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Sociodemographic Characteristics and Beverage Intake of Children Who Drink Tap Water

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Abstract

Background—Tap water provides a calorie-free, no-cost, environmentally friendly beverage option, yet only some youth drink it.

Purpose—To examine sociodemographic characteristics, weight status, and beverage intake of those aged 1–19 years who drink tap water.

Methods—National Health and Nutrition Examination Survey data (2005–2010) were used to examine factors associated with tap water consumption. A comparison was made of beverage intake among tap water consumers and nonconsumers, by age, race/ethnicity, and income.

Results—Tap water consumption was more prevalent among school-aged children (OR=1.85, 95% CI=1.47, 2.33, for those aged 6–11 years; OR=1.85, 95% CI=1.32, 2.59, for those aged 12–19 years) as compared to those aged 1–2 years. Tap water intake was less prevalent among girls/women (OR=0.76, 95% CI=0.64, 0.89); Mexican Americans (OR=0.32, 95% CI=0.23, 0.45); non-Hispanic blacks (OR=0.48, 95% CI=0.34, 0.67); and others (OR=0.50, 95% CI=0.36, 0.68) as compared to whites; Spanish speakers (OR=0.72, 95% CI=0.55, 0.95); and among referents with a lower than Grade-9 education (OR=0.52, 95% CI=0.31, 0.88); Grade 9–11 education (OR=0.50, 95% CI=0.32, 0.77); and high school/General Educational Development test completion (OR=0.50, 95% CI=0.33, 0.76), as compared to college graduates. Tap water consumers drank more fluid (52.5 vs 48.0 ounces, $p<0.01$); more plain water (20.1 vs 15.2 ounces, $p<0.01$); and less juice (3.6 vs 5.2 ounces, $p<0.01$) than nonconsumers.

Conclusions—One in six children/adolescents does not drink tap water, and this finding is more pronounced among minorities. Sociodemographic disparities in tap water consumption may contribute to disparities in health outcomes. Improvements in drinking water infrastructure and culturally relevant promotion may help to address these issues.

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Appendix

Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.amepre.2013.04.001.

Introduction

Water is a no-calorie alternative to sugar-sweetened beverages (SSBs) such as soda and sports drinks. Drinking plain water instead of SSBs may help prevent obesity and obesity-related comorbidities.[1–5] According to estimates from the National Health and Nutrition Examination Survey (NHANES), if children and adolescents substitute SSB intake with plain water, they can reduce their daily caloric intake by ~235 kilocalories.[6] Drinking fluoridated plain water also can reduce dental caries, one of the most common chronic conditions among children and adolescents.[7–9]

In the U.S., in most cases, individuals historically have consumed water directly from the tap (e.g., faucet, sink), as it provides a clean and low-cost beverage option. Over the past several decades, however, bottled water consumption has increased because of active marketing in conjunction with escalating consumer concerns regarding water quality, taste preferences for bottled water, and convenience (i.e., portability of bottled water).[10,11] Unfortunately, unlike most tap water, the majority of bottled water does not contain sufficient fluoride to prevent dental caries.[12–15] Moreover, intake of bottled water may pose a financial burden for families, particularly families who drink bottled water exclusively.[16] Bottled-water containers also adversely affect the environment.[11,14]

There is limited information regarding the sources of drinking water that U.S. children and adolescents consume. Previous studies, including several regional surveys[16–20] and a brief report using national data,[21] suggest that tap water intake is less common among low-income populations and of individuals of Latino and black race/ethnicity. It is unclear whether real problems or perceived concerns about water quality are driving low tap-water intake among these groups.

The current study was designed to augment this previous work by conducting a more comprehensive analysis of NHANES data spanning a lengthier time frame of 2005–2010. Specifically, in this study, an examination was made of whether sociodemographic characteristics and weight status of children and adolescents aged 1–19 years in the U.S. are associated with intake of plain tap water. Investigation also was made of whether beverage consumption patterns, including intake of bottled water, which typically is not fluoridated, differed between tap water consumers and nonconsumers, stratified by age, race/ethnicity, and income level.

Based on prior literature,[16–21] the current authors hypothesized that children from under-represented minority backgrounds and in families of lower income and lower educational levels would be less likely to drink tap water. Additionally, it was postulated that children who did not drink tap water would drink more SSBs and fruit juice and would be more likely to be overweight than children who drink tap water. Study results can be used to further understand and eliminate disparities in tap water intake, and potentially associated health conditions, among U.S. children and adolescents.

Methods

Data Source, Design, and Study Population

From 2011 to 2012, an analysis was made of dietary and physical examination data from NHANES (2005–2010) including dietary and physical examination data. The NHANES is administered continuously by the National Center for Health Statistics (NCHS) through a series of interviews, physical examinations, and questionnaires that is described on the NCHS website.[22] Dietary data are collected using a multiple-pass 24-hour dietary interview method described elsewhere.[23,24] During the interviews, respondents are asked to recall all foods and beverages consumed during the prior 24 hours. Demographic information and data regarding respondents' typical diet also are collected. Interview participants vary by age; participants aged ≥12 years completed interviews on their own; interviews for children aged ≤5 years were completed by a proxy; and interviews with children aged 6–11 years were proxy-assisted. Thorough physical examinations, including anthropomorphic measurements, also are included in NHANES data collection procedures.

In order to collect nationally representative data, the NCHS administers the NHANES using a complex, four-stage, probability sampling procedure. The NCHS samples counties, segments within counties, households within segments, and individuals within households. The NHANES oversamples certain population groups (e.g., African Americans and adolescents) who may be of particular public health interest. For the current study, the sample weights provided by the NCHS were applied, in order to account for the unequal probability of selection and nonresponse. The current analysis used data from three NHANES releases (2005–2006, 2007–2008, and 2009–2010) for which data on the water-intake outcomes of interest were first available. Individuals with incomplete or unreliable dietary data, as coded by NHANES staff, were excluded from the analysis.

Outcome Variables

The primary outcome was the proportion of children and adolescents aged 1–19 years who drank tap water. As part of the household interview, respondents or their proxy (for children aged <6 years) were asked: When you drink tap water, what is the main source of the tap water? Responses were categorized as: (1) *community supply*; (2) *well or rain cistern*; (3) *spring*; (4) *don't drink tap water*; or (5) *other*. Children aged <1 year were excluded, as infants' fluid intake consists of breast milk or infant formula.

A comparison was made of the following sociodemographic characteristics of respondents who drank tap water versus those who did not: age (1–2 years, 3–5 years, 6–11 years, 12–19 years); gender; race/ethnicity (Mexican American, non-Hispanic white, non-Hispanic black, other); ratio of monthly family income to the poverty level based on the DHHS poverty guidelines (0%–129%, 130%–349%, 350%–499%, ≥500%); survey year (2005–2006, 2007–2008, 2009–2010); language of the interview (English, Spanish); and education level of a household reference person (<Grade 9; Grades 9–11; high school graduate/General Educational Development test [GED] equivalent; some college or another advanced degree; college graduate or above).

An examination also was made of how weight status varied among tap water consumers and nonconsumers. Children were categorized as obese, overweight, or normal weight based on CDC-recommended BMI % cutoffs.[25,26] For children aged ≥2 years, height and weight were used to calculate BMI% based on gender- and age-specific growth charts. Children in the 85%–95% were categorized as overweight, children ≥95% were categorized as obese, and children <85% were categorized as normal weight.

Finally, in order to examine differences in beverage intake by tap water consumers and nonconsumers, estimates were made of the mean daily ounces of beverages consumed by children in each group. Using U.S. Department of Agriculture's Food and Nutrient Database codes,[27] beverages were categorized into one of seven groups: (1) plain water, including tap and noncarbonated bottled water without sweeteners or other additions; (2) milk (including flavored milk); (3) 100% fruit/vegetable juice (including nectars); (4) SSBs (sodas, sports/energy drinks, fruit drinks, sweetened coffee/tea, other sweetened beverages); (5) low-calorie beverages (diet sodas, other beverages sweetened with low-calorie sweeteners); (6) unsweetened coffee/tea; and (7) other beverages. Similar to previous studies,[6,24] estimates were made of both the mean daily volumetric intake and the mean daily caloric intake of beverages from each of these categories.

Data Analysis

A chi-square test was used to assess the association between each variable and whether the respondent drank tap water. Multivariable logistic regression was used, including all variables, to examine factors associated with tap water intake. Differences in the mean consumption of beverages between tap water consumers and nonconsumers stratified by age, race/ethnicity, and income were assessed using a Student's *t*-test. All analyses were performed using survey commands in Stata 11 to adjust for survey design, including sample weights, primary sampling units, and strata.

Results

The final data set includes 10,470 children and adolescents aged 1–19 years. Although a total of 12,043 children and adolescents were surveyed; 1573 were excluded because either their dietary recall status was not reliable or there were missing data with regard to the current outcome of interest (i.e., source of water consumed). Study sample characteristics did not differ by 2-year release increments (Table 1).

Of the 83% of children and adolescents who drank tap water, 67% drank water from a community supply, 15% from a well/rain cistern, and 2% from a spring. Of those who did not drink tap water, 59% reported that they drank bottled water. During the study period (2005–2010), plain water intake did not change; tap water intake decreased (20.0 to 19.1 ounces; p-value=0.05); and bottled water consumption increased (7.1 to 9.1 ounces; p=0.03).

In multivariable analysis adjusting for sociodemographic characteristics, weight status, and survey year, tap water consumption was more likely among school-aged children as compared to those aged 1–2 years (Table 2). Tap water consumption was less likely among girls; Mexican Americans, non-Hispanic blacks, and other race/ethnicity as compared to

whites; Spanish speakers as compared to English speakers; and among households in which referents had less than a Grade-9 education, a Grade-9–11 education, or high school/GED completion as compared to college graduates.

Total mean intake of all beverages was 51.8 (0.8) ounces. Total beverage intake consisted primarily of three beverages: plain water (19.2 [0.6] ounces); SSBs (14.7 [0.5] ounces); and milk (10.6 [0.2] ounces). Appendix A (available online at www.ajpmonline.org) shows the mean consumption of beverages among tap water consumers and nonconsumers stratified by age group. Tap water consumers drank on average 4.9 ounces more of plain water per day, 7 ounces less of bottled water per day, and 1.6 ounces less of juice per day than nonconsumers. Overall, tap water consumers drank a greater average volume of all beverages than nonconsumers; however, there were no significant differences across groups in the average caloric intake from all beverages. Results stratified by race/ethnicity and income are shown in Appendixes B and C (available online at www.ajpmonline.org).

Discussion

This is the first comprehensive, national study to examine the sociodemographic characteristics of U.S. children and adolescents who drink tap water. This study showed disparities in tap water consumption related to age, gender, education, language, and race/ethnicity. As in a previous national data brief and smaller regional studies,[15–19,21] whites in the current study were more likely to drink tap water as compared to under-represented minority children. In a 2011 data brief that examined national trends in the mean amount of bottled and tap water consumption (in cups) among U.S. adults and children using 2005–2008 NHANES data, non-Hispanic white teens (aged 12–19 years) drank more tap water than Hispanic and non-Hispanic black teens.[21]

In a study conducted of parents of children presenting to pediatric clinics in Salt Lake City UT, twice as many Latinos as whites reported never giving their child tap water (44% vs 21%).[18] Similarly, in a study of parents of pediatric patients presenting to emergency departments in an urban/suburban location in Milwaukee WI, the percentage of Latino and African-American parents who reported exclusive bottled-water intake was double that of non-Latino whites.[16]

Perceptions of tap water as a health risk and taste preferences may contribute to racial/ethnic disparities in tap water consumption.[16] The finding that Spanish speakers are less likely to drink tap water than English speakers supports the hypothesis that immigrants may perceive water in the U.S. as unsafe due to contaminants in their “home” country water supply.[18] Alternatively, preference for bottled water may stem from poor water quality/safety in the current communities in which they live. Indeed, minority populations may be more likely to live in older homes in which water has elevated levels of lead, is discolored, or is not palatable due to antiquated or poorly maintained plumbing.[28] In order to reduce such disparities in tap water intake, it is critical to first ensure equal access to safe and potable drinking water. In locations where drinking water is safe, culturally specific messaging may help increase intake of tap water instead of bottled water or non-nutritive beverages.

The current study also demonstrates that independent of income, a lower educational status of the household referent is negatively associated with tap water intake. To our knowledge, no previous studies have found such a relationship. Even in communities where tap water is safe to drink, there may be negative perceptions regarding the safety of tap water. Efforts to educate families, particularly those of lower educational status, about the health and financial benefits of tap water consumption, may help to improve intake among youth.

In areas where water is unsafe to drink directly from the tap (e.g., as a result of lead leaching from old plumbing, groundwater nitrate contamination), there should be a concerted effort by communities and the government to improve the drinking water infrastructure so that families do not have to bear the burden of purchasing bottled water or filtration devices to ensure access to safe drinking water.[29,30] In the short term, public health officials and local community agencies can inform families of the most cost-effective ways to provide safe drinking water when potable water is unavailable (e.g., filtering water rather than purchasing individual-use disposable bottles).

In the current study, older children were more likely to drink tap water as compared to younger children. A previous NHANES study of water intake among adults, children, and adolescents found that mean intake of plain water (including tap and bottled water) was higher among older children, after adjusting for child and household sociodemographic characteristics, child BMI, physical activity, and screen time behaviors.[31] Because of concerns regarding water intoxication, a condition in which water can dilute a baby's sodium levels leading to seizures, coma, brain damage, and death, many pediatricians do not recommend that children aged <1 year drink water.[32–34] Further, popular parenting books suggest that parents boil or use purified water when infants are young.[35]

It is possible that the age differences in tap water intake observed in this study may be due to messages parents receive from healthcare providers and parenting sources that discourage plain water consumption in the early years and encourage purified or bottled water use for young children. Because of the numerous topics that need to be covered during the well-child visit,[34] clinicians may not revisit the importance of water intake at health maintenance visits. Pediatricians and public health officials should increase efforts to educate families about the importance of encouraging tap water intake in toddlers, school-aged children, and adolescents.

Overall consumption of plain water in this study was low as defined by previous studies (<3 glasses/day). As would be expected, children and adolescents who drank tap water drank less bottled water than nonconsumers. Tap water consumers also drank half a cup more of plain water overall (i.e., from bottled and/or tap water sources) and consumed less juice than nonconsumers. Moreover, children who drank tap water drank more fluid overall than children who did not drink tap water. No previous studies have examined differences in beverage intake in terms of volume and kilocalories among tap water consumers and nonconsumers.

A previous study of beverage intake patterns among adults based on 1999–2001 NHANES data demonstrated that among water consumers (including tap and bottled water) there was a

lower overall intake of kilo-calories from nondairy caloric beverages (namely juice and soda) than among adults who did not consume water.[36] In a study of children and adolescents using NHANES data, plain water intake was not associated with energy intake but was asso ciated with intake of foods of lower energy density.[31] In the current study, no significant difference was found in SSB intake or weight status among tap water consumers and nonconsumers overall. However, given that consumption of SSBs is associated with adverse health effects (e.g., dental caries and obesity),[24,37–41] and overall hydration status is associated with cognitive functioning in children and adolescents,[42,43] it is important to encourage consumption of water in lieu of SSBs, and in particular tap water (a low-cost and often fluoridated beverage), among children and adolescents.

Limitations

Several limitations to this study are acknowledged. Although several sociodemographic factors were controlled for in the analyses, there may be unmeasured confounders that were not possible to account for in the current study. For example, because there may be geographic variability in the safety and quality of tap water, future studies should examine how tap water intake varies by geographic locale (e.g., region, urban-centric locale).

Despite variability in dietary intake for 1-day, 24-hour dietary recall, the 1-day recall provides unbiased estimates of population-level intake. Because the survey respondent interviewed varies by age (i.e., surveys are proxy-completed for younger children), this could have led to differential reporting by age. For example, perhaps adolescents are more likely to report tap water intake as compared to proxies such as parents. Finally, because this study relies on closed-ended survey data, it is not possible from the current results to fully understand the reasons that children and adolescents do not drink tap water. An in-depth qualitative study may be a better methodology for examining why younger children and children and adolescents from underserved backgrounds are least likely to drink tap water.

Conclusion

Although tap water is a readily accessible and low-cost beverage with health benefits, approximately one in six U.S. children and adolescents do not drink tap water. Children who are from underserved backgrounds (minority, low-education, and immigrant) are least likely to drink tap water; only one in three Mexican-American youth in the U.S. drink tap water. Although efforts increasingly discourage consumption of non-nutritive, energy-dense beverages, greater emphasis should be placed on increasing intake of water, and especially tap water, which is typically fluoridated and of low cost. A first step toward this goal is to ensure equal access to safe tap water, particularly in low-income and minority communities. In addition to drinking-water infrastructure improvements, it is also important to develop and disseminate culturally relevant messages to promote tap water intake among low-income and minority families.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Stookey JD, Constant F, Popkin BM, Gardner CD. Drinking water is associated with weight loss in overweight dieting women independent of diet and activity. Obesity (Silver Spring). 2008; 16(11): 2481–8. [PubMed: 18787524]
2. Dennis EA, Dengo AL, Comber DL, et al. Water consumption increases weight loss during a hypocaloric diet intervention in middle-aged and older adults. Obesity (Silver Spring). 2010; 18(2): 300–7. [PubMed: 19661958]
3. Ebbeling CB, Feldman HA, Osganian SK, Chomitz VR, Ellenbogen SJ, Ludwig DS. Effects of decreasing sugar-sweetened beverage consumption on body weight in adolescents: a randomized, controlled pilot study. Pediatrics. 2006; 117(3):673–80. [PubMed: 16510646]
4. Muckelbauer R, Libuda L, Clausen K, Toschke AM, Reinehr T, Kersting M. Promotion and provision of drinking water in schools for overweight prevention: randomized, controlled cluster trial. Pediatrics. 2009; 123(4):e661–e667. [PubMed: 19336356]
5. Stookey JD, Constant F, Gardner CD, Popkin BM. Replacing sweetened caloric beverages with drinking water is associated with lower energy intake. Obesity (Silver Spring). 2007; 15(12):3013–22. [PubMed: 18198310]
6. Wang YC, Ludwig DS, Sonneville K, Gortmaker SL. Impact of change in sweetened caloric beverage consumption on energy intake among children and adolescents. Arch Pediatr Adolesc Med. 2009; 163(4):336–43. [PubMed: 19349562]
7. Armfield JM. Community effectiveness of public water fluoridation in reducing children's dental disease. Public Health Rep. 2010; 125(5):655–64. [PubMed: 20873281]
8. Lee M, Dennison PJ. Water fluoridation and dental caries in 5- and 12-year-old children from Canterbury and Wellington. N Z Dent J. 2004; 100(1):10–5. [PubMed: 15346876]
9. McDonagh MS, Whiting PF, Wilson PM, et al. Systematic review of water fluoridation. BMJ. 2000; 321(7265):855–9. [PubMed: 11021861]
10. Doria MF. Bottled water versus tap water: understanding consumers' preferences. J Water Health. 2006; 4(2):271–6. [PubMed: 16813019]
11. Napier GL, Kodner CM. Health risks and benefits of bottled water. Prim Care. 2008; 35(4):789–802. [PubMed: 18928830]
12. Johnson SA, DeBiase C. Concentration levels of fluoride in bottled drinking water. J Dent Hyg. 2003; 77(3):161–7. [PubMed: 14596161]
13. Steinmetz JE, Martinez-Mier EA, Jones JE, et al. Fluoride content of water used to reconstitute infant formula. Clin Pediatr (Phila). 2011; 50(2):100–5. [PubMed: 21242202]
14. Bullers AC. Bottled water: better than the tap? FDA Consum. 2002; 36(4):14–8. [PubMed: 12184297]
15. Sriraman NK, Patrick PA, Hutton K, Edwards KS. Children's drinking water: parental preferences and implications for fluoride exposure. Pediatr Dent. 2009; 31(4):310–5. [PubMed: 19722439]
16. Gorelick MH, Gould L, Nimmer M, et al. Perceptions about water and increased use of bottled water in minority children. Arch Pediatr Adolesc Med. 2011; 165(10):928–32. [PubMed: 21646572]
17. Huerta-Saenz L, Irigoyen M, Benavides J, Mendoza M. Tap or bottled water: drinking preferences among urban minority children and adolescents. J Community Health. 2012; 37(1):54–8. [PubMed: 21643824]
18. Hobson WL, Knochel ML, Byington CL, Young PC, Hoff CJ, Buchi KF. Bottled, filtered, and tap water use in Latino and non-Latino children. Arch Pediatr Adolesc Med. 2007; 161(5):457–61. [PubMed: 17485621]

19. Williams BL, Florez Y, Pettygrove S. Inter- and intra-ethnic variation in water intake, contact, and source estimates among Tucson residents: implications for exposure analysis. J Expo Anal Environ Epidemiol. 2001; 11(6):510–21. [PubMed: 11791167]
20. Weissman AM. Bottled water use in an immigrant community: a public health issue? Am J Public Health. 1997; 87(8):1379–80. [PubMed: 9279282]
21. Sebastian, RS.; Wilkinson Enns, C.; Goldman, JD. Drinking water intake in the U.S.: What We Eat In America, NHANES 2005-2008.. Food Surveys Research Group dietary data brief no. 7. Sep. 2011 ars.usda.gov/Services/docs.htm?docid=19476
22. National Health and Nutrition Examination Survey. www.cdc.gov/nchs/nhanes/nhanes2005-2006/nhanes05_06.htm
23. Pereira MA, Fulgoni VL 3rd. Consumption of 100% fruit juice and risk of obesity and metabolic syndrome: findings from the national health and nutrition examination survey 1999-2004. J Am Coll Nutr. 2010; 29(6):625–9. [PubMed: 21677126]
24. Wang YC, Bleich SN, Gortmaker SL. Increasing caloric contribution from sugar-sweetened beverages and 100% fruit juices among U.S. children and adolescents, 1988-2004. Pediatrics. 2008; 121(6):e1604–e1614. [PubMed: 18519465]
25. CDC. Growth charts. www.cdc.gov/growthcharts/
26. CDC. A SAS program for CDC growth charts. www.cdc.gov.laneproxy.stanford.edu/nccdphp/dnpao/growthcharts/resources/sas.htm
27. U.S. Department of Agriculture. National nutrient database for standard reference, Release 24. ndb.nal.usda.gov/
28. Hood E. Dwelling disparities: how poor housing leads to poor health. Environ Health Perspect. 2005; 113(5):A310–A317. [PubMed: 15866753]
29. Cradock AL, Wilking CL, Olliges SA, Gortmaker SL. Getting back on tap: the policy context and cost of ensuring access to low-cost drinking water in Massachusetts schools. Am J Prev Med. 2012; 43(3S2):S95–S101. [PubMed: 22898169]
30. Giles CM, Kenney EL, Gortmaker SL, et al. Increasing water availability during afterschool snack: evidence, strategies, and partnerships from a group randomized trial. Am J Prev Med. 2012; 43(3S2):S136–S142. [PubMed: 22898163]
31. Kant AK, Graubard BI. Contributors of water intake in U.S. children and adolescents: associations with dietary and meal characteristics—National Health and Nutrition Examination Survey 2005-2006. Am J Clin Nutr. 2010; 92(4):887–96. [PubMed: 20685949]
32. Scariati PD, Grummer-Strawn LM, Fein SB. Water supplementation of infants in the first month of life. Arch Pediatr Adolesc Med. 1997; 151(8):830–2. [PubMed: 9265887]
33. Gartner LM, Morton J, Lawrence RA, et al. Breastfeeding and the use of human milk. Pediatrics. 2005; 115(2):496–506. [PubMed: 15687461]
34. Hagan, JF.; Shaw, JS.; Duncan, PM., editors. Bright futures: guidelines for health supervision of infants, children, and adolescents. 3rd ed.. American Academy of Pediatrics; Elk Grove Village IL: 2008.
35. Jana, L.; Shu, J. Heading home with your newborn: from birth to reality. 1st ed.. American Academy of Pediatrics Publishing; Elk Grove Village IL: 2005.
36. Lasater G, Piernas C, Popkin BM. Beverage patterns and trends among school-aged children in the U.S., 1989-2008. Nutr J. 2011; 10:103. [PubMed: 21962086]
37. Malik VS, Popkin BM, Bray GA, Despres JP, Hu FB. Sugar-sweetened beverages, obesity, type 2 diabetes mellitus, and cardiovascular disease risk. Circulation. 2010; 121(11):1356–64. [PubMed: 20308626]
38. Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. Am J Clin Nutr. 2006; 84(2):274–88. [PubMed: 16895873]
39. Ismail AI, Sohn W, Lim S, Willem JM. Predictors of dental caries progression in primary teeth. J Dent Res. 2009; 88(3):270–5. [PubMed: 19329463]
40. Marshall TA, Broffitt B, Eichenberger-Gilmore J, Warren JJ, Cunningham MA, Levy SM. The roles of meal, snack, and daily total food and beverage exposures on caries experience in young children. J Public Health Dent. 2005; 65(3):166–73. [PubMed: 16171262]

41. Marshall TA, Levy SM, Broffitt B, et al. Dental caries and beverage consumption in young children. Pediatrics. 2003; 112(3 Pt 1):e184–e191. [PubMed: 12949310]

42. D'Anci KE, Constant F, Rosenberg IH. Hydration and cognitive function in children. Nutr Rev. 2006; 64(10 Pt 1):457–64. [PubMed: 17063927]

43. Edmonds CJ, Jeffes B. Does having a drink help you think? 6-7-year-old children show improvements in cognitive performance from baseline to test after having a drink of water. Appetite. 2009; 53(3):469–72. [PubMed: 19835921]

Table 1

Characteristics of the study sample, by survey year, %[a,b]

Characteristic	2005–2006 (*n*=3984)	2007–2008 (*n*=3152)	2009–2010 (*n*=3334)	2005–2010 (*n*=10,470)	*p* (X^2)
Age (years)					0.97
1–2	11	11	12	11	
3–5	16	16	16	16	
6–11	32	32	33	32	
12–19	41	41	40	41	
Gender					0.93
Male	51	50	50	51	
Female	49	50	50	49	
Race/ethnicity					0.90
Mexican American	13	13	14	13	
Non-Hispanic white	62	61	58	60	
Non-Hispanic black	15	14	13	14	
Other	11	12	14	12	
Poverty level, %					0.32
0–130	27	33	34	31	
131–350	39	34	36	36	
351–499	18	16	14	16	
≥500	15	17	16	16	
Language of sample person interview					0.36
English	94	92	91	92	
Spanish	6	8	9	8	
Household reference person's education level					0.33
<Grade 9	5	7	7	6	
Grade 9–11	13	13	13	13	
High school graduate/GED	26	26	21	24	
Some college/associate's degree	34	30	31	31	
College graduates	23	24	28	25	
Birth country					0.89
U.S.	95	94	95	95	
Mexico	2	2	2	2	
Other	3	4	3	3	
Weight status[b]					
Overweight	31	31	32	31	0.96
Obese	16	16	17	17	0.82

GED, General Educational Development test

[a] Weighted to be nationally representative

[b]Data regarding weight status were available for 9536 of the 10,470 children in the study sample. Overweight was defined as BMI ≥85th percentile for age and gender; obese was defined as ≥95th percentile for age and gender (according to 2000 CDC growth charts).

Table 2

Factors associated with tap water consumption in children and adolescents aged 1–19 years (2005–2010; N=9536)[a,b]

Characteristic	Proportion reporting tap water consumption, %	*p* (X^2)	AOR (95% CI) for reporting tap water consumption
Age (years)		<0.01	
1–2	76		1.00
3–5	76		1.00 (0.77, 1.31)
6–11	85		1.85 (1.47, 2.33)
12–19	87		1.85 (1.32, 2.59)
Gender		<0.01	
Male	86		1.00
Female	82		0.76 (0.64, 0.89)
Race/ethnicity		<0.01	
Mexican American	65		0.32 (0.23, 0.45)
Non-Hispanic white	90		1.00
Non-Hispanic black	78		0.48 (0.34, 0.67)
Other	79		0.50 (0.36, 0.68)
Poverty level, %		<0.01	
0–129	75		0.63 (0.38, 1.05)
130–349	86		0.85 (0.52, 1.38)
350–499	89		0.82 (0.51, 1.32)
≥500	92		1.00
Survey year		0.20	
2005–2006	87		1.00
2007–2008	83		0.72 (0.48, 1.09)
2009–2010	82		0.72 (0.45, 1.15)
Language of sample person interview		<0.01	
English	86		1.00
Spanish	59		0.72 (0.55, 0.95)
Household reference person's education level		<0.01	
<Grade 9	67		0.52 (0.31, 0.88)
Grade 9–11	75		0.50 (0.32, 0.77)
High school graduate/GED or equivalent	82		0.50 (0.33, 0.76)
Some college or associate's degree	87		0.67 (0.45, 1.00)
College graduates or above	92		1.00
Weight status[c]			
Normal	84		1.00
Overweight	83	0.49	1.03 (0.82, 1.29)

GED, General Educational Development test

[a] Weighted to be nationally representative

[b] Adjusted for age, gender, race/ethnicity, poverty level, survey year, language of interview, household reference education level, and child weight status.

[c] Data regarding weight status was available for 9,536 of the 10,470 children in the study sample. Overweight was defined as BMI ≥85th percentile for age and gender (according to 2000 CDC growth charts).