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Lunchtime School Water Availability and Water Consumption among California Adolescents

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Abstract

Purpose—To examine the potential impact of California SB1413, which required school districts to provide free, fresh drinking water during mealtimes in food service areas by July 1, 2011, on greater water consumption among California adolescents.

Methods—Data were drawn from the 2012 and 2013 state-representative California Health Interview Survey. A total of 2,665 adolescents aged 12-17 were interviewed regarding their water consumption and availability of free water during lunchtime at their school.

Results—Three-fourths reported that their school provided free water at lunchtime, mainly via fountains. In a multivariate model that controlled for age, gender, income, race/ethnicity, BMI, and school type, adolescents in schools that provided free water consumed significantly more water than adolescents who reported that water was not available, b (SE) = 0.67 (0.28), p = .02. School water access did not significantly vary across the two years.

Conclusions—Lunchtime school water availability was related to water consumption, but a quarter of adolescents reported that their school did not provide free water at lunch. Future research should explore what supports and inducements might facilitate provision of drinking water during school mealtimes.

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Keywords

Adolescent health; obesity prevention; water

INTRODUCTION

In the United States, about 17% of adolescents are obese, and about a third are overweight.(1, 2) To help curb obesity rates, policymakers have enacted federal and state legislation about the school food and beverage environment. In accordance with 2007 Institute of Medicine recommendations,(3) California state-specific legislation (SB 1413),(4) and the Healthy Hunger-Free Kids Act (S.3307)(5) require availability and provision of water at schools. Water, which is non-caloric, may displace less healthy, caloric beverages, and is associated with reduced dental caries and improved cognitive functioning in children.(6-12) Moreover, an analysis of a representative U.S. sample suggests that over half of youth aged 6-19 are not adequately hydrated.(13)

Experimental and quasi-experimental studies of increased water provision in schools through non-fountain sources, as well as by supplying drinking cups near water sources, have shown that improved water availability and promotion can result in increased student water consumption.(14-17) Moreover, in a representative sample of California school administrators, 75% reported that their schools provided free drinking water in food service areas in 2011 (and this percentage increased from pre- to post-implementation of SB 1413, from 72% to 83%).(18) However, no previous studies have examined these issues in a large population-based sample of adolescents.

In the present research, we examined adolescents' perceptions of water access at lunchtime in California schools over time (in 2012 and in 2013), since the passage of California SB 1413, which required school districts to provide free, fresh drinking water during mealtimes in school food service areas by July 1, 2011. We also examined whether perceptions of water access in schools during lunchtime were associated with adolescents' water consumption. Based on the prior research reviewed above, we hypothesized that greater school water access during lunchtime would be associated with greater water consumption overall.

We also explored the association between lunchtime water availability and milk consumption. Milk consumption in adolescence can be beneficial for increasing bone mineral density, especially among girls.(19) Thus, some school stakeholders have been concerned about potential negative effects of water availability on milk consumption. However, research has suggested that milk consumption may be relatively stable even when water is provided in school food areas (16). Thus, we did not make firm a hypothesis about the expected direction of the effect.

Because adolescents are in a developmental period in which they are beginning to make independent choices about diet, gaining autonomy from their parents and being more influenced by their peers at school, we chose to focus this study on adolescents.(20-22) We used data from the state-representative California Health Interview Survey (CHIS), which interviews adolescents aged 12-17 annually.

METHODS

Participants

The present analysis used data from the 2012 and 2013 CHIS, a population-based telephone survey with a multi-stage sampling design that is representative of the California non-institutionalized population. Detailed information about CHIS methodology is available elsewhere.(23-27) A total of 20,355 adults and 1,464 adolescents aged 12-17 years provided data in CHIS 2012, and 20,724 adults and 1,201 adolescents provided data in CHIS 2013.

One randomly selected adult (aged 18 years or older) was interviewed in each household after providing informed consent. If the household contained adolescents aged 12-17, one randomly selected adolescent was interviewed as well, upon obtaining parental permission and assent from the adolescent. In 2012, 59.6% of the randomly selected adolescents were given parental permission to participate in the interview, and 66.5% of them completed the interview. In 2013, these rates were 59.3% and 71.3%, respectively. Interviews were conducted in English, Cantonese, Korean, Mandarin, Spanish, and Vietnamese. This research was approved by the Institutional Review Boards of RAND Corporation and the University of California, Los Angeles.

Measures

School Lunchtime Water Availability—Adolescents were asked items constructed for the present study to assess water availability in schools during lunchtime; these items were monitored closely by interviewers for comprehension issues during the first few months of data collection, and no issues were identified. Adolescents were first asked, “Does your school offer free drinking water to students during lunchtime?” If the adolescent asked what “free” meant, the interviewer clarified, “By free, I mean water that you don’t have to pay for.”

Adolescents who indicated that their school offered free drinking water to students at lunch were further asked questions about the different sources of free water in their schools, including: drinking fountains or faucets; water pitchers; a water cooler, such as a large container of water with a spout; and free bottled water. For example, adolescents were asked, “Does your school offer free drinking water to students at lunchtime from drinking fountains or faucets in the cafeteria or where students eat?” Adolescents who indicated that their school offered free drinking water to students at lunch were also asked, “Does your school give out free cups for drinking water during lunchtime?” (Students in schools that gave out free bottled water were not asked about cups, because it was assumed that such students would not need to pour the water from the bottle into the cup. In addition, students were only asked about water availability at lunch, and not breakfast, which is also covered by California SB 1413.)

Water and Milk Consumption—Adolescents were asked, “Yesterday, how many glasses of water did you drink at school, home, and everywhere else? Count one cup as one glass and count one bottle of water as two glasses. Count only a few sips, like from a water fountain, as less than one glass. Your best guess is fine." If needed, the interviewer clarified by saying, "Include tap water, like from a sink, faucet, fountain, or pitcher, and bottled water like Aquafina®. Do not include flavored sweetened water." If the adolescent was not in school the day before the interview, he/she was instead asked about "the last day that you were in school." This item was drawn from a prior California school-based study.(28) One item was used to assess milk consumption: "Yesterday, how many glasses of nonfat or low-fat milk did you drink? Do not include 2% milk or whole milk." Responses to both items were considered continuously (as number of glasses of water or milk reported); responses of less than a glass of water were coded as .5 glasses.

Covariates: Socio-demographic Characteristics, BMI, and School Type—Socio-demographic characteristics included age, gender, and race/ethnicity, which were reported by adolescents, and household income, which was reported by parents. Race categories were listed as: White, Black or African American, Asian, American Indian or Alaska Native, Other Pacific Islander, Native Hawaiian, and Other; participants were asked about Latino or Hispanic ethnicity in a separate question. Household income responses were categorized into 0-99% of Federal Poverty Level (FPL), 100-199% of FPL, 200-299% of FPL, and ≥300% of FPL. Adolescents reported their height and weight, from which BMI was calculated and classified as underweight (BMI <5th percentile), normal weight (BMI ≤ (5th but <85th percentile), overweight (BMI ≥85th percentile and < 95th percentile), or obese (BMI ≥95th percentile) (29). Adolescents also reported the type of school that they attended (elementary, middle, or high school, or not in school).

Analyses

We examined descriptive statistics for socio-demographic characteristics by each year separately, as well as for the combined 2012/2013 sample. We also examined the percentages of participants who reported lunchtime water availability at their school overall and by specific type of water delivery (e.g., fountains) for 2012 and 2013 separately and overall, testing differences between years for each water availability variable. We then performed bivariate and multivariate linear regressions predicting water consumption with lunchtime water availability, controlling for socio-demographic characteristics (age, gender, income, race/ethnicity, and school type) and BMI, and adjusting for clustering within school. Parallel analyses were performed for milk consumption. Weights were used to account for CHIS's complex survey design as well as to adjust the sample to be representative of the California population.

RESULTS

Descriptive Statistics of the Sample

On average, adolescents reported that they drank 5.10 (SE = 0.12) cups of water and 0.76 cups of milk (SE = 0.05) per day. Table 1 shows descriptive statistics of the sample's socio-demographic characteristics overall and by year. The sample was close to evenly split by gender and age (12-14-year-olds vs. 15-year-olds), and about 20.8% had very low income (0-99% of FPL). In terms of race/ethnicity, 5.3% were African American/Black, 10.7%, Asian, 47.6% Latino, and 31.5% White; 4.9% identified with two or more racial/ethnic groups, American Indian, Alaska Native, other Pacific Islander, Native Hawaiian, or other. In addition, there was a lower percentage than expected (statistically) of those with income 0-99% of the federal poverty line in 2013 (18.2%) than in 2012 (23.1%), $\chi^2 = 2.16$, $p = .03$, and a higher percentage than expected of those at or over incomes within 300% of the federal poverty line in 2013 (44.8%) than in 2012 (39.4%), $\chi^2 = 2.26$, $p = .02$. There was also a greater percentage than expected of overweight adolescents in 2013 (19.4%) than in 2012 (14.9%), $\chi^2 = 2.11$, $p = .04$. Given the large number of comparisons tested and small number of comparisons found to be significant, we combined the two study years for analysis.

School Lunchtime Water Availability

Table 2 shows the percentages of schools that offered free water overall and by method. Across both years, 75.3% of adolescents reported that their schools offered free water at lunch, and 21.3% reported that they had access to free cups. Among adolescents who reported that their schools offered free water, 93.3% reported access to fountains, 18.2% to water coolers, and 17.0% to pitchers; 10.1% received bottled water. School lunchtime water availability percentages did not significantly differ between 2012 and 2013.

Test of the Relationship between School Lunchtime Water Availability and Water Consumption

In bivariate analyses, adolescents in schools in which water was available for free during lunchtime drank more cups of water (M=5.25, SE=.15) than did adolescents in schools without free water availability (M=4.54, SE=.19). Further examination of the distribution of number of glasses of water consumed by water availability revealed that a higher percentage (14.0%) of adolescents who reported that water was available at their schools drank 8 or more glasses of water, compared with adolescents who did not report that water was available (3.1%), Rao-Scott $\chi^2(3) = 8.2$, $p = .04$. A t-test indicated that water consumption did not differ between adolescents in schools that offered cups, M (SE) = 5.2 (0.4), and adolescents in schools that did not, M (SE) = 5.3 (0.2), $p = 0.72$.

Table 3 presents the results of bivariate and multivariate regression analyses of water consumption. In the bivariate and multivariate analyses, lunchtime water availability was associated with greater water consumption, [bivariate: b (SE) = 0.74 (0.26), $p < .01$; multivariate: b (SE) = 0.67 (0.28), $p < .05$]. In the multivariate analysis, age and race/ethnicity were also related to consumption, with younger adolescents (aged 12-14) reporting drinking fewer cups of water per day than older adolescents (aged 15-17), and African American/Black adolescents drinking fewer cups of water than White adolescents. In addition, adolescents who were not in school drank fewer cups of water than did adolescents in high school (the reference group).

Test of the Relationship between Water Availability and Milk Consumption

Lunchtime water availability was not significantly associated with milk consumption in a bivariate test. Specifically, adolescents who reported that they had free access to water at lunch, M = 0.7 (SE = 0.1), did not consume more milk than adolescents who reported that

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they did not have access to free water at lunch, M = 0.8 (SE = 0.1), b (SE) = 0.1 (0.1), p = 0.35. Thus, a multivariate analysis was not conducted.

DISCUSSION

California law has required schools, starting in July 2011, to provide fresh, free drinking water for their students during mealtimes, a requirement that was bolstered by a similar provision in the federal Healthy Hungry-Free Kids Act. We set out to examine whether California schools are indeed providing free water by querying a representative sample of California youth, finding that three-quarters of adolescents reported that schools are doing so at lunchtime, mostly via water fountains, and that one-fifth of adolescents reported that schools provided cups. We did not find that milk consumption was adversely affected by water availability. Despite the potential for the recent legislation to lead to increased water availability over the first few years following passage, adolescents reported no change in water availability between 2012 and 2013.

Most participants had access to water only via drinking fountains. Prior qualitative and quantitative research suggests that students may be reluctant to rely mainly on water fountains for water intake during the school day due to negative attitudes about water fountains.(14, 18) For example, in a survey of 3,211 students at ten California middle schools, 59% of students reported that school fountains are unclean, and 48% that fountain water does not taste good. In qualitative interviews, school employees also have cited concerns about water quality, despite assurances that school water systems undergo testing and monitoring.(14) Moreover, school water fountains may be insufficient to meet student needs for adequate drinking water with meals, especially if many students share fountains during lunchtime and cups are not available with which to obtain an adequate serving.(14, 17)

School water availability was associated with greater water consumption. These results speak to the potential for schools to have tangible effects on students' health, by promoting healthful beverage consumption. Some schools offered alternatives to drinking fountains (e.g., pitchers) and provided cups, possibly because they were prompted by the law to find alternatives to fountains. Combined with the availability of cups or water bottles, such alternatives may provide more realistic ways for students to obtain enough water to drink with a meal. However, we did not find that offering cups had a measureable impact on student water consumption beyond offering water solely via fountains or other sources. These results are in contrast to a prior randomized controlled trial, in which supplying cups to students near school water sources resulted in greater water consumption.(17) Our non-significant results for cups may be in part because we were not able to control for factors that may have influenced the use of cups (e.g., differences in cup location and availability by school) – variables that were held constant in the randomized controlled trial.

Our analysis suggested the presence of disparities in water access and intake, with White adolescents reporting greater access to water at school and also greater water consumption. Adolescents of color may on average attend schools in districts with lower funding for new initiatives, such as improved water access beyond water fountains. The California state and federal school water laws did not earmark funds for improving water access in schools, and thus schools with more resources may be better able to comply with the law. Additional research is needed to examine whether racial/ethnic disparities in obesity, indicating greater obesity levels among African American/Black and Latino adolescents versus White adolescents (2) parallel racial/ethnic disparities in school water access.

Our analysis has several limitations. The water availability items were not validated against school observations and may not match actual water availability; some students may not eat lunch in or near the cafeteria and thus may not be aware of any water availability at their school during mealtimes. The water consumption item assessed water consumption in general, rather than water consumption at school, and water availability at school presumably would have a stronger effect on water consumption specifically at school. In addition, we cannot conclude causality between water availability and water consumption from our cross-sectional, non-experimental study. Other confounding factors that we did not measure may be responsible for the increase in water consumption. Further, although we had data from two years of CHIS, we could not conduct a longitudinal analysis following a cohort of adolescents over time, because different adolescents are sampled in each CHIS wave.

Conclusion

Despite the existence of state and federal law on school water availability, at least a quarter of California schools were not offering free water to students during lunch, and many schools offered water via fountains, which may provide insufficient water quantity and are perceived to have poor quality water. Although school water availability was related to water consumption, adolescents of color were less likely to have water access at school during lunchtime. Future research should continue to examine whether water access in schools is increasing nationally, as is suggested by prior research.(30) A lack of an increase in some districts could suggest a need for drinking fountain upgrades or sustainable alternatives, as well as technical assistance, training, and funding to implement such improvements.

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Abbreviations

CHIS	California Health Interview Survey
FPL	Federal Poverty Level

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Implications and Contribution

To help prevent obesity and promote health, California SB1413 requires school districts to provide free drinking water at mealtimes in food service areas. We examined SB 1413's potential impact, finding that lunchtime school water availability was related to adolescents' water consumption in the 2012 and 2013 California Health Interview Survey.

Table 1

Descriptive Statistics of the Sample of 2,625 Adolescents in the California Health Interview Survey, 2012-2013

Socio-Demographic Characteristic	2012 (%) N = 1,464	2013 (%) N = 1,201	Combined 2012/2013 Data (%)N = 2,665	Test of Difference Between Years (χ^2, p-value)
Age M (SE)[a]	14.6 (0.1)	14.5 (0.1)	14.5 (0.1)	——
Aged 12-14	48.7%	49.0%	48.8%	χ^2 = 0.10, p = 0.92
Aged 15-17	51.4%	51.0%	51.2%	χ^2 = 0.10, p = 0.92
Annual Household Income				
0-99% of FPL	23.1%	18.2%	20.8%	χ^2 = 2.16, p = 0.03
100-199% of FPL	24.8%	25.1%	24.7%	χ^2 = 0.11, p = 0.91
200-299% of FPL	12.7%	11.8%	12.5%	χ^2 = 0.40, p = 0.69
≥300% of FPL	39.4%	44.8%	42.0%	χ^2 = 2.26, p = 0.02
Gender[b]				
Boys	51.2%	51.2%	51.2%	_____
Girls	48.8%	48.8%	48.8%	_____
Race/Ethnicity				
African American/Black	4.4%	6.2%	5.3%	χ^2 = 1.9, p = 0.10
Asian	11.4%	9.9%	10.7%	χ^2 = 0.94, p = 0.35
Latino	48.1%	47.2%	47.6%	χ^2 = 0.34, p = 0.73
White	30.8%	32.2%	31.5%	χ^2 = 0.71, p = 0.48
Two or More Races/Ethnicities	5.3%	4.5%	4.9%	χ^2 = 0.77, p = 0.44
BMI				
Underweight	2.8%	2.1%	2.5%	χ^2 = 0.90, p = 0.37
Normal Weight	67.0%	64.1%	64.5%	χ^2 = 0.97, p = 0.33
Overweight	14.9%	19.4%	16.9%	χ^2 = 2.11, p = 0.04
Obese	15.3%	14.4%	16.2%	χ^2 = 0.39, p = 0.70
School Level				
Elementary	4.1%	5.5%	4.1%	χ^2 = 0.94, p = 0.35
Middle	28.7%	27.9%	29.0%	χ^2 = 0.43,

Socio-Demographic Characteristic	2012 (%) N = 1,464	2013 (%) N = 1,201	Combined 2012/2013 Data (%)N = 2,665	Test of Difference Between Years (χ^2, p-value)
				p = 0.67
High	56.7%	54.8%	55.1%	χ^2 = 0.87, p = 0.38
Other	10.5%	11.6%	11.7%	χ^2 = 0.65, p = 0.52

[a]The age range of the sample in both years is 12-17 years, based on the adolescent interview eligibility criteria.

[b]Because gender was used to create weights for the present dataset, the SE for gender is zero and the percentages remained the same in each set of weights; thus, no inferential statistical test was performed between years.

Table 2

Availability of Free Water during Lunchtime at School among California Adolescents, 2012-2013

	2012 (%, 95% Confidence Interval) N = 1,464	2013 (%, 95% Confidence Interval) N = 1,201	Combined 2012/2013 Data (%, 95% Confidence Interval) N = 2,665	Difference between 2012 and 2013 (χ^2, p-value)
Water Available at School at Lunch	74.8% (71.0-78.6)	75.8% (71.5-80.1)	75.3% (72.4-78.1)	$\chi^2 = 0.34$, $p = 0.73$
Free Cups Provided	20.5% (16.3-24.6)	22.1% (17.2-27.0)	21.3% (18.1-24.5)	$\chi^2 = 0.50$, $p = 0.62$
Water Provided Via:[a]				
Bottled Water	10.7% (7.8-13.6)	9.6% (6.2-13.0)	10.1% (7.9-12.4)	$\chi^2 = 0.47$, $p = 0.64$
Fountains	93.1% (90.8-95.4)	93.5% (90.1-96.9)	93.3% (91.3-95.3)	$\chi^2 = 0.18$ $p = 0.86$
Pitchers	17.3% (13.2-21.5)	16.6% (12.1-21.1)	17.0% (13.9-20.0)	$\chi^2 = 0.24$, $p = 0.81$
Water Cooler	17.5% (13.8-21.3)	19.0% (14.0-23.9)	18.2% (15.2-21.3)	$\chi^2 = 0.45$, $p = 0.65$

[a]Among students in schools with water availability

Table 3

Linear Regressions of Association of Lunchtime Water Availability in School with Glasses of Water Consumed by Students Yesterday

	Unadjusted b (SE)	Adjusted b (SE)
Free Water Availability	0.74 (0.26)**	0.67 (0.28)*
Aged 12-14 (Reference = 15-17)	-0.46 (0.24)+	-0.80 (0.32)*
Income (Reference = ≥300% of FPL)		
0-99% of FPL	-0.13 (0.38)	0.17 (0.38)
100-199% of FPL	-0.20 (0.36)	0.03 (0.40)
200-299% of FPL	-0.28 (0.30)	-0.20 (0.29)
Female Gender (Reference = Male)	-0.38 (0.24)	-0.32 (0.25)
Race/Ethnicity (Reference = White)		
African American/Black	-1.32 (0.47)**	-1.23 (0.52)*
Asian	0.65 (0.49)	0.62 (0.50)
Latino	-0.36 (0.29)	-0.40 (0.32)
Two or More Races/Ethnicities	0.58 (0.74)	0.53 (0.69)
BMI (Reference = Normal Weight)		
Underweight	-0.56 (0.59)	-0.71 (0.64)
Overweight	0.38 (0.43)	0.52 (0.38)
Obese	-0.16 (0.33)	-0.02 (0.31)
School Level (Reference = High School)		
Not in School	-2.08 (0.15)***	-2.84 (0.45)***
Elementary	-0.66 (0.37)+	-0.04 (0.45)
Middle	-0.07 (0.34)	0.53 (0.42)
Other	-0.26 (0.33)	-0.09 (0.35)

+ $p < .10$;

* $p < 0.05$;

** $p < 0.01$

Note: All analyses are adjusted for clustering within school. M(SE) of water consumption = 5.1 (0.1) cups.