Changing Beverage Consumption Patterns Have Resulted in Fewer Liquid Calories in the Diets of US Children: National Health and Nutrition Examination Survey 2001-2010

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ABSTRACT

Background Beverage consumption patterns have been linked to obesity and chronic disease risk. Although the consumption of sugar-sweetened beverages (SSBs) has decreased recently, little is known about the parallel trends in intake of other beverages.

Objective To describe recent trends in consumption of all commonly consumed beverages among US children aged 2 to 19 years.

Design Twenty-four–hour dietary recalls from 18,541 participants in the National Health and Nutrition Examination Survey from 2001-2010 were used to assess beverage intake, including SSBs (ie, sodas, fruit-flavored drinks, sport and energy drinks, fruit juices, coffees/teas, and other [nondairy] sugar-sweetened drinks); milks (ie, plain whole, reduced fat, and low-/nonfat, sweetened, other milks/milk-based drinks, and milk alternatives); 100% juices (ie, fruit, and vegetable/mixed without added sugar); low-/no-calorie beverages (ie, unsweetened or artificially sweetened: sodas, coffees/teas, flavored waters, diet sport/energy drinks, and other low/no-calorie drinks); alcohol-containing; and plain water (during 2005-2010 only). Weighted mean intakes (percent total energy and total ounces) and consumption prevalence were estimated. Regression models and analytical procedures that account for the complex sampling methods were used to test trends.

Results Between 2001-2002 and 2009-2010, total daily beverage consumption (excluding water) decreased from 24.4% to 21.1% energy (32.0 to 27.9 oz). Significant decreases ($P<0.05$) occurred in sugar-sweetened sodas (13.5% to 10.2% energy), whole milk (2.7% to 1.6% energy), fruit juices with sugar added (2.3% to 2.1% energy), and fruit-flavored drinks (1.6% to 0.8% energy). Significant increases occurred for sweetened coffees/teas, energy drinks, sport drinks, and unsweetened juices though the contribution of each to total energy intake remained <1%. Low-/no-calorie drink consumption also increased, rising from 0.2 to 1.3 oz/day.

Conclusions Changing beverage consumption patterns reflect positive trends in the form of reduced intake of SSBs, whole milk, and total calories from beverages. Although the consumption of sport drinks, energy drinks, and low-calorie beverages have increased, their contribution to total beverage intake remains small.
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DESPITE THEIR LIMITED ROLE IN THE EARLY HUMAN experience,[1,2] beverages have become a major contributor of calories to the modern diet.[3,4] In 2001, an estimated 20.9% of total energy in the US diet was consumed as beverages with the majority of these calories coming from sugar-sweetened sodas and other soft drinks.[5] Whereas recent research has highlighted a decreasing trend in the consumption of sugar-sweetened beverages (SSBs) during the past decade,[4] little is known about how patterns of consumption of other beverages have changed over the same period. Understanding the changing beverage consumption patterns is important, because these patterns have been linked to diet quality and increased obesity and chronic disease risk.[6,7]

Consumption of liquid calories has been associated with increased risk of obesity, possibly due to a failure to fully compensate for these calories by subsequently reducing intake of solid foods, resulting in an energy imbalance.[4] Multiple epidemiologic studies and clinical trials have examined the association between SSB intake and obesity risk among children and adults and many of them have demonstrated a positive association.[8,9] Others studies, also among both children[10-13] and adults,[14-17] suggest a link between SSB consumption and type 2 diabetes, dyslipidemia, and nonalcoholic fatty liver disease.

Although the body of evidence suggesting increased obesity and chronic disease risk with greater SSB consumption has grown substantially over recent years, the limited research on the effects of consuming fruit juices, which are naturally sweet but have a nutrient composition very similar to SSBs, has been more mixed.[18-21] The same is true of the research examining the association between artificially sweetened beverages and childhood obesity.[22,23]

Milk is also a major contributor of liquid calories in the diets of US children, but its nutrient composition, which includes protein as well as calcium and vitamin D (if fortified), differs markedly from other commonly consumed caloric beverages.[4] Research examining the association between milk consumption and obesity and other indicators of increased cardiometabolic risk suggests that milk, particularly milk low in fat, may have a protective effect.[24] The 2010 Dietary Guidelines for Americans (DGA) recommend that children and adolescents aged >2 years consume 2 to 2.5 cups low- or nonfat milk (or a fortified alternative) daily.[25]

DGA 2010 also advise limiting the intake of SSBs and other sources of added sugars, and limiting fruit juice to less than half a day's intake of fruit.[26] Although not referenced in DGA 2010, recommendations from the Institute of Medicine advise that access to artificially sweetened beverages and sport drinks be limited for school-aged children.[27]

Given the demonstrated decrease in SSB consumption in recent years, the aim of this study was to determine whether and how the consumption of other beverages has changed over the same time period. This information is needed to inform programs and policies that seek to promote healthy dietary patterns among children.

METHODS

Sample

Secondary analysis was performed using data from the National Health and Nutrition Examination (NHANES), a continuous series of complex, stratified, multistage probability surveys of the US population. The sample consisted of all subjects aged 2 to 19 years who participated in NHANES between 2001 and 2010 and who provided dietary data determined to be reliable (n=18,541).[28] This includes data from five 2-year cycles of NHANES: 2001-2002 (n=4,291), 2003-2004 (n=3,826), 2005-2006 (n=4,032), 2007-2008 (n=3,109), and 2009-2010 (n=3,285). Information on NHANES sampling methods and protocols are described in detail elsewhere.[29] All protocols for data collection were approved by the Institutional Review Board at the National Center for Health Statistics.[30] Informed consent was obtained from all participants aged 18 years and older and parental consent was obtained for those aged 17 years and younger. Interviews for children younger than age 6 years were conducted by proxy (parent or guardian), whereas children aged 6 to 11 years self-reported with a proxy assistant (parent or guardian). Children aged 12 years or older self-reported unless a proxy was needed.[28]

Dietary intake was estimated using data from one 24-hour dietary recall. Because a single dietary recall was collected on all NHANES participants before 2003, only the first 24-hour dietary recall from later cycles was used in this analysis. Recalls were performed in person at a mobile examination center by trained interviewers using the US Department of Agriculture (USDA) Automated Multiple Pass Method software program. Additional information on the 24-hour dietary recall procedure can be found elsewhere.[28]

Beverage Classification

Food codes and descriptions from the Food and Nutrient Database for Dietary Studies (USDA) were used to group beverages into six categories, including SSBs, milks, 100% juices, low-/no-calorie beverages, alcohol-containing beverages, and plain water (Table 1; available online at www.andjrl.org). In addition, the Food Combination Type code was used to identify unsweetened beverages (ie, milk, 100% juice, and coffee/tea) to which sugars were added after purchase. Beverages purchased as unsweetened were included in their respective SSB group if determined to have had caloric sweeteners (ie, sugar, honey, maple syrup, or flavored syrups) added to them before consumption. For example, if a subject reported drinking coffee and the food combination code indicated it was consumed with sugar, this coffee was grouped with the sweetened coffees/teas in the SSB grouping, whereas if it were consumed without the sugar it would be grouped with the unsweetened coffees/teas in the low-/no-calorie drinks grouping.

The categorization of drinks into the SSBs was consistent with previous reports[5,31,32] and included any of the following to which sugar was added before purchase: sodas (ie, sweetened or flavored carbonated beverages); fruit-flavored drinks (ie, fruit-flavored, noncarbonated drinks, and nonalcoholic fruit drinks); sweetened fruit juices (ie, nectars and mixed juices, juices with added caloric sweeteners, and nondairy-based fruit smoothies); sport drinks (including thirst quenchers); energy drinks (including energy juices and energy sodas); sweetened teas and coffees; and other (nondairy) sugar-sweetened drinks (eg, horchatas, rice drinks, and other traditional drinks). In addition, for completeness, we also included here any of the beverages above that were purchased unsweetened but to which sugars were added before consumption, as was done by Miller and colleagues[33] in their recent assessment of added sugar intake. We also assessed consumption of alcohol-containing beverages, which is reported separately (whether or not they contain added sugar), and sweetened milks, which are reported together with the other milks.

Milk categorization was also consistent with previous reports[7] in that it included plain milks (whole, reduced-fat (2%), low-fat (1%), and nonfat milk) and sugar-sweetened milks but in addition it also included milk alternatives (eg, soy milk, imitation milk, and coconut milk), and sweetened milk-based drinks (eg, milkshakes, milk-based smoothies, eggnog, and malted drinks). The 100% juice category used in our analysis was similar to that used in previous research,[32] in that it included only 100% juices (those with sugar added were included in the SSB grouping). For completeness, we include vegetables/mixed juices as well as fruit juices.

Low-/no-calorie beverages included reduced-calorie sodas and drinks (ie, low-sugar/low-calorie [<40 kcal per serving],[34] calorie-free sodas and drinks [sugar-free or <5 kcal per serving],[34] low-calorie energy drinks and diet sport drinks, unsweetened or artificially sweetened teas and coffees, and flavored waters [eg, sweetened, flavored, and/or carbonated]). Alcohol-containing beverages included wines,