumed at dinner by adolescents following a consistent, moderately consistent, or inconsistent meal pattern, by selected food groups¹

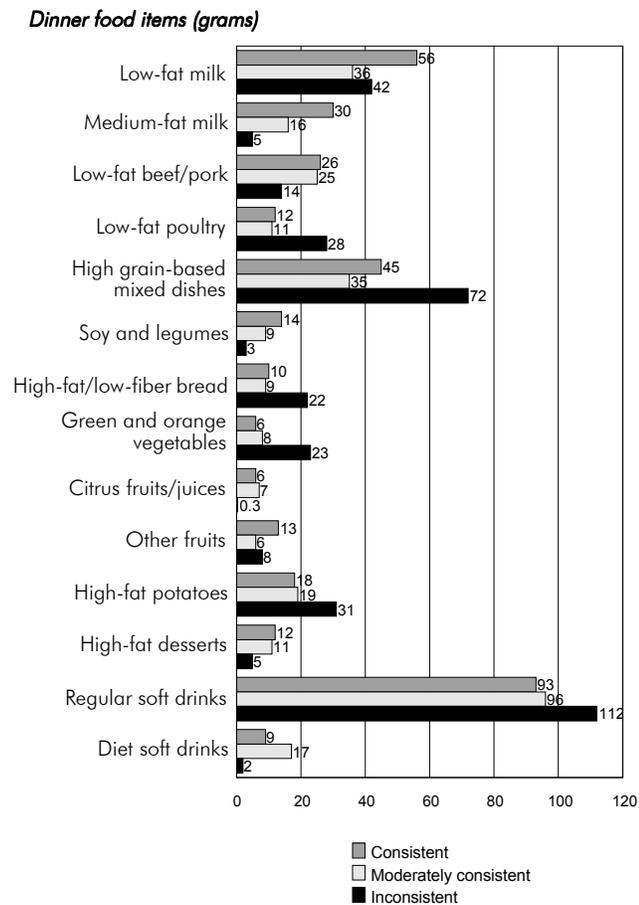
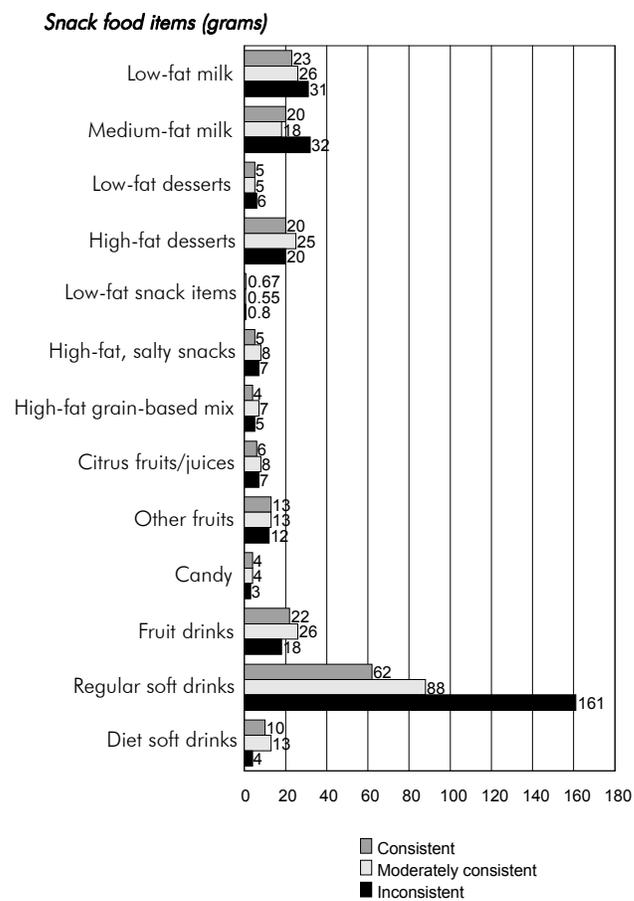


Figure 7. Grams consumed at snack by adolescents following a consistent, moderately consistent, or inconsistent meal pattern, by selected food groups¹



¹University of North Carolina at Chapel Hill food-grouping system.

¹University of North Carolina at Chapel Hill food-grouping system.

other meal patterns. This occurs simply by how this group was defined, those consuming one meal plus or minus snacks on 3 days of intake. The nutrient contribution of snacks for this adolescent group is similar to that reported by Ruxton et al. (16) in a study of 7- to 8-year-olds (n=136), from five schools in Scotland). In our study, snacks for the inconsistent group provided more of most nutrients than did breakfast or lunch with the exception of iron and folate, which were higher at breakfast. By using the 1977 Nationwide Food Consumption Survey (NFCS),

researchers found that for most adolescents, snacks compared with meals contributed significantly more magnesium, calcium, vitamin A, and vitamin C to the diet (2). For the only nutrient on which we overlapped, calcium, this was not found in the 1989-91 USDA survey. Because of the frequency of snacking and the significant proportion of energy and other nutrients that snacks provide adolescents with an inconsistent meal pattern, we believe the nutritional quality of snacks has important implications for the health status of these adolescents.

Another nutritionally important issue is adolescents' high intake of soft drinks and lower intake of milk [also noted in the 1977 NFCS survey (9)]. These consumption patterns apply to adolescents regardless of meal-pattern group. Even though adolescents with a consistent meal pattern consume the most milk, their calcium intakes are lower than recommended. Also, adolescents appear to be consuming more high-fat and low-fiber foods than the more healthful alternatives. Consuming more high-fat and low-fiber foods may have serious health consequences (i.e.,

obesity, osteoporosis, and cardiovascular diseases) if they are consumed in high amounts throughout life. The reasons for the high consumption of these types of foods may be directly related to their source (home vs. away-from-home food sources) as well as the taste preferences of adolescents. A Minnesota survey of 900 adolescents reported a strong preference for high-fat foods that related to taste appeal despite the health consequences associated with consumption of these foods (21).

A limitation of this study is the small sample size for the group with an inconsistent meal pattern. However, there were 27 million adolescents in the United States (24) around the time of this survey. Thus 950,000 U.S. adolescents are represented as following an inconsistent meal pattern for 3 days. In general, adolescents are consuming a large quantity of carbonated beverages and few fruits and vegetables. And for adolescents who follow an inconsistent meal pattern, dinner and snacks provide a disproportionate amount of nutrients. Differences are also noted in food selection: adolescents following an inconsistent meal-pattern group consume more types of fast foods. Both meal-pattern and food-selection behaviors should be used to target future public health messages to adolescents. More research is warranted on the determinants of adolescent eating patterns. Information on the determinants could help guide interventions for changing eating-pattern behaviors noted in this study.

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