



How Beverages Relate to Nutrient Intakes and Body Weight

What America Drinks is based on a comprehensive study conducted by ENVIRON International Corporation led by the research team of Mary M. Murphy, MS, RD and Judith Spungen Douglass, MS, RD (www.vironcorp.com). The study was commissioned by the Milk Processor Education Program. What America Drinks is a component of an education campaign called Think About Your Drink. For more information visit www.thinkaboutyourdrink.com.

The report was reviewed by Rachel K. Johnson, PhD, RD, dean and professor of nutrition at the University of Vermont, and Susan I. Barr, PhD, RD, professor of nutrition at the University of British Columbia, who provided invaluable input on the design of the study and the analysis of the results. Editorial assistance and coordination of the project were provided by Janet Helm, MS, RD and Lori Fromm, MS, RD of Weber Shandwick. The project was managed by Cary Frye of the International Dairy Foods Association.

TABLE OF CONTENTS

Executive Summary	5-6
Sweetened Beverages	5
Milk	5
Water	5
Other Beverages	6
Nutrient Intakes and Body Mass Index (BMI) by Beverage Intake Pattern	6
Introduction	7-8
Consumption of Milk and Soft Drinks	7
Potential Link to Obesity	7
Low Intakes of Milk	8
Methods	8-11
Sample Population	8
Identification of Plausible Reporters	9
Beverage Categories	10
Nutrient and Volume Data	11
Body Mass Index Data	11
Statistical Analysis	11
Results	12-23
Total Beverage Intakes	12
Sweetened Beverages	12
Regular Soft Drinks	13
Fruit Drinks	13
Tea-Presweetened	13
Sports Drinks	13
Diet Drinks	13
Fruit/Vegetable Juice	14
Milk	14
Plain Milk	14
Flavored Milk	15
Milk-based Beverages	15
Coffee	15
Tea	16
Meal Replacements	16
Alcoholic Beverages	16
Other Beverages	16
Water	16
Total Fluid Intake	17
Contributions to Calorie and Nutrient Intakes	18
Calories	18
Vitamins	18
Minerals and Electrolytes	19
Protein	20
Carbohydrates	20
Added Sugars	20
Fat and Cholesterol	21
Nutrient Intakes and BMI by Beverage Intake Pattern	21
Discussion	24-25
Strengths of Study	25
Conclusions	25
References	26-27

LIST OF TABLES AND FIGURES

Tables

Table 1: Population Counts	10
Table 2: Beverage Categories	10
Table 3: Percent of People Consuming Different Beverages	12
Table 4: Mean Per Capita Beverage Intakes	12
Table 5: Mean Per User Beverage Intakes	13
Table 6: Consumption by Milk Type	15
Table 7: Intakes of Plain Water	16
Table 8: Per Capita Total Fluid Intake	17
Table 9: Percent of Total Calories from Beverages (Per Capita)	18
Table 10: Contributions of Beverages to Vitamin and Mineral Intakes, Males and Females Ages 4 and Older	18
Table 11: Contributions of Beverages to Macronutrients, Added Sugars and Cholesterol Intakes, Males and Females Ages 4 and Older	21
Table 12: Percentiles of Milk and Sweetened Beverage Intake by Beverage Pattern (n=2,510)	21
Table 13: Mean Nutrient Intakes by Pattern of Milk and Sweetened Beverage Intake	22
Table 14: Mean Adjusted Body Mass Index by Pattern of Milk and Sweetened Beverage Intake	23

Figures

Figure 1: Per Capita Availability of Milk and Carbonated Soft Drinks in the United States Marketplace, 1945-1997	7
Figure 2: Mean Beverage Per Capita Intakes for Males and Females Ages 4 and Older (Fluid Ounces)	17
Figure 3: Vitamin and Mineral Contributions of Milk and Sweetened Beverages, Males and Females Ages 4 and Older	19
Figure 4: Mean Adjusted Body Mass Index by Pattern of Milk and Sweetened Beverage Intake	23

EXECUTIVE SUMMARY

From the mid-1970s to the mid-1990s, consumption of milk by Americans declined, and consumption of sweetened beverages increased. The purpose of the *What America Drinks* study was to characterize current beverage consumption patterns in the United States using recent nationwide survey data. The analyses utilized data from more than 10,000 Americans ages 4 and older who participated in the U.S. National Health and Nutrition Examination Survey (NHANES) 1999-2000 and 2001-2002 and provided plausible dietary reports of food/beverage intakes. Relationships among selected patterns of beverage use, nutrient intakes and body mass index (BMI) were examined.

The results of the analyses indicate that more than 99% of Americans ages 4 and older consumed at least one beverage other than plain water on any particular day. Total fluid intake averaged more than 11 cups per day. On average, beverages provided nearly one-quarter (22%) of total calories in a day, along with comparable or even higher percentages of carbohydrates, added sugars and key vitamins and minerals including vitamin A, vitamin C, calcium, phosphorus, magnesium, and potassium.

Sweetened Beverages

Nearly 50% of people ages 4 and older consumed regular soft drinks on any given day. Soft drinks provided 6% of total calories, 13% of total carbohydrates, and 36% of all added sugars in the diet. The contributions of soft drinks to total added sugars intakes were highest among teenagers. Mean regular soft drink intake per capita (averaged across the whole population, including nonconsumers) was about 12 fluid ounces (fl oz) per day, and mean intake by users (those who drank soft drinks on the day of the survey) was about 24 fl oz per day. Teenage boys consumed regular soft drinks in the greatest quantities, with an average of 31 fl oz per day per user.

Nearly 20% of people 4 and older consumed fruit drinks (fruit-flavored beverages containing less than 100% fruit juice) and about 9% reported drinking presweetened tea. Fruit drinks provided about 2% of total calories, 10% of added sugars and 14% of total dietary vitamin C.

The combination of regular soft drinks, fruit drinks and presweetened teas contributed about 9% of total calories, 18% of carbohydrates and 49% of added sugars.

Milk

Forty-five percent of Americans reported drinking plain milk (or consuming it with a ready-to-eat cereal). The mean intake by people who used plain milk was about 13 fl oz per day, and mean per capita intake was about 6 fl oz per day. Plain milk provided about 4% of total calorie intake and was a key contributor to the total daily intake of several essential nutrients, including vitamin A (13%), calcium (22%), phosphorus (12%), magnesium (7%), potassium (9%), protein (7%) and zinc (6%).

Flavored milk was used by 7% of Americans and was most often consumed by children (22%), male preteens (20%) and female preteens (19%). Flavored milk contributed less than 1% of total calorie intake for Americans ages 4 and older, but about 2-3% of the calories for children and preteens. About 6% of Americans consumed a milk-based beverage.

The flavored milk, milk-based beverages and coffee (which often contains added milk) categories also contributed to intakes of vitamin A, calcium, phosphorus, magnesium, potassium, protein and zinc for selected age/gender groups. Although a relatively small amount of fat, saturated fat and cholesterol was supplied by beverages, the primary sources were milk and milk-based beverages, which included milk shakes.

Water

Overall, nearly 90% of Americans ages 4 and older said they drank plain drinking water (tap or non-carbonated bottled water), with a mean per capita intake of about 38 fl oz per day and a per user intake of about 44 fl oz per day.

Other Beverages

About one in six Americans drank a diet drink (diet soft drink, fruit drink, presweetened tea or other beverage that contained a non-caloric sweetener). The primary consumers of these beverages were female adults ages 19 and older, and male adults ages 50 and older.

Slightly more than one-quarter (28%) of Americans ages 4 and older reported drinking fruit or vegetable juices. Fruit/vegetable juice provided about 2% of total calories, but contributed 28% of dietary vitamin C. Fruit/vegetable juices were generally the second highest beverage source of potassium and the highest beverage source of folate.

Coffee was reported by nearly 40% of people ages 4 and older. Tea (not presweetened) was consumed by 12% of Americans ages 4 and older. Adults were the primary consumers of these beverages.

Sports drinks were consumed by about 3% of people ages 4 and older, and were most likely to be consumed by males, particularly teenagers. Meal replacements were consumed by fewer than 2% of Americans ages 4 and older on the day of recall.

Alcoholic beverages, mixtures containing alcohol, and alcohol substitutes were reported by nearly 20% of the population ages 4 and older, with a mean per user intake of 31 fl oz per day and a mean per capita intake of about 6 fl oz per day. Adult males consumed between 5% and 6% of all calories in the form of alcoholic beverages, while adult females consumed about 3% of total calories from this source.

Very few Americans (about 1%) consumed beverages other than those listed above, such as soy- or rice-based beverages.

Nutrient Intakes and Body Mass Index (BMI) by Beverage Intake Pattern

Dietary intakes were evaluated to identify people with 1) high consumption of milk beverages and low consumption of sweetened beverages (high MB/low SB) and 2) low consumption of milk beverages and high consumption of sweetened beverages (low MB/high SB). Mean intakes of vitamin A, calcium, magnesium and potassium were significantly higher in the high MB/low SB groups versus the low MB/high SB groups. Vitamin C intakes were generally similar between beverage patterns. After adjusting for calorie intake and age, BMIs of female preteens, female teens and female adults (19-49 years) in the high MB/low SB group were significantly lower than BMIs of females in the low MB/high SB groups.

The results of this study show that beverages make significant contributions to calorie and nutrient intakes of Americans. Milk provided Americans with a substantial proportion of essential nutrients, while other types of beverages tended to contribute substantially to calories and added sugars intakes but provided few nutrients other than vitamin C, potassium and some folate.

By drinking more lowfat and fat-free milk in place of sweetened beverages, Americans can help enhance their intakes of essential nutrients that are typically suboptimal, including calcium, vitamin A, magnesium and potassium. These same patterns of beverage intake may have a beneficial role in weight management.



INTRODUCTION

The goal of the *What America Drinks* report was to examine total beverage intake in this country using the most recent national food consumption data. Relationships among selected patterns of beverage use, nutrient intakes and body mass index also were examined.

This report differs from previous beverage studies in two important ways: this analysis considered the plausibility of the reported intakes and the age groups used in the analysis correspond to those used for the Dietary Reference Intakes. Furthermore, most of the previous investigations examined only specific beverages, such as soft drinks, or focused on certain subpopulations. Previous studies did not consider the plausibility of the reported intakes, thus failing to account for the serious and pervasive problem of underreporting.

What America Drinks examines overall beverage patterns in America, with a particular emphasis on the impact of milk consumption vs. sweetened beverage consumption.

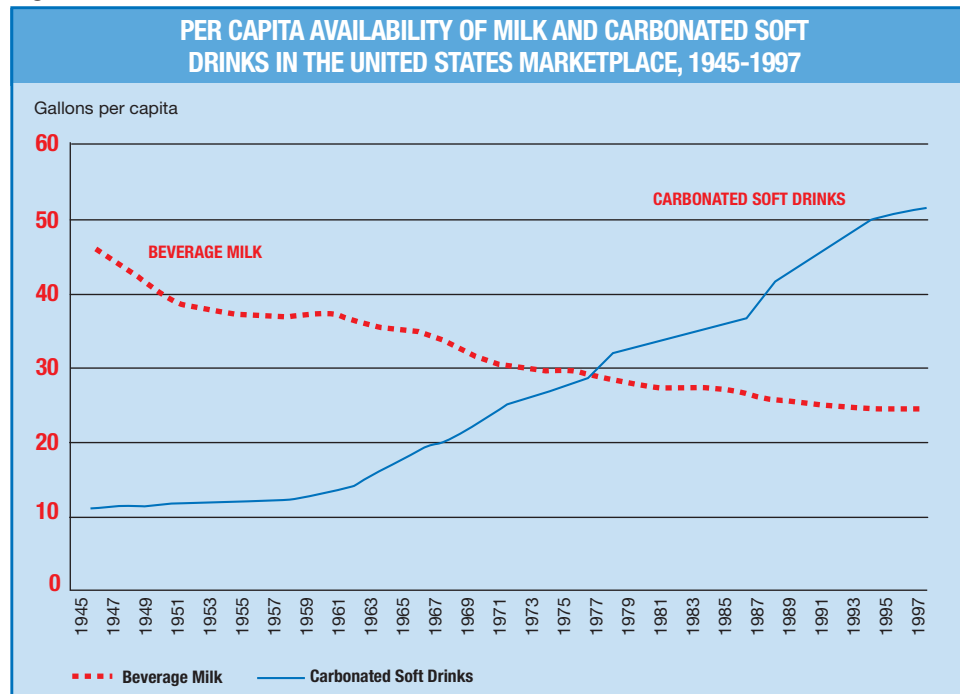
Consumption of Milk and Soft Drinks

A dramatic shift in U.S. beverage consumption patterns has been the marked increase in consumption of soft drinks and other sweetened beverages (fruit drinks and presweetened teas) and the decline in milk consumption. Between 1977 and 2000, the proportion of calories from sweetened beverages more than doubled – from about 4% to 9% – with a concurrent reduction in the proportion of calories from milk.¹

Per capita soft drink availability in the U.S. marketplace has increased by nearly 100% since the 1970s (**Figure 1**). This increase corresponds with a decline in milk availability.²

The most significant spike in soft drink consumption has been among children and adolescents. Since the late 1970s, there has been a 123% increase in per capita soft drink consumption by 6-17 year-olds, with the estimate being the highest (196%) for teenage boys.³ In the late 1970s, teenage boys and girls in this country drank 2.2 and 1.5 times more milk than regular soft drinks, respectively.⁴ By the mid-1990s, per capita soft drink intake was nearly twice as great as milk intake for both genders.⁴

Figure 1



Source: Putnam, Gerrior 1999.²

Carbonated soft drinks include regular and diet soft drinks.

Potential Link to Obesity

The increased consumption of sugar-sweetened beverages, such as soft drinks and fruit drinks, appears to parallel the increase in adult and child obesity in America. In the last two decades, the percentage of adults who are overweight has doubled, and the percentage of children and teenagers who are overweight has tripled.^{5,6}

Several potential mechanisms to explain the association between sweetened beverages and obesity have been proposed – including excess calorie intake and the concept that liquid calories are less satiating than solid foods.^{7,8,9,10}

Data from a national survey indicate that children (ages 2-5) who consumed more than 9 fluid ounces of regular soft drinks per day took in 256 more calories compared to children who consumed no soft drinks.¹¹ Teenagers who consumed at least 26 fluid ounces of regular soft drinks had calorie intakes 620 calories higher than non-consumers.¹¹

Some research suggests that we don't compensate for the extra calories in sweetened beverages. Evidence suggests that these findings may be attributable to differences in the extent to which foods and beverages satisfy the appetite, which appear to relate to form and composition. For example, one study demonstrated that people were less likely to compensate for calories consumed in the form of a sweetened beverage compared to a solid sweetened candy (jelly beans).¹²

Low Intakes of Milk

Some researchers believe the consumption of low-nutrient sweetened beverages contributes to the risk of obesity by displacing milk in the diet⁷ as some studies suggest that consuming adequate amounts of milk, dairy foods and calcium may play a role in achieving and maintaining a healthy weight.¹³ While the results are not entirely consistent, the majority of studies find that increased milk or dairy consumption is either associated with lower body weight or has a neutral effect on weight.

A study examining changes over time in beverage intake among girls who were initially 9 years of age found that milk consumption decreased by 30-40% and soft drink consumption increased almost 3-fold over a 10-year period.¹⁴ Consumption of regular soft drinks was positively associated with body mass index (BMI) during the study period. Intake of regular soft drinks was also associated with a statistically significant decrease in calcium intake, which would be expected if soft drinks were displacing milk in the diet. The authors speculated that decreased calcium intake may have contributed to the risk for obesity.

In a study of Asian and Caucasian girls (ages 9-14) in Hawaii, beverage choices were linked to body fat and body weight during adolescence.¹⁵ In this cross-sectional study of 323 girls, increased milk intake was associated with decreased body fat (measured by skinfold thickness), while regular soft drink intake was associated with greater body weight. The researchers concluded that decreasing soft drink and increasing dairy consumption among girls may help maintain appropriate body fat and weight during adolescence.

National survey data indicate that soft drinks and other sweetened beverages are now the leading sources of calories and added sugars in the diets of teenagers and the leading beverage sources of calories and added sugars for adults.^{16,17} Per capita intakes of soft drinks by teenagers are approximately twice as high as intakes of milk.^{4,18}

METHODS

Sample Population

What America Drinks used data from people ages 4 and older participating in the National Health and Nutrition Examination Surveys (NHANES) 1999-2000 and 2001-2002. This nationwide survey was conducted by the Center for Disease Control and Prevention's National Center for Health Statistics (NCHS). The dietary recall component of the survey was jointly developed by the U.S. Department of Health and Human Services and the U.S. Department of Agriculture (USDA).

The NHANES design is a stratified, multistage probability sample of the civilian noninstitutionalized U.S. population; the results provide nationally representative nutrition and health data and prevalence estimates for nutrition and health status measures.^{19,20} During the survey periods spanning 1999-2002, low-income persons, adolescents ages 12-19 years, adults ages 60 years and older, African Americans, and Mexican Americans were over-sampled to allow for more reliable estimates for these subpopulations.

In total, 18,322 children, adolescents and adults ages 4 and older were interviewed in NHANES 1999-2002. These respondents also were asked to complete an examination component in which dietary recalls were collected and physical exams were performed. In the dietary recall portion of the examination, trained dietary interviewers collected detailed information on all foods and beverages consumed by respondents in the previous 24 hour time period (midnight to midnight) using computerized, multiple-pass collection methods.

During the physical examination, body measures including height and weight were measured and recorded. Our study population included the 15,159 people who participated in NHANES 1999-2000 or NHANES 2001-2002, ages 4 and older, not pregnant or lactating, who provided food consumption data judged reliable by NHANES, and for whom height and weight measurements were provided in the survey datasets.

Identification of Plausible Reporters

The analysis for the *What America Drinks* report used a scientific method that eliminated NHANES respondents with unrealistic calorie intakes. The results are based on a subset of the total study population referred to as “plausible reporters.” All of the data presented in the report represent the plausible sample.

There is substantial evidence that the accuracy of dietary recall data varies among survey participants, and that under-reporting is more common than over-reporting of foods consumed.²¹ Additionally, foods and beverages that may be perceived as “bad” may be more likely to be under-reported, while foods and beverages perceived as “good” may be less likely to be under-reported.²²

Using a modification of the method specified by McCrory et al.²³, cut-offs were calculated for plausible calorie intakes by the NHANES respondents. For each person, ratios of reported calorie intake to predicted calorie (energy) requirements were calculated. Predicted calorie requirements were estimated using equations developed by the Institute of Medicine that consider the person’s age, gender, height, weight, body weight status and activity level.²⁴

However, the available NHANES data did not allow a respondent’s category of physical activity to be definitively identified as falling within one of the four Institute of Medicine activity levels (sedentary, low active, active, very active). In previous studies using the McCrory approach for identifying plausible dietary recalls^{25,26} it was assumed that most people have low activity levels, and in those studies, plausibility of dietary recalls was based solely on the ratio of reported calorie intake to predicted calorie requirements at the low active level.

POPULATION CATEGORIES	
Children	4-8 years
Preteens	9-13 years
Teenagers	14-18 years
Younger Adults	19-49 years
Older Adults	50+ years

To avoid misclassification error potentially resulting from the assumption that all respondents had low activity levels, we calculated the ratio of reported calorie intake to the calorie requirement predicted for that person at each physical activity level (i.e., we calculated four ratios for each person). Plausible dietary recalls were identified as those for which the person’s ratio of reported calorie intake to predicted sedentary, low active, active, or high active calorie requirements fell within cutpoints calculated using the formula of McCrory et al.²³

Using this approach, the range of predicted calorie needs for each person is much greater than a range associated with just one activity level. Consequently, this approach classifies more respondents as plausible reporters as compared with studies in which each person was assumed to have low activity.

Table 1

POPULATION COUNTS					
Population	Total Sample	Plausible Sample		EXCLUDED SAMPLE	
		N	%	Under-Reporter	Over-Reporter
Males & Females 4-8 y	1652	1367	82.7	117	168
Males 9-13 y	1103	780	70.7	249	74
Males 14-18 y	1392	980	70.4	347	65
Males 19-49 y	2333	1614	69.2	555	164
Males 50+ y	1998	1294	64.8	668	36
Females 9-13 y	1141	823	72.1	257	61
Females 14-18 y	1319	935	70.9	345	39
Females 19-49 y	2193	1516	69.1	589	88
Females 50+ y	2028	1298	64.0	701	29
Males & Females 4+ y	15159	10607	70.0	3828	724

¹Percentages based on unweighted data

Of the 15,159 people in our sample, 70% (10,607) provided plausible dietary recalls. We divided the population into children (ages 4-8 years), preteens (ages 9-13 years), teenagers (ages 14-18 years), younger adults (ages 19-49 years) and older adults (ages 50 years and up). The total population and plausible sample sizes by age/gender are shown in **Table 1**. All of the reported findings in *What America Drinks* are based on the plausible sample.

Beverage Categories

The dietary intake records of respondents were reviewed and beverages were categorized into one of 14 categories (listed in **Table 2**). Beverages were identified in these records either by a single food code representing a beverage or beverage mixture, or as multiple food codes each representing a different component of a beverage mixture. Beverage combinations were mapped to the category most representative of the beverage mixture. For example, a combination of plain milk and strawberry syrup was identified as flavored milk, while a combination of coffee and small amounts of sugar and milk was coded as coffee (unless it contained >50% milk by weight and then it was identified as a milk-based beverage).

Table 2

BEVERAGE CATEGORIES	
Beverage Category	Types of Beverages in Category
* regular soft drinks	carbonated beverages with caloric sweeteners, including sweetened carbonated water
* fruit drinks	fruit drinks containing <100% fruit juice (e.g., cranberry cocktail, lemonade), Kool-Aid® type beverages, fruit ades
* presweetened tea	tea presweetened with caloric sweeteners
sports drinks	sports drinks such as Gatorade® or PowerAde®
diet drinks	carbonated beverages with non-caloric sweeteners, including sugar-free or plain carbonated water, fruit drinks/ades with non-caloric sweeteners, tea presweetened with non-caloric sweeteners
fruit/vegetable juices	100% fruit juice, vegetable juice, fruit-only smoothies, nectar
# plain milk	whole, reduced fat, lowfat, and fat free milks, buttermilk, condensed milk, evaporated milk
# flavored milk	whole, reduced fat, lowfat, and fat free milk combined with flavored syrup or powder, hot cocoa made with milk, ready-to-drink flavored milk
# milk-based beverages	cocoa powder and water mixtures, YooHoo®, milk mixed with fruit and/or sugar, dairy-based smoothies, coffee drinks (e.g. latte, cappuccino), combinations of milk/cream and coffee or tea containing >50% milk/cream (by weight), egg nog, shakes, floats, ice cream mixtures
coffee	brewed coffee, coffee prepared from substitute or presweetened/lightened dry mix
tea	unsweetened tea
meal replacement beverages	milk- or soy-based meal replacement beverages, infant formula, combinations containing milk- or soy-based protein powder
alcoholic beverages and substitutes	beer, wine, cocktails, and alcoholic beverage substitutes
other	soy beverages, rice milk, gelatin drink, fluid replacement, mixtures of water and another beverage (excluding alcohol) that were primarily water

If two or more beverages were reported in a single beverage combination, all components in the mixture were coded as the primary ingredient. For example, if a person reported drinking a combination of lemonade and plain tea that was mostly lemonade, both ingredients in the combination were coded as fruit drinks. However, any beverage combination that contained alcohol, regardless of the amount, was coded as an alcoholic beverage. The beverage portions of ready-to-eat cereal combinations also were mapped to the corresponding beverage category and included in the analysis. Garnishes reported in beverage combinations (e.g., a lemon slice) were not considered to be part of the beverage.

In a sub-analysis, categories of “milk beverage” and “sweetened beverage” consumers were created by combining selected beverage categories. Milk beverages included all reported intakes of plain milk, flavored milk and milk-based beverages, and sweetened beverages included regular soft drinks, fruit drinks and presweetened tea.

Analyses included all beverages reported as a single beverage food code, all food codes coded as part of a beverage combination, and any beverage reported in a ready-to-eat cereal combination. Garnishes (e.g., lemon slice) were not counted as a beverage.

* These categories were combined to form a "sweetened beverage" category that was used in sub-analyses.
 # These categories were combined to form a "milk beverage" category that was used in sub-analyses.

Following the dietary recall, NHANES participants were asked about total plain water consumption in the previous 24 hours. Responses to this question were used to estimate total plain water intakes.

Nutrient and Volume Data

The USDA Multi-Year Food and Nutrient Database for Dietary Studies (FNDDS), 1.0²⁷ was used as the primary data source to calculate calories and a total of 17 nutrient/constituent intakes from foods reported in the NHANES 1999-2002 dietary recalls. Values for the remaining nutrients or constituents were obtained from complementary databases or imputed.^{28,29} The 17 nutrients/constituents include macronutrients, cholesterol, added sugars, vitamin A, vitamin E (alpha tocopherol), vitamin C, folate, calcium, phosphorus, magnesium, potassium, sodium, iron and zinc. Estimates of beverage volume were calculated by converting the gram weight of each reported beverage intake to a measure of fluid ounces using USDA food portion description data in FNDDS.

Body Mass Index Data

People participating in NHANES 1999-2002 were asked to complete an extensive physical examination. During the examination, the height and body weight of each participant were measured and recorded and body mass index (BMI) values were calculated as kg/m².

Statistical Analysis

The percent of people consuming each category of beverage was calculated by age/gender group, and mean beverage intakes (fluid ounces) were calculated on both a per capita and per user basis. Survey respondents were considered to be consumers of a beverage category if any amount of a beverage within that category was reported on the day of recall. The proportion of beverage users and volume intake estimates were calculated for the study sample. Per capita total calorie and nutrient intakes and percent contributions by beverage category and from all beverages combined were calculated for each age/gender group. Intakes in the “plain milk” beverage category were further categorized by type of milk and percent users and mean intakes per user were calculated for plain milk drinkers. Total per capita beverage intakes may not equal the sum of individual beverages due to rounding.

Relationships among patterns of beverage use and nutrient intakes and BMI also were examined. Using the sum of all reported sweetened beverage and milk beverage intakes on the day of recall, quartiles of intakes were calculated for each beverage grouping and age/gender group. Respondents in the top quartile (intakes above the 75th percentile) of milk beverage intake and the bottom quartile (intakes less than or equal to the 25th percentile) of sweetened beverage intake were identified as “high milk/low sweetened beverage” drinkers, and likewise respondents in the bottom quartile of milk beverage intake and the top quartile of sweetened beverage intake were identified as “low milk/high sweetened beverage” drinkers.

Mean total daily intakes of calories and five shortfall nutrients³⁰ including vitamin A, vitamin C, calcium, magnesium and potassium were calculated by age/gender group and beverage pattern and intakes were compared. Mean BMI was compared between beverage patterns after adjustments for total calorie intake, age and gender.

All analyses were completed with NCHS sampling weights to adjust for differences in representation of subpopulations; results for the total sample therefore could be considered representative of the U.S. population ages 4 and older. The plausible sample may not be representative, nevertheless, the plausible sample is referred to as “Americans” throughout the report.

Error terms and statistical comparisons were generated using STATA version 9.2 (StataCorp LP, College Station, Texas). Comparisons between calorie and nutrient intakes and adjusted BMI by beverage pattern were completed using Wald tests following linear regression analysis of variance. P values < 0.05 were considered significant.

RESULTS

Total Beverage Intakes

The percentages of people reporting consumption of beverages in each of the 14 beverage categories are shown in **Table 3**. As indicated, 99.1% of Americans ages 4 and older reported consuming at least one beverage other than plain water on the day of recall. For most age/gender groups, the percentage of regular soft drink users was higher than the percentage of milk users.

Table 3

Per capita intakes of various beverages (in fluid ounces) are presented in **Table 4**. Per user intakes are shown in **Table 5**, indicating the average amount of each beverage consumed by people who used that beverage on the day of recall.

PERCENT OF PEOPLE CONSUMING DIFFERENT BEVERAGES															
Population	Regular soft drinks	Fruit drinks	Presweetened tea	Sports drinks	Diet drinks	Fruit/vegetable juices	Plain milk	Flavored milk	Milk-based beverages	Coffee	Tea (not presweetened)	Meal replacements	Alcoholic beverages	Other	Total beverages ¹
% USERS															
M&F 4-8 y	45.4	43.0	5.2	2.5	6.4	37.3	74.3	21.9	5.8	1.0	1.4	0.8	0.1	0.3	98.5
M 9-13 y	66.6	31.5	8.0	3.8	6.0	30.6	64.8	20.0	4.9	2.4	2.7	0.3	0.5	0.8	99.2
M 14-18 y	74.7	24.0	12.1	7.6	4.4	26.5	55.2	13.5	4.2	3.1	4.1	1.1	6.2	0.4	98.5
M 19-49 y	58.5	16.4	10.7	4.6	15.4	22.2	37.4	3.7	4.8	39.7	10.7	1.9	34.1	1.1	99.6
M 50+ y	35.1	12.7	7.4	1.4	20.8	35.5	45.3	2.4	4.0	71.3	17.3	1.5	31.5	0.7	99.3
F 9-13 y	60.5	36.1	7.3	3.3	8.2	30.7	59.9	18.9	6.3	1.1	4.8	0.5	0.1	0.2	98.8
F 14-18 y	67.0	28.6	11.1	3.2	9.8	26.7	43.5	8.2	5.7	5.0	5.9	0.3	4.4	0.3	98.9
F 19-49 y	51.0	15.9	8.9	1.3	19.0	23.4	32.5	3.3	6.3	38.7	14.2	2.6	20.6	1.6	98.7
F 50+ y	25.9	12.2	8.2	0.6	21.0	34.3	44.7	3.3	7.5	67.9	22.8	3.0	16.0	3.0	99.2
M&F 4+ y	49.2	19.8	8.8	2.6	15.6	28.4	44.7	6.9	5.6	38.3	12.3	1.8	19.9	1.2	99.1

¹ Excluding plain water

Mean total intake of beverages other than plain water was about 52 fl oz, or roughly 6½ cups (**Table 4**). Adult males 19-49 years old reported drinking the largest volume of beverages (72 fl oz/day), while children ages 4-8 years reported drinking the smallest amount of total beverages (27 fl oz/day). Males consistently reported higher overall beverage intakes than females.

Sweetened Beverages

For both male and female preteens and teenagers on a per capita basis (shown in **Table 4**), consumption of sweetened beverages including regular soft drinks, fruit drinks and presweetened tea, represented more than half of total beverage volume intakes, excluding water. Consistently, teenagers and adults up to age 49 reported drinking twice as much sweetened beverages as milk.

Table 4

MEAN PER CAPITA BEVERAGE INTAKES															
Population	Regular soft drinks	Fruit drinks	Presweetened tea	Sports drinks	Diet drinks	Fruit/vegetable juices	Plain milk	Flavored milk	Milk-based beverages	Coffee	Tea (not presweetened)	Meal replacements	Alcoholic beverages	Other	Total beverages ¹
FLUID OUNCES															
M&F 4-8 y	5.2	4.9	0.5	0.4	0.6	3.5	8.3	2.3	0.8	0.0	0.1	0.1	0.0	0.0	26.8
M 9-13 y	12.6	4.2	1.3	0.8	0.8	3.8	9.3	2.7	0.6	0.1	0.3	0.0	0.0	0.1	36.5
M 14-18 y	23.2	5.3	3.5	1.8	1.2	4.9	9.8	1.8	0.7	0.4	0.7	0.2	2.4	0.0	56.0
M 19-49 y	17.6	4.2	3.9	1.2	5.5	3.3	5.7	0.6	0.8	11.0	3.1	0.5	14.7	0.2	72.2
M 50+ y	7.5	2.0	2.0	0.3	5.2	4.2	5.8	0.5	0.7	17.6	4.0	0.2	9.1	0.1	59.1
F 9-13 y	10.6	5.1	1.1	0.6	0.9	3.3	7.5	1.9	0.7	0.1	0.8	0.1	0.0	0.0	32.4
F 14-18 y	15.0	4.8	1.9	0.5	1.8	3.8	5.8	0.8	0.8	0.8	1.1	0.1	1.1	0.1	38.3
F 19-49 y	12.7	2.9	2.1	0.2	4.7	3.0	4.1	0.5	0.9	8.3	3.7	0.3	4.5	0.3	48.2
F 50+ y	4.4	1.7	1.7	0.1	4.7	2.9	4.7	0.3	1.2	13.4	5.0	0.4	2.3	0.5	43.3
M&F 4+ y	11.8	3.4	2.3	0.6	4.0	3.4	5.8	0.9	0.8	8.9	3.0	0.3	6.3	0.2	51.6

¹ Excluding plain water
0.0 represents a value < 0.05

PER CAPITA INTAKES OF SWEETENED BEVERAGES VS. MILK		
Age/Gender	Sweetened Beverages	Milk
FLUID OUNCES		
Children, 4-8 y	11	1
Preteen boys, 9-13 y	18	13
Preteen girls, 9-13 y	17	10
Teenage boys, 14-18 y	32	12
Teenage girls, 14-18 y	22	7
Adult men, 19-49 y	26	7
Adult women, 19-49 y	18	6
Older adult men, 50+ y	12	7
Older adult women, 50+ y	8	6

Sweetened beverages include regular soft drinks, juice drinks and presweetened tea. Milk includes plain milk, flavored milk and milk-based beverages.

Regular Soft Drinks

The analysis indicated that nearly 50% of Americans ages 4 and older consumed regular soft drinks on any given day. Soft drinks were particularly dominant in the diets of preteens and teens; three out of four teenage boys reported consuming soft drinks, and two out of three teen girls and preteen boys drank these beverages. In addition to being most likely to consume soft drinks, teenage males also reported the greatest soft drink intakes. Male teenage consumers of regular soft drinks drank on average about 31 fl oz/day of these beverages.

Adult males (19-49 years) on average consumed similar volumes of soft drinks (30 fl oz/day per user); slightly fewer than 60% reported intake of soft drinks on the day of recall. Regular soft drink intake by females peaked at an average of 25 fl oz/day per user in adults (ages 19-49). Slightly fewer than half of all young children reported soft drinks on the day of recall, with an average intake of about 12 fl oz/day per user. Older adults were least likely to consume soft drinks in comparison with other age groups.

Fruit Drinks

Fruit drinks were consumed by nearly 20% of Americans. Children 4-8 years old were most likely to consume these fruit-flavored beverages (defined as <100% juice). Within the population of children, fruit drinks were the third most commonly consumed beverage. Among both males and females, the proportions of fruit drink consumers were steadily lower across the preteen, teenage, and adult age groups. The mean per user intake of fruit drinks for the total sample was 17 fl oz/day. The highest mean intakes were reported by teenage and adult males (22-26 fl oz/day per user), while the lowest daily mean intake was reported by children (11 fl oz/day per user).

Tea – Presweetened

About 9% of Americans reported drinking presweetened tea (data on non-presweetened teas are presented later in this report). Teenagers and adults 19-49 years old were most likely to report drinking these beverages (9-12%). In contrast to a relatively low proportion of consumers, the mean amount of presweetened tea consumed by users of these products was 26 fl oz/day – the same average amount as the per user intake of diet drinks and second only to intakes of alcoholic beverages.

Sports Drinks

Sports drinks were most likely to be consumed by males, particularly teenagers (8% users). Mean per user intakes of sports drinks were 16 fl oz/day for children, 20-25 fl oz/day for males, and 10-18 fl oz/day for females.

Diet Drinks

About one in six Americans drank some type of diet drink – defined as a diet soft drink, fruit drink, presweetened tea or other beverage that contained a non-caloric sweetener. The primary consumers of these beverages were female adults 19-49 years, and male and female adults 50 years and older (19-21% users). These beverages were consumed by a relatively small proportion of people under the age of 19 in general, though a higher percentage of female preteens and teens consumed diet drinks compared to males. The mean per user intake of diet drinks was 26 fl oz/day.

Table 5

Population	MEAN PER USER BEVERAGE INTAKES														
	Regular soft drinks	Fruit drinks	Presweetened tea	Sports drinks	Diet drinks	Fruit/vegetable juices	Plain milk	Flavored milk	Milk-based beverages	Coffee	Tea (not presweetened)	Meal replacements	Alcoholic beverages	Other	Total beverages ¹
FLUID OUNCES															
M&F 4-8 y	11.6	11.4	9.7	16.1	9.1	9.3	11.1	10.7	13.9	3.8	9.1	9.5	3.0	7.3	27.2
M 9-13 y	18.9	13.2	16.0	20.3	13.5	12.3	14.3	13.3	13.1	6.3	10.2	16.0	0.8	10.3	36.8
M 14-18 y	31.1	21.9	29.1	24.0	26.8	18.3	17.8	13.4	17.0	13.9	16.5	15.5	38.6	9.1	56.8
M 19-49 y	30.1	25.7	35.9	25.0	35.7	14.6	15.3	17.0	15.6	27.6	29.0	26.5	43.2	14.3	72.5
M 50+ y	21.5	15.6	26.6	22.8	25.0	11.8	12.7	20.6	16.7	24.6	23.3	13.9	28.8	10.1	59.5
F 9-13 y	17.5	14.0	14.5	18.0	11.2	10.8	12.5	9.8	10.5	5.4	15.7	11.3	2.0	13.7	32.8
F 14-18 y	22.4	16.6	17.5	15.0	18.0	14.4	13.3	9.9	14.7	15.5	19.1	30.6	23.9	17.5	38.7
F 19-49 y	25.0	18.2	23.5	15.7	25.0	12.9	12.5	14.6	13.8	21.5	25.9	12.9	21.7	18.2	48.8
F 50+ y	16.8	14.0	20.7	10.4	22.2	8.3	10.6	10.5	15.5	19.8	22.0	14.7	14.5	17.5	43.7
M&F 4+ y	23.9	17.2	25.8	21.4	25.8	12.0	13.0	12.8	14.7	23.2	24.3	16.8	31.4	15.9	52.1

¹ Excluding plain water

Fruit/Vegetable Juice

Slightly more than one-quarter (28%) of Americans reported drinking fruit or vegetable juices. The percent of people drinking juice declined from 31% to 22-23% over the preteen, teenage and young adult populations. The percent of older adults reporting fruit/vegetable juice consumption on the day of recall was comparable to the percent of children drinking these beverages (34-36%). The average intake of fruit and vegetable juice by users was 12 fl oz/day. With a mean per user daily intake of 18 fl oz, teenage boys reported drinking the largest volume per user, while intakes by children and older adult females were the lowest (8-9 fl oz/day).

Milk

Per capita intakes of milk, including plain milk, flavored milk and milk-based beverages, ranged from 6 fl oz/day to 13 fl oz/day with older adult women at the low end and preteen boys at the high end of the range.

Plain Milk

Forty-five percent of Americans reported drinking plain milk (or consuming it with a ready-to-eat cereal), making plain milk the second most commonly consumed beverage after regular soft drinks (49%). Children were most likely to consume plain milk (74% users). The proportion of people drinking plain milk was progressively lower for preteen, teenage and young adult males (65-37% users) and females (60-33% users), though the proportion of people drinking plain milk increased slightly in the older adult years (45% users).

TYPES OF MILK		
	Milk Fat (%)	Fat/8 fl oz (grams)
Whole¹	3.25	8
Reduced fat²	2	5
Lowfat²	1	2.5
Fat-free²	0	<0.5

¹U.S. Food and Drug Administration, Health and Human Services. Food Standards General, Code of Federal Regulations 21 CFR §131.110. Washington, DC: U.S. Government Printing Office, April 2006.

²U.S. Food and Drug Administration, Health and Human Services. Food Labeling, Code of Federal Regulations 21 CFR §101. Washington, DC: U.S. Government Printing Office, April 2006.

Plain milk was the top beverage choice among children 4-8 years of age. The percentages of preteen boys and girls reporting plain milk or regular soft drinks on the day of recall were comparable, while teenagers and younger adults were more likely to consume regular soft drinks than plain milk. In all age groups, fewer females reported consumption of plain milk compared to males, and mean per user intakes by females were lower than intakes by males. The disparity in use was most pronounced among teenagers, as milk intake was reported by 55% of teenage boys and 44% of teenage girls. On average, teenage boys who drank milk reported drinking nearly 18 fl oz of milk, whereas teenage girls reported drinking 13 fl oz of milk.

Table 6

CONSUMPTION BY MILK TYPE ¹					
Population	Whole (3.25%)	Reduced Fat (2%)	Lowfat (1%)	Fat-Free	Not Specified
PERCENT USERS					
M&F 4-8 y	29.9	26.7	9.6	8.6	3.6
M 9-13 y	19.7	27.9	7.7	7.1	4.5
M 14-18 y	19.8	22.2	7.2	5.5	2.1
M 19-49 y	11.1	14.8	4.7	7.0	0.6
M 50+ y	9.7	17.6	7.0	11.5	0.5
F 9-13 y	19.9	20.8	7.7	9.5	5.6
F 14-18 y	12.2	16.1	7.6	7.1	1.5
F 19-49 y	10.2	9.8	3.4	9.2	0.3
F 50+ y	9.0	14.8	7.3	14.7	0.2
M&F 4+ y	13.2	16.2	6.0	9.4	1.2
MEAN INTAKE (FLUID OUNCES) PER USER					
M&F 4-8 y	11.1	10.4	9.9	10.1	9.4
M 9-13 y	11.8	13.9	14.3	20.9	10.3
M 14-18 y	15.6	17.8	15.9	24.8	10.7
M 19-49 y	14.2	15.5	16.3	14.8	11.0
M 50+ y	13.9	11.6	12.0	12.9	10.5
F 9-13 y	10.0	13.0	11.4	12.6	12.4
F 14-18 y	13.9	11.3	16.9	11.8	10.5
F 19-49 y	12.4	11.6	10.1	13.7	14.7
F 50+ y	9.7	8.5	10.7	12.2	5.6
M&F 4+ y	12.5	12.4	12.6	13.5	10.7

¹ Excluding condensed or evaporated milk

As shown in **Table 6**, Americans ages 4 and older were most likely to drink reduced fat milk (16%), followed by whole (13%), fat-free (9%), and lowfat milk (6%), though the predominant type of milk consumed varied across the population groups. Children 4-8 years old were most likely to drink whole milk (30%), which was followed closely by reduced fat milk (27%); children drank lowfat and fat-free milks in comparable but lower proportions. Reduced fat milk tended to be the type of milk favored by preteens, teenagers and all adults.

Among both males and females, the percent of people who drank whole milk was progressively lower across increasing age segments in the population, while the percent who drank reduced fat plain milk was highest in the preteen years and then fell (although it increased slightly among older adults). The percent who drank fat-free milk increased between the teenage and older adult segments. The percent of people who drank lowfat milk was relatively constant across the age segments for both males and females, with the exception of a lower percent in the population of adults 19-49 years old.

The mean amount of milk reported per user within a population group tended to vary little across milk types. An exception was boys ages 9-13 and 14-18 years who drank fat-free milk; these males drank considerably higher amounts of fat-free milk as compared to drinkers of other types of milk (although few preteen and teen boys drank fat free milk). The mean per user intake of milk differed by about 1 fl oz/day across the four specified types of milk (12.4-13.5 fl oz/day). People may have reported drinking more than one type of milk on the day of recall.

Flavored Milk

About one in five children and preteens reported drinking flavored milk. Flavored milk was used by 14% of male teenagers, 8% of female teenagers and 2-4% of all adults. Overall, 7% of the total sample drank flavored milk. The mean intake per user was 13 fl oz/day, which was equivalent to the mean per user intake of plain milk. Mean intakes of flavored milk by males ranged from 13-21 fl oz/day with older adult males reporting the highest intakes (yet this sample size was low). Female users consumed an average of 10-15 fl oz/day of flavored milk, while 4-8 year old users drank about 11 fl oz/day.

Milk-based Beverages

About 6% of Americans consumed a milk-based beverage, such as a coffee drink that was primarily milk (by weight) or a smoothie made with milk. Eight percent of older adult females drank milk-based beverages, while use in the other populations ranged from 4-6%. Americans who drank these beverages reported a mean intake of 15 fl oz/day. Mean intakes of milk-based beverages were relatively similar across all age/gender groups (11-17 fl oz/day).

Coffee

Coffee was reported by nearly 40% of people ages 4 and older, making it the third most commonly consumed beverage among Americans. Older adults (50+ years) were the top coffee drinkers, with about 70% of these adults reporting intakes of 20-25 fl oz of the beverage on the day of recall. About 40% of younger adults ages 19-49 years reported drinking coffee. Mean per user intakes of coffee by younger adults were 22-28 fl oz/day.

Tea

Tea (not presweetened) was consumed by 12% of Americans ages 4 and older. Adults, and in particular older adults and females, were the primary tea consumers. Twenty-three percent of older females reported drinking tea versus 17% of older men. Adult tea drinkers reported drinking on average 22-29 fl oz/day of tea. Tea was consumed by a relatively small proportion of children, preteens and teenagers ($\leq 6\%$).

Meal Replacements

Meal replacements were consumed by fewer than 2% of Americans ages 4 and older on the day of recall. About 2% and 3% of adult (19+ years) males and females, respectively, reported drinking meal replacements, while $\leq 1\%$ of other groups reported the beverages. The mean per user intake of meal replacements was 17 fl oz/day.

Alcoholic Beverages

Alcoholic beverages, mixtures containing alcohol, and alcohol substitutes were reported by nearly 20% of the population ages 4 and older, with a mean per user daily intake of 31 fl oz. Adults, and males in particular, were the primary consumers of these beverages. About one-third of all adult males reported an alcoholic beverage on the day of recall compared to about 16-21% of adult females ages 19 and above. Mean daily alcoholic beverage intake by younger adult males was 43 fl oz per user. The per user volume intakes of alcoholic beverages by males (14+ years) and by the entire sample were higher than per user volume intakes reported for any other beverage category.

In these analyses, the alcoholic beverage category included alcoholic beverages and all beverage combinations containing alcohol, regardless of the amount. These volumes therefore also reflect soft drinks, juice, water or any other beverages mixed with an alcoholic beverage. About 5% of teens reported drinking alcoholic beverages or substitutes.

Other Beverages

Beverages in the “other” category (e.g., soy and rice beverages) were relatively infrequently reported by Americans ages 4 and older (1%). The mean per user intake of beverages in the “other” category was 16 fl oz/day.

Water

Overall, nearly 90% of Americans ages 4 and older said they drank plain drinking water (**Table 7**). Plain drinking water included only tap or non-carbonated bottled water that was not consumed as a part of a beverage mixture. Children were least likely to report drinking plain water, but about 83% did so, while older adults were most likely to drink water (91-93%). Mean per user intakes by both males and females were highest among younger adults; younger adult men on average consumed 56 fl oz/day, and younger adult women reported drinking an average of 47 fl oz/day. The lowest per user intakes were reported by children (19 fl oz/day).

Table 7

INTAKES OF PLAIN WATER					
Population	Count	PER CAPITA		PER USER	
		Total plain water	Count of users	Percent users	Total plain water
		FLUID OUNCES			FLUID OUNCES
M&F 4-8 y	1341	16.0	1128	82.7	19.4
M 9-13 y	776	25.0	696	86.6	28.8
M 14-18 y	974	39.8	839	87.5	45.5
M 19-49 y	1610	48.2	1394	86.7	55.6
M 50+ y	1288	40.1	1179	90.5	44.3
F 9-13 y	818	22.9	734	89.1	25.7
F 14-18 y	934	34.5	777	86.3	40.0
F 19-49 y	1511	41.2	1303	86.9	47.4
F 50+ y	1291	37.5	1210	93.2	40.2
M&F 4+ y	10543	38.2	9260	87.9	43.5

Counts differ slightly from Table 1 because not all people reported water intake.

Total Fluid Intake

Table 8 shows the per capita daily intake of all fluids (i.e., from all beverage categories plus plain water). Total fluid intake is expressed in fluid ounces and also in cups (1 cup = 8 fluid ounces). For all individuals ages 4 and older, total fluid intake averaged more than 11 cups/day.

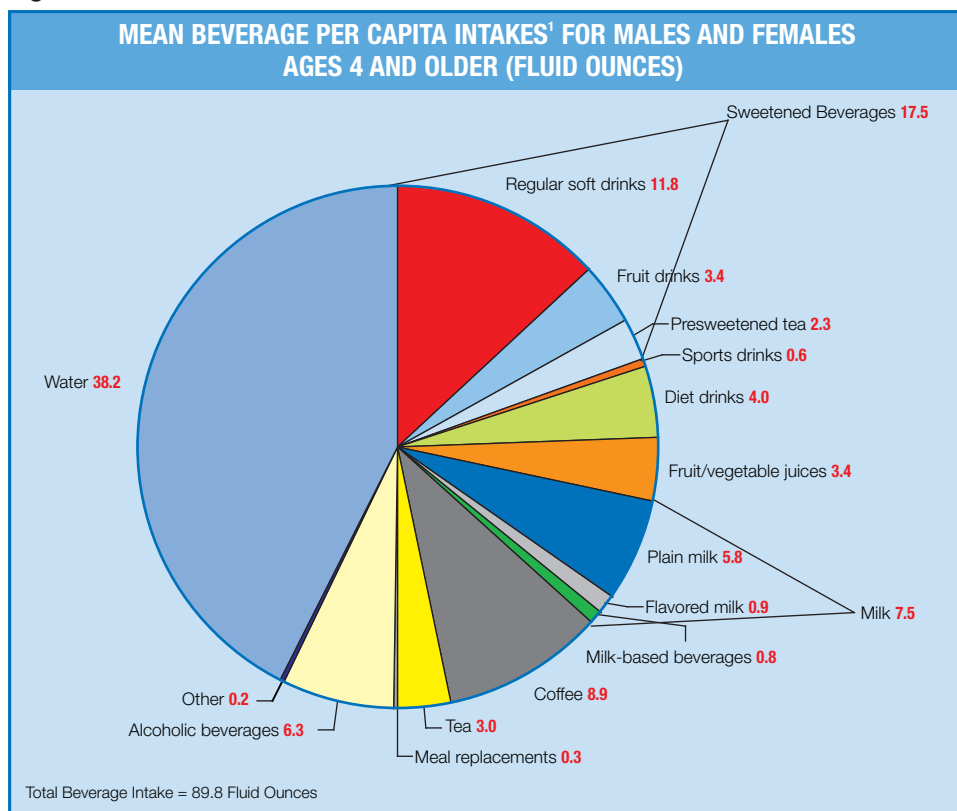
Table 8 also presents total fluid intake in liters, to facilitate comparison to the Adequate Intake (AI) set by the Institute of Medicine (IOM).³¹ The AI was based on data from Americans studied in NHANES III (1988-1994). In addition to diet recalls, these individuals provided serum samples that were analyzed for osmolality, an indicator of hydration status. There was no evidence of dehydration among NHANES III participants, even among those with the lowest total water intakes.

Accordingly, the average total water intake was used to set the AI, as it exceeded the amounts needed to maintain normal hydration status. The AI was set for total water intake, including water provided from foods, which ranges from 19% of total water in adults to 29% of total water in young children. By subtracting the water provided from food, the AI can also be expressed in terms of fluid intake from beverages (including plain water and other beverages). The calculated beverage AIs are shown in **Table 8**

The IOM also emphasized that all sources of fluid intake contribute to meeting the AI.³¹ In other words, there is no requirement for a certain amount of plain water. Conceivably, the AI could be met without consuming any plain water, but with intakes of other beverages including milk, coffee, juices, and other drinks.

The average per capita intakes were very close to the beverage AI for all age/gender groups. Since average intakes from NHANES III (conducted in 1998-1994) were used to set the AI, it is not surprising that participants in NHANES 1999-2002 had similar average intakes. However, what these data confirm is that Americans are drinking more than enough to ensure good hydration status.

Figure 2



¹From all beverage categories listed in Table 2 and from plain water in Table 7

Table 8

Population	PER CAPITA TOTAL FLUID INTAKE				
	PER CAPITA DAILY INTAKE				BEVERAGE AI ²
	Beverages	Water	Total	Total	
fluid ounces	fluid ounces	fluid ounces (cups)	L ¹	L	
M&F 4-8 y	26.8	16.0	42.8 (5.4)	1.27	1.2
M 9-13 y	36.5	25.0	61.5 (7.7)	1.82	1.8
M 14-18 y	56.0	39.8	95.8 (12.0)	2.83	2.6
M 19-49 y	72.2	48.2	120.4 (15.0)	3.56	3.0
M 50+ y	59.1	40.1	99.2 (12.4)	2.93	3.0
F 9-13 y	32.4	22.9	55.3 (6.9)	1.64	1.6
F 14-18 y	38.3	34.5	72.8 (9.1)	2.15	1.8
F 19-49 y	48.2	41.2	89.4 (11.2)	2.64	2.2
F 50+ y	43.3	37.5	80.8 (10.1)	2.39	2.2
M&F 4+ y	51.6	38.2	89.8 (11.2)	2.66	n/a

¹ 1 L = 33.8 fl oz

² AI = Adequate Intake. The AI established by the Institute of Medicine (2004) is for total water intake,³¹ including water from food. However, the AI can also be expressed in terms of beverage intake. For example, the AI for total water for children ages 4-8 years is 1.7 L/day of total water. In this age group, 71% of total water is from beverages so the AI from beverages is about 1.2L.

n/a= not applicable, AIs are specific for age and gender groups

Table 9

Contributions to Calorie and Nutrient Intakes

The per capita percent contributions of beverages to total calorie and nutrient intakes were calculated by dividing the mean per capita intake of calories and nutrients from each beverage by the mean per capita total calorie and nutrient intakes. Percent contributions were calculated for each beverage category and all beverages combined for each age/gender group in the plausible sample.

PERCENT OF TOTAL CALORIES FROM BEVERAGES (PER CAPITA)																
Population	TOTAL DIET (food + bevs)	Regular soft drinks	Fruit drinks	Presweetened tea	Sports drinks	Diet drinks	Fruit/vegetable juices	Plain milk	Flavored milk	Milk-based beverages	Coffee	Tea (not presweetened)	Meal replacements	Alcoholic beverages	Other	Total Beverages ¹
CALORIES		% OF TOTAL CALORIES														
M&F 4-8 y	1789	3.7	3.6	0.2	0.2	0.0	2.8	7.2	3.1	0.8	0.0	0.0	0.1	0.0	0.0	21.7
M 9-13 y	2279	7.0	2.5	0.3	0.3	0.0	2.3	6.1	2.9	0.5	0.0	0.0	0.1	0.0	0.0	22.1
M 14-18 y	2956	10.0	2.4	0.7	0.5	0.0	2.3	5.1	1.4	0.5	0.1	0.1	0.2	1.1	0.0	24.4
M 19-49 y	2987	7.5	1.9	0.7	0.3	0.1	1.4	2.9	0.5	0.5	1.5	0.2	0.3	6.3	0.0	24.1
M 50+ y	2547	3.8	1.1	0.5	0.1	0.1	2.1	3.3	0.4	0.4	1.8	0.2	0.2	5.4	0.0	19.3
F 9-13 y	2054	6.6	3.2	0.3	0.2	0.0	2.3	5.4	2.2	0.6	0.0	0.0	0.1	0.0	0.0	21.0
F 14-18 y	2192	8.7	3.0	0.5	0.2	0.0	2.5	3.9	0.9	0.8	0.3	0.1	0.1	0.8	0.0	21.9
F 19-49 y	2136	7.6	1.8	0.6	0.1	0.1	1.9	2.8	0.5	0.7	1.6	0.3	0.4	3.4	0.1	21.7
F 50+ y	1877	2.9	1.3	0.5	0.0	0.1	2.1	3.4	0.4	1.0	2.0	0.4	0.5	2.5	0.2	17.3
M&F 4+ y	2364	6.4	1.9	0.6	0.2	0.1	1.9	3.6	0.9	0.6	1.3	0.2	0.3	3.8	0.1	21.7

¹ Excluding plain water
0.0 represents a value < 0.05

Calories

Americans consumed 22% of all calories in the form of beverages (Table 9). Teenage and younger adult males consumed the greatest percent of the day's calorie intake from beverages (24%), while older adults consumed the smallest percent of calories from beverages (17-19%). Sweetened beverages (including regular soft drinks, fruit drinks and presweetened teas) were the largest contributor of calories compared to other beverages for all age/gender groups except children (4-8 years) and older adults (50+ years). Specifically, regular soft drinks were the top beverage source of calories for all preteens, teenagers and adults 19-49 years old. For teenagers and adults up to age 50, the calories from regular soft drinks were typically double the calories from milk. With a mean contribution to total calorie intake of 6%, regular soft drinks were the highest per capita source of beverage calories for Americans ages 4 and older. For teenage boys, they provided one out of every 10 calories consumed.

Table 10

CONTRIBUTIONS OF BEVERAGES TO VITAMIN AND MINERAL INTAKES MALES AND FEMALES AGES 4 AND OLDER																
	TOTAL DIET (food + bevs)	Regular soft drinks	Fruit drinks	Presweetened tea	Sports drinks	Diet drinks	Fruit/vegetable juices	Plain milk	Flavored milk	Milk-based beverages	Coffee	Tea (not presweetened)	Meal replacements	Alcoholic beverages	Other	Total Beverages ¹
		% OF DAILY INTAKE														
Vitamins																
Vitamin A (mcg RAE)	662	0.0	0.7	0.0	0.0	0.0	1.8	13.1	2.2	0.9	0.7	0.1	2.2	0.1	0.0	21.9
Vitamin E (mg alpha tocopherol)	7.3	0.0	0.6	0.0	0.0	0.0	2.2	0.8	0.2	0.2	0.9	0.0	2.4	0.1	0.0	7.3
Vitamin C (mg)	98.3	0.0	14.4	0.0	0.0	0.4	28.4	0.1	0.3	0.4	0.0	0.1	0.8	0.8	0.0	45.8
Folate (mcg DFE)	577	0.0	0.3	0.5	0.0	0.1	3.0	1.5	0.2	0.2	0.8	0.6	0.7	1.4	0.0	9.3
Minerals and Electrolytes																
Calcium (mg)	937	1.1	1.0	0.0	0.0	0.4	1.2	22.3	3.3	1.7	1.4	0.2	1.4	1.0	0.1	35.3
Phosphorus (mg)	1409	2.2	0.2	0.1	0.1	0.7	0.9	11.9	1.9	1.0	1.3	0.1	0.8	1.6	0.1	22.9
Magnesium (mg)	288	1.3	0.8	0.7	0.1	0.5	3.3	6.6	1.4	1.0	2.4	0.9	1.2	3.5	0.2	23.7
Iron (mg)	16.5	0.8	0.6	0.1	0.0	0.2	2.1	0.3	0.4	0.2	0.3	0.1	1.1	0.7	0.1	7.2
Zinc (mg)	12.7	0.7	0.2	0.1	0.0	0.1	0.5	5.9	1.0	0.5	0.5	0.2	1.1	0.4	0.1	11.4
Sodium (mg)	3819	0.6	0.3	0.1	0.2	0.2	0.3	1.9	0.4	0.2	0.2	0.1	0.3	0.4	0.0	5.2
Potassium (mg)	2820	0.1	0.8	0.8	0.1	0.3	5.9	9.4	1.6	1.0	4.9	1.1	0.6	1.8	0.1	28.6

¹ Excluding plain water
0.0 represents a value < 0.05

Adult males consumed between 5% and 6% of all calories in the form of alcoholic beverages, while adult women consumed about 3% of total calories from this source. The top source of beverage calories among children and older female adults was plain milk, and the milk category ranked third for contributions to total calories for people ages 4 and older. The fruit drinks and fruit/vegetable juice categories each provided about 2% of total calories for Americans ages 4 and older. Adults (19+ years) consumed about 2% of calories from coffee. Flavored milk accounted for less than 1% of total calorie intake in the total sample, but about 2-3% for children and preteens. All other beverage categories accounted for about 1% or less of total calorie intakes.

Vitamins

Table 10 illustrates the contributions of beverages to the vitamin and mineral intakes of Americans ages 4 and older. Percent contributions from beverages were also estimated for each age/gender group, though the data are not shown in this report. Beverages provided 22% of vitamin A in the diets of Americans, and plain milk was the top beverage source of this vitamin. Plain milk provided 13% of total vitamin A, which is more than half of the total vitamin A from beverages. Flavored milk and meal replacements provided slightly more than 2% of total vitamin A, while fruit/vegetable juices accounted for just under 2% of total vitamin A.

Seven percent of vitamin E (alpha-tocopherol) intake was from beverages. Vitamin E in meal replacements and fruit/vegetable juices each accounted for slightly more than 2% of daily vitamin E intakes. Plain milk and coffee beverages each provided close to 1% of vitamin E. Fruit drinks ranked fifth as a beverage source of vitamin E.

The vitamin C in beverages accounted for 46% of the total dietary intake of this vitamin. Fruit/vegetable juices were the primary beverage source of vitamin C. These juices accounted for 28% of vitamin C, or nearly two-thirds of vitamin C from all beverages. Fruit drinks (<100% juice) provided 14% of total vitamin C, or roughly one-third of vitamin C from beverages. Children, preteens and teenagers consumed about 20% of their daily intakes of vitamin C from fruit drinks.

About 9% of dietary folate was from beverages. Fruit/vegetable juices were the top beverage source of folate (3%), while plain milk and alcoholic beverages made the second largest beverage contributions (about 1-2% each). Coffee, meal replacements, plain tea, and presweetened tea made small contributions to total intakes of folate.

Minerals and Electrolytes

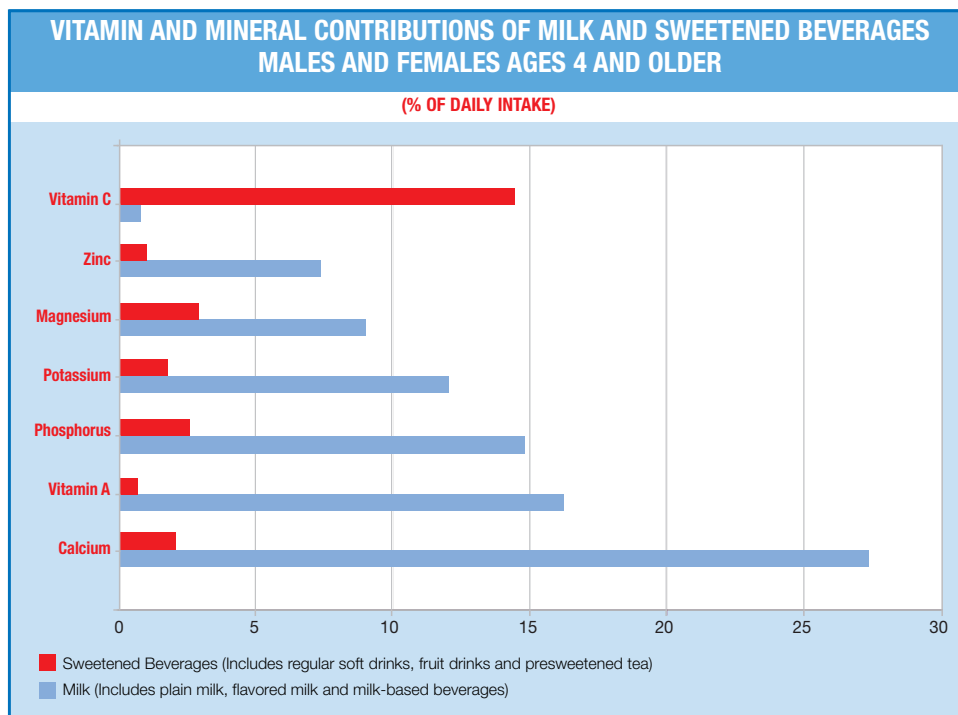
Beverages accounted for more than one-third of all calcium consumed by Americans, and nearly one-fourth of total phosphorus and magnesium (**Table 10**). In all age/gender groups, plain milk was the predominant source of both calcium and phosphorus, though flavored milks were also key sources of these minerals for children and preteens – providing 5-10% of these minerals.

Magnesium from plain milk provided 11-13% of total magnesium for children and preteens, which was roughly half of all magnesium from beverages consumed by these groups. The percent contribution of magnesium from plain milk declined across older segments of the population, and accounted for slightly less than 7% of total magnesium consumed by the sample ages 4 and older.

Americans consumed 7% of dietary iron from beverages. Fruit/vegetable juices were the top beverage source (2%) and meal replacements were the second-ranked beverage source (1%). All other beverage categories each provided less than 1% of total iron intakes.

Zinc consumed in beverages accounted for 11% of total zinc intakes. Plain milk was the predominant source of zinc from beverages (6%), particularly in populations of children (11%) and preteens (9%). Meal replacements and flavored milk beverages each provided 1% of total zinc intakes, and all other beverage categories provided less than 1% each.

Figure 3



Beverages accounted for 5% of all dietary sodium among the sample. Plain milk provided about 2% of total sodium, and all other beverage categories contributed less than 1% each.

Twenty-nine percent of potassium was consumed in the form of beverages. Plain milk was the top beverage source of potassium. It provided an average of 9% of total potassium intakes of Americans ages 4 and older, and as much as 15-19% for children and preteens. Fruit/vegetable juices were generally the second highest beverage source of potassium. In populations of older adults, coffee and milk provided comparable amounts of potassium, and each of these beverages provided a greater source of potassium compared to juice.

Protein

The contribution of beverages to total intakes of macronutrients, added sugars and cholesterol for people ages 4 and older are shown in **Table 11**. Percent contributions from beverages were also estimated for each age/gender group, though the data are not shown in this report.

“Choose and prepare foods and beverages with little added sugars or caloric sweeteners . . . the greater the consumption of foods containing large amounts of added sugars, the more difficult it is to consume enough nutrients without gaining weight.”

Dietary Guidelines for Americans 2005³⁰

About 11% of total protein intake came from beverages, most of which was attributable to plain milk. Children and preteens had the highest proportion of protein from plain milk (11-14%). The flavored milk and coffee beverage categories ranked second and third (each at about 1%), respectively for contributions to protein intake (**Table 11**).

Carbohydrates

Beverages provided nearly one-third of all carbohydrates (**Table 11**). Soft drinks provided 13% of total carbohydrate intake, making them the number one per capita beverage source of carbohydrates. Fruit drinks, fruit/vegetable juices, plain milk, and alcoholic beverages were minor beverage sources of carbohydrates, with each accounting for about 2-4% of total carbohydrate intakes in the diets of Americans ages 4 and older.

Added Sugars

Nearly 60% of the added sugars consumed on a given day were from beverages (**Table 11**). Regular soft drinks and fruit drinks combined provided the vast majority of all added sugars from beverages; soft drinks provided 36% of all added sugars, and fruit drinks contributed another 10%. The contributions of soft drinks to added sugars intakes peaked in the teenage years among both males and females. The percent contributions of added sugars from fruit drinks to total intakes were highest among children, all preteens, and teenage girls. Presweetened tea and coffee each accounted for 3% of total added sugars intakes.

Fat and Cholesterol

Beverages provided about 8% of the total fat, 11% of saturated fat and 6% of dietary cholesterol (**Table 11**). Plain milk, coffee (presumably containing milk ingredients), flavored milk, and milk-based beverages were the primary beverage sources of total fat, saturated fat and cholesterol. Children 4-8 years old consumed the greatest percent of total fat (12%) and saturated fat (20%) intakes from plain milk, flavored milk, and milk-based beverages – presumably because they were the primary users of whole milk. Since adults typically favor lower fat milks, the combined beverage categories of milks accounted for only 3-4% of total fat and about 7% of saturated fat for adults ages 19-49 years. Fat from coffee drinks made larger contributions to total fat compared to plain milk among older adults (50+ years).

Table 11

CONTRIBUTIONS OF BEVERAGES TO MACRONUTRIENTS, ADDED SUGARS AND CHOLESTEROL INTAKES, MALES AND FEMALES AGES 4 AND OLDER																
	TOTAL DIET (food + bevs)	Regular soft drinks	Fruit drinks	Presweetened tea	Sports drinks	Diet drinks	Fruit/vegetable juices	Plain milk	Flavored milk	Milk-based beverages	Coffee	Tea (not presweetened)	Meal replacements	Alcoholic beverages	Other	Total Beverages ¹
		% OF DAILY INTAKE														
Protein (g)	85.0	0.1	0.1	0.0	0.0	0.1	0.6	6.9	1.0	0.6	0.8	0.1	0.5	0.5	0.1	11.4
Carbohydrate (g)	300	12.9	3.9	1.1	0.3	0.1	3.7	2.8	1.0	0.8	1.2	0.4	0.4	2.0	0.1	30.7
Added sugars (tsp)	25.1	36.2	9.7	3.1	0.9	0.0	0.2	0.0	1.4	1.3	2.9	0.7	0.4	1.1	0.2	58.1
Fat (g)	88.8	0.0	0.0	0.0	0.0	0.0	0.1	3.6	0.7	0.5	2.7	0.0	0.2	0.0	0.0	7.9
Saturated fat (g)	29.0	0.0	0.0	0.0	0.0	0.0	0.1	6.7	1.3	0.9	1.4	0.1	0.2	0.1	0.0	10.7
Cholesterol (mg)	292	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.7	0.6	0.4	0.0	0.1	0.0	0.0	6.1

¹ Excluding plain water
0.0 represents a value < 0.05

Table 12 Nutrient Intakes and BMI by Beverage Intake Pattern

For a separate beverage pattern analysis, quartiles of milk and sweetened beverage intakes were calculated for each age/gender group. Milk beverages (MB) included plain milk, flavored milk and milk-based beverages. Sweetened beverages (SB) included regular soft drinks, fruit drinks and presweetened teas.

“High” and “low” consumers of each beverage category were identified based on intakes > 75th percentile and ≤ 25th percentile, respectively. For each age/gender group, people with high MB/low SB and low MB/high SB beverage patterns were identified (**Table 12**). These two groups combined comprised about 25% of the plausible sample (2,510 out of 10,607).

PERCENTILES OF MILK AND SWEETENED BEVERAGE INTAKE BY BEVERAGE PATTERN (N=2,510)						
Population	MILK BEVERAGES (MB)			SWEETENED BEVERAGES (SB)		
	25th Percentile	50th Percentile	75th Percentile	25th Percentile	50th Percentile	75th Percentile
	FLUID OUNCES					
M&F 4-8 y	4.0	8.5	16.0	2.0	8.0	16.0
M 9-13 y	0	8.0	16.0	12.9	28.0	43.0
M 14-18 y	0	8.0	16.0	7.5	15.0	25.1
M 19-49 y	0	0	10.0	0	22.0	40.0
M 50+ y	0	0	11.0	0	0	15.9
F 9-13 y	0	8.0	15.1	6.0	12.0	23.9
F 14-18 y	0	0	11.0	11.0	19.0	32.0
F 19-49 y	0	0	8.0	0	14.0	28.0
F 50+ y	0	0	8.0	0	0	12.0

Milk beverages category includes plain milk, flavored milk and milk based beverages

Sweetened beverages category includes regular soft drinks, fruit drinks and presweetened tea

Table 13

Mean total intakes of calories, vitamin A, vitamin C, calcium, magnesium, and potassium on the day of recall were calculated for people in either the high MB/low SB or low MB/high SB pattern group (**Table 13**).

Older adult males (50+ years) and females (14+ years) in the low MB/high SB pattern group had significantly higher calorie intakes compared to individuals in the high MB/low SB pattern group, while calorie intakes did not differ between the two beverage patterns in the other age/gender groups.

In each age/gender group, mean intakes of vitamin A, calcium, magnesium and potassium were significantly higher in the high MB/low SB groups versus the low MB/high SB groups. Vitamin C intakes were generally similar between beverage patterns, though older adult men in the high MB/low SB group had significantly higher intakes compared to the low MB/high SB group.

MEAN NUTRIENT INTAKES BY PATTERN OF MILK AND SWEETENED BEVERAGE INTAKE		
Population	High Milk/ Low Sweetened Beverage	Low Milk/ High Sweetened Beverage
MEAN ± STANDARD ERROR		
Calories		
M&F 4-8 y	1886 ± 43.2	1845 ± 36.9
M 9-13 y	2433 ± 112.7	2467 ± 100.3
M 14-18 y	2919 ± 139.3	3219 ± 116.5
M 19-49 y	2942 ± 82.1	3149 ± 47.5
M 50+ y	2489 ± 60.0 ^y	2735 ± 68.3 ^x
F 9-13 y	2055 ± 76.8	2267 ± 74.8
F 14-18 y	2202 ± 46.9 ^y	2434 ± 66.4 ^x
F 19-49 y	2079 ± 51.3 ^y	2346 ± 44.5 ^x
F 50+ y	1891 ± 47.7 ^y	2057 ± 58.9 ^x
Vitamin A (mcg RAE)		
M&F 4-8 y	839 ± 56.8 ^x	358 ± 24.9 ^y
M 9-13 y	1111 ± 90.7 ^x	449 ± 44.3 ^y
M 14-18 y	1128 ± 100.2 ^x	369 ± 35.4 ^y
M 19-49 y	1000 ± 49.7 ^x	445 ± 32.5 ^y
M 50+ y	1037 ± 66.0 ^x	587 ± 54.9 ^y
F 9-13 y	831 ± 78.8 ^x	350 ± 40.8 ^y
F 14-18 y	907 ± 64.3 ^x	288 ± 42.1 ^y
F 19-49 y	826 ± 48.9 ^x	382 ± 26.6 ^y
F 50+ y	852 ± 33.0 ^x	482 ± 35.9 ^y
Vitamin C (mg)		
M&F 4-8 y	73.1 ± 5.58	80.1 ± 8.80
M 9-13 y	118.9 ± 16.21	85.5 ± 10.88
M 14-18 y	105.6 ± 10.04	103.6 ± 10.17
M 19-49 y	99.3 ± 8.65	103.9 ± 9.36
M 50+ y	114.4 ± 8.42 ^x	85.9 ± 7.63 ^y
F 9-13 y	101.4 ± 18.62	71.2 ± 9.38
F 14-18 y	117.2 ± 19.51	94.9 ± 10.27
F 19-49 y	82.9 ± 7.46	81.3 ± 7.09
F 50+ y	114.9 ± 5.59	99.4 ± 9.30
Calcium (mg)		
M&F 4-8 y	1340 ± 45.4 ^x	594 ± 37.7 ^y
M 9-13 y	1830 ± 156.6 ^x	678 ± 71.8 ^y
M 14-18 y	1847 ± 71.8 ^x	889 ± 64.9 ^y
M 19-49 y	1730 ± 88.1 ^x	831 ± 26.2 ^y
M 50+ y	1404 ± 40.3 ^x	683 ± 37.8 ^y
F 9-13 y	1348 ± 85.2 ^x	592 ± 40.4 ^y
F 14-18 y	1376 ± 79.4 ^x	644 ± 50.5 ^y
F 19-49 y	1259 ± 52.4 ^x	625 ± 26.3 ^y
F 50+ y	1231 ± 52.3 ^x	554 ± 26.0 ^y
Magnesium (mg)		
M&F 4-8 y	250 ± 7.7 ^x	171 ± 5.0 ^y
M 9-13 y	342 ± 25.1 ^x	218 ± 11.0 ^y
M 14-18 y	366 ± 14.8 ^x	265 ± 14.3 ^y
M 19-49 y	401 ± 13.1 ^x	289 ± 8.0 ^y
M 50+ y	402 ± 16.3 ^x	282 ± 8.7 ^y
F 9-13 y	289 ± 12.3 ^x	195 ± 9.3 ^y
F 14-18 y	285 ± 15.8 ^x	211 ± 7.7 ^y
F 19-49 y	324 ± 7.3 ^x	213 ± 6.5 ^y
F 50+ y	316 ± 8.9 ^x	227 ± 6.3 ^y
Potassium (mg)		
M&F 4-8 y	2645 ± 60.9 ^x	1623 ± 57.3 ^y
M 9-13 y	3607 ± 266.7 ^x	1988 ± 107.9 ^y
M 14-18 y	3785 ± 186.5 ^x	2342 ± 125.8 ^y
M 19-49 y	3990 ± 144.0 ^x	2802 ± 78.1 ^y
M 50+ y	3978 ± 131.3 ^x	2857 ± 94.8 ^y
F 9-13 y	3080 ± 158.9 ^x	1875 ± 81.4 ^y
F 14-18 y	2949 ± 176.1 ^x	1992 ± 96.3 ^y
F 19-49 y	3157 ± 90.3 ^x	2052 ± 62.7 ^y
F 50+ y	3306 ± 89.2 ^x	2334 ± 67.8 ^y

^{xy} superscripts in the same row indicate significantly different means (p<0.05)

Milk category includes plain milk, flavored milk and milk based beverages
Sweetened beverage category includes regular soft drinks, fruit drinks and presweetened tea

Low category corresponds to intake at or below the 25th percentile of intake

High category corresponds to intake above the 75th percentile of intake

BMI, adjusted for total calorie intake, age and gender, was compared between beverage pattern groups (**Table 14**). Female preteens, female teens, and female adults (19-49 years) in the high MB/low SB groups had significantly lower adjusted BMIs than females in the low MB/high SB groups. In the analysis of males and females combined, mean adjusted BMIs of the high MB/low SB groups of all preteens, teenagers and adults (19-49 years) also were lower than mean adjusted BMIs in the low MB/high SB groups of all individuals (**Figure 4**).

Table 14

MEAN ADJUSTED ¹ BODY MASS INDEX BY PATTERN OF MILK AND SWEETENED BEVERAGE INTAKE		
Population	High Milk/ Low Sweetened Beverage Consumers	Low Milk/ High Sweetened Beverage Consumers
BMI (kg/m ²)		
M&F 4-8 y	16.8 ± 0.26	17.4 ± 0.37
M 9-13 y	20.0 ± 0.44	21.2 ± 0.91
M 14-18 y	22.5 ± 0.58	23.0 ± 0.50
M 19-49 y	26.8 ± 0.62	28.1 ± 0.44
M 50+ y	28.3 ± 0.73	28.8 ± 0.50
F 9-13 y	19.9 ± 0.35 ^y	21.3 ± 0.57 ^x
F 14-18 y	22.0 ± 0.29 ^y	24.1 ± 0.89 ^x
F 19-49 y	25.8 ± 0.71 ^y	28.5 ± 0.69 ^x
F 50+ y	27.7 ± 0.44	29.4 ± 0.73

^{xy} superscripts in the same row indicate significantly different means (p<0.05)

¹ Estimates of mean body mass index adjusted for total calorie intake, age and gender

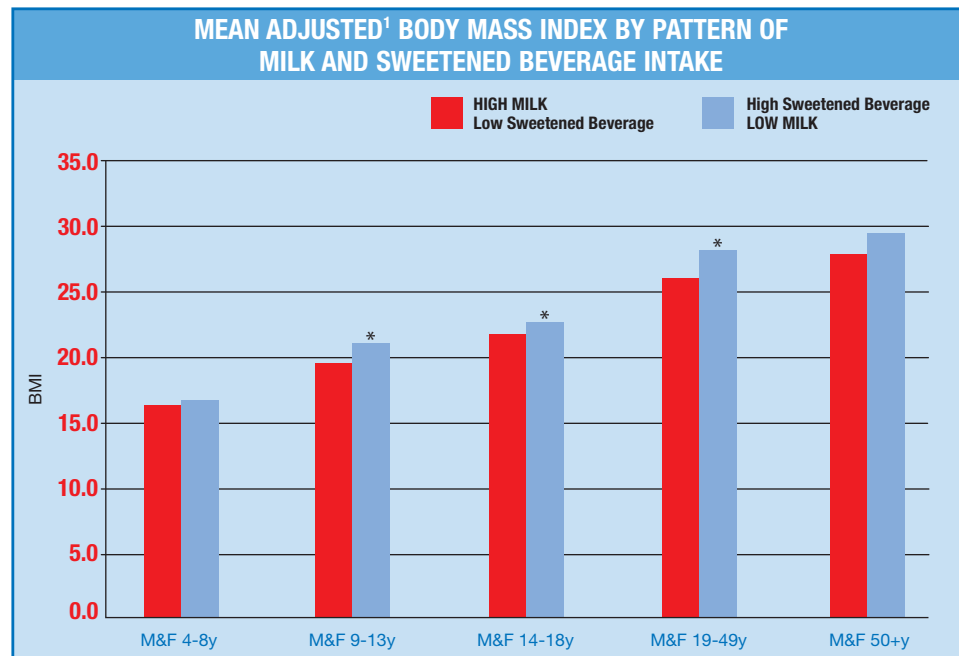
Milk category includes plain milk, flavored milk and milk-based beverages

Sweetened beverage category includes regular soft drinks, fruit drinks and presweetened tea

Low category corresponds to intake at or below the 25th percentile of intake

High category corresponds to intake above the 75th percentile of intake

Figure 4



¹ Estimates of mean body mass index adjusted for total calorie intake, age and gender.

* Statistically significant (p<0.05)

Standard errors range from 0.26 - 0.59

DISCUSSION

The *What America Drinks* report analyzed data from more than 10,000 Americans ages 4 and older who participated in the government's National Health and Nutrition Examination Survey (NHANES) 1999-2000 and 2001-2002 and provided plausible dietary reports of food/beverage intakes. Findings from the report show that beverages accounted for a significant proportion of the daily calorie and nutrient intakes of Americans. On average, beverages provided nearly one-quarter (22%) of total calories in a day, along with comparable or even higher percentages of carbohydrates, added sugars, and key vitamins and minerals including vitamin A, vitamin C, calcium, phosphorus, magnesium, and potassium.

Plain milk was the primary beverage source of several essential nutrients, including vitamin A, calcium, phosphorus, magnesium, potassium, protein and zinc. The flavored milk, milk-based, and coffee (which often contains added milk) beverage categories also contributed to these nutrients for selected age/gender groups.

Although a relatively small amount of fat, saturated fat and cholesterol was supplied by beverages, the primary source was milk and milk-based beverages, which included milk shakes. The amounts were lower for adults in comparison with children, because adults were more likely to consume lower fat milks.

Regular soft drinks were the top source of beverage calories, carbohydrates, and more than one-third of all added sugars in the total diet. Vitamin C was provided primarily by fruit/vegetable juices, and to a smaller degree by fruit drinks. Fruit/vegetable juices also contributed to potassium and folate intakes.

The results of this study show that milk consumed as a beverage, or eaten with ready-to-eat cereal, continues to provide Americans with a substantial proportion of essential nutrients, while other types of beverages tend to contribute substantially to calories and added sugars intakes but provide few nutrients other than vitamin C, potassium and some folate.

Results from this analysis show that milk continues to be consumed primarily by young children, with no more than half of some other age/gender groups drinking milk on any given day. The low intakes of milk, flavored milk and milk-based beverages by many age/gender groups may contribute to a failure to meet nutrient needs: these beverages are important sources of nutrients such as vitamin A, magnesium, calcium, potassium and zinc, and estimated usual intakes of these nutrients fall short of recommended intakes for most or some subpopulations of Americans.³²

Data on beverage consumption trends available in the literature detail beverage patterns for different subpopulations of Americans than those used in the current analysis of beverage consumption patterns. Specifically, other analyses typically have used subpopulations of preschool-aged children (2-5 years), young school-aged children (6-11 years), adolescents/teenagers (12-19 years) and adults (20+ years).

The current analyses were based on the life stage groups used in the Dietary Reference Intakes. Given the differences in the subpopulations used in the current and previous analyses along with the inclusion of all components of beverage mixtures, it is not possible to directly compare the current findings with information on beverage patterns based on older surveys.

Results from this analysis showing significantly lower energy intakes for males 50+ years and for females 14-18, 19-49, and 50+ years with high intakes of milk and low intakes of sweetened beverages (high MB/low SB) vs. high intakes of sweetened beverages and low intakes of milk (high SB/low MB) suggest that people may not compensate for added calorie intake from sweetened beverages by reducing calories from other food sources. However, findings that BMIs, adjusted for total calorie intakes, were significantly lower among female preteens, teenagers, and adults 19-49 yrs in the high MB/low SB group vs. the high SB/low MB group provide evidence that sweetened beverage consumption is associated with higher relative weight, and that this may be due, at least in part, to factors over and above total calorie intakes. This finding is in agreement with previous research.⁸

Strengths of the Study

A major strength of the *What America Drinks* report is the identification of a plausible sample of dietary recalls within the total sample of Americans. It is well known that dietary recalls are prone to bias as a result of selective under-reporting and to a lesser degree over-reporting.³³ Foods perceived as “bad” may be more likely to be under-reported,²² and overweight individuals or people dissatisfied with their body image may be more susceptible to under-reporting.^{34,35}

The elimination of implausible reporters from our study population should produce results more reflective of actual intakes. Consequently, relationships between beverage intakes and BMI should be less confounded by overweight individuals who may have under-reported consumption of beverages on the day of recall. It is important to recognize, however, that the subset of NHANES respondents determined to have plausible recalls may not necessarily be representative of the entire U.S. population.

Another major strength of this analysis is the fact that all components of beverage mixtures were considered in the classification of beverages to a beverage category and calculation of nutrients from beverages. This approach produced more consistent coding of similar types of beverages – for example chocolate milk purchased ready-to-drink or plain milk reported in combination with chocolate syrup were both categorized as flavored milk.

Additionally, the calorie and nutrient contributions from foods stirred into beverages, (e.g., milk and sugar in coffee or tea), were captured in this analysis. The estimates of calories and nutrients consumed from beverages therefore do indeed reflect all of the nutritional contributions made by beverages in the diets of Americans.

Conclusions

In conclusion, beverages make significant contributions to calorie and nutrient intakes of Americans. People consuming high amounts of milk and low amounts of sweetened beverages tend to have diets that are higher in calcium, vitamin A, magnesium and potassium. Women in the preteen through young adult years (ages 9-49) who consume high amounts of milk and low amounts of sweetened beverages have significantly lower BMIs than women who consume high amounts of sweetened beverages and low amounts of milk, regardless of total calorie intake (lower energy-adjusted BMI). By drinking more lowfat and fat-free milk in place of sweetened beverages, Americans can help enhance their intakes of essential nutrients that are typically suboptimal, including calcium, vitamin A, magnesium and potassium. These same patterns of beverage intake may have a beneficial role in weight management.



REFERENCES

- ¹ Nielsen SJ, Popkin BM. Changes in beverage intake between 1977 and 2001. *American Journal of Preventive Medicine*. 2004;27:205–210.
- ² Putnam J, Gerrior S. Trends in the US food supply. In: Frazao E, ed. *America's Eating Habits: Changes and Consequences*. Washington, DC: U.S. Department of Agriculture, 1999;133–160.
- ³ French SA, Lin BH, Guthrie JF. National trends in soft drink consumption among children and adolescents age 6 to 17 years: prevalence, amounts, and sources, 1977/1978 to 1994/1998. *Journal of the American Dietetic Association*. 2003;103:1326-1331.
- ⁴ Enns CW, Mickle SJ, Goldman JD. Trends in food and nutrient intakes by adolescents in the United States. *Family Economics and Nutrition Review*. 2003;15:15-28.
- ⁵ Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, Flegal KM. Prevalence of overweight and obesity among U.S. children, adolescents, and adults, 1999-2002. *Journal of the American Medical Association*. 2004;291:2847-2850.
- ⁶ Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among U.S. children and adolescents, 1999-2000. *Journal of the American Medical Association*. 2002;288:1728-1732.
- ⁷ Bachman CM, Baranowski T, Nicklas TA. Is there an association between sweetened beverages and adiposity? *Nutrition Reviews*. 2006;64:153-174.
- ⁸ Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. *American Journal of Clinical Nutrition*. 2006;84:274-288.
- ⁹ Pereira, MA. The possible role of sugar-sweetened beverages in obesity etiology: a review of the evidence. *International Journal of Obesity*. 2006;30:S28-S36.
- ¹⁰ Mattes RD. Dietary compensation by humans for supplemental energy provided as ethanol or carbohydrate in fluids. *Physiology and Behavior*. 1996;59:179-187.
- ¹¹ Harnack L, Stang J, Story M. Soft drink consumption among US children and adolescents: nutritional consequences. *Journal of the American Dietetic Association*. 1999;99:436–441.
- ¹² DiMeglio DP, Mattes RD. Liquid versus solid carbohydrate: effects on food intake and body weight. *International Journal of Obesity and Related Metabolic Disorders*. 2000;24:794–800.
- ¹³ Zemel MB. The role of dairy foods in weight management. *Journal of the American College of Nutrition*. 2005; 24:537S-546S.
- ¹⁴ Striegel-Moore RH, Thompson D, Affenito SG, Franko DL, Obarzanek E, Barton BA, Schreiber GB, Daniels SR, Schmidt M, Crawford PB. Correlates of beverage intake in adolescent girls: The National Heart, Lung, and Blood Institute Growth and Health Study. *Journal of Pediatrics*. 2006;148:183-187.
- ¹⁵ Novotny R, Daida YG, Acharya S, Grove JS, Vogt TM. Dairy intake is associated with lower body fat and soda intake with greater weight in adolescent girls. *Journal of Nutrition*. 2004;134:1905-1909.
- ¹⁶ Murphy M, Douglass J, Latulippe M, Barr S, Johnson R, Frye C. Beverage as a source of energy and nutrients in diets of children and adolescents. *The FASEB Journal*. 2005;19:A275.4.
- ¹⁷ Cotton PA, Subar AF, Friday JE, Cook A. Dietary sources of nutrients among US adults, 1994 to 1996. *Journal of the American Dietetic Association*. 2004;104:921-930.
- ¹⁸ Bowman S. Beverage choices of young females: changes and impact on nutrient intakes. *Journal of the American Dietetic Association*. 2002;102:1234-1239.

- ¹⁹ Centers for Disease Control and Prevention (CDC). National Center for Health Statistics (NCHS). 1999-2000 National Health and Nutrition Examination Survey Data. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2004. Available at: http://www.cdc.gov/nchs/about/major/nhanes/nhanes99_00.htm. Accessed July 21, 2006.
- ²⁰ Centers for Disease Control and Prevention (CDC). National Center for Health Statistics (NCHS). 2001-2002 National Health and Nutrition Examination Survey Data. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2004. Available at: <http://www.cdc.gov/nchs/about/major/nhanes/nhanes01-02.htm>. Accessed July 21, 2006.
- ²¹ Johnson RK. Changing eating and physical activity patterns of US children. *Proceedings of the Nutrition Society*. 2000;59:295-301.
- ²² Krebs-Smith SM, Graubard BI, Kahle LL, Subar AF, Cleveland LE, Ballard-Barbash R. Low energy reporters vs others: a comparison of reported food intakes. *European Journal of Clinical Nutrition*. 2000;54:281-287.
- ²³ McCrory MA, Hajduk CL, Roberts SB. Procedures for screening out inaccurate reports of dietary energy intake. *Public Health Nutrition*. 2002;5:873-882.
- ²⁴ Institute of Medicine. *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients)*. National Academy Press: Washington DC, 2005.
- ²⁵ Howarth NC, Huang TT, Roberts SB, Lin BH, McCrory MA. Eating patterns and dietary composition in relation to BMI in younger and older adults. *International Journal of Obesity* 2006;Sep. 5. [Epub ahead of print] doi:10.1038/sj.ijo.0803456
- ²⁶ Huang TT, Roberts SB, Howarth NC, McCrory MA. Effect of screening out implausible energy intake reports on relationships between diet and BMI. *Obesity Research*. 2005;13:1205-1217.
- ²⁷ U.S. Department of Agriculture (USDA). *Multi-year Food and Nutrient Database for Dietary Studies, 1.0*. Beltsville, MD: Agriculture Research Service, Food Surveys Research Group; 2004.
- ²⁸ Cook AJ, Friday JE. Pyramid Servings database for USDA Survey Codes Version 2.0 (PyrServDB_v2). 2004. Beltsville, MD: USDA, Agricultural Research Service, Community Nutrition Research Group. Available at: <http://www.ba.ars.usda.gov/cnrg>. Accessed July 21, 2006.
- ²⁹ U.S. Department of Agriculture (USDA). Database of Vitamin A (mcg RAE) and Vitamin E (mg AT) for National Health and Nutrition Examination Survey 1999-2000. Beltsville, MD: Agricultural Research Service, Food Surveys Research Group; 2006.
- ³⁰ U.S. Department of Health and Human Services, U.S. Department of Agriculture. *Dietary Guidelines for Americans, 2005*. 6th Edition, Washington, DC: U.S. Government Printing Office, January 2005.
- ³¹ Institute of Medicine. *Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate*. National Academy Press: Washington DC, 2004.
- ³² Moshfegh A, Goldman J, Cleveland L. *What We Eat in America, NHANES 2001-2002: Usual Nutrient Intakes from Food Compared to Dietary Reference Intakes*. U.S. Department of Agriculture, Agricultural Research Service, 2005.
- ³³ Maurer J, Taren DL, Teixeira PJ, Thomson CA, Lohman TG, Going SB, Houtkooper LB. The psychosocial and behavioral characteristics related to energy misreporting. *Nutrition Reviews*. 2006;64:53-66.
- ³⁴ Fisher JO, Johnson RK, Lindquist C, Birch LL, Goran MI. Influence of body composition on the accuracy of reported energy intake in children. *Obesity Research*. 2000;8:597-603.
- ³⁵ Novotny JA, Rumpler WW, Riddick H, Hebert JR, Rhodes D, Judd JT, Baer DJ, McDowell M, Briefel R. Personality characteristics as predictors of underreporting of energy intake on 24-hour dietary recall interviews. *Journal of the American Dietetic Association*. 2003;103:1146-1151.