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Trends in Sugar-Sweetened Beverage and 100% Fruit Juice Consumption Among California Children

Dr. Amy L. Beck, MD, MPH,

Department of Pediatrics, University of California San Francisco

Dr. Anisha Patel, MD, MSPH, and

Department of Pediatrics, University of California San Francisco, San Francisco, CA

Dr. Kristine Madsen, MD, MPH

Division of Community Health and Human Development, University of California Berkeley, School of Public Health, 219 University Hall, #7360, Berkeley, CA 94720-7360, Phone 510-666-3726

Amy L. Beck: BeckA@peds.ucsf.edu; Anisha Patel: PatelA@peds.ucsf.edu; Kristine Madsen: madsenk@berkeley.edu

Abstract

Objective—To determine trends in the consumption of sugar-sweetened beverages (SSBs) and 100% fruit juice by California children ages 2–11 years from 2003 to 2009

Methods—This analysis used serial cross-sectional data from the *California Health Interview Survey*, a telephone survey of households in California. Parents were asked how many servings of SSBs and 100% fruit juice the child consumed the day before. A test of trend was used to evaluate changes in consumption over time. Multivariate logistic regression was used to determine the independent effects of race/ethnicity, parental education and household income on beverage consumption.

Results—The percent of children consuming an SSB on the prior day declined from 41% in 2003 to 16% in 2009 ($p<0.001$) among children ages 2–5 and from 56% in 2003 to 33% in 2009 ($p<0.001$) among children ages 6–11. The percent of children consuming any SSB decreased for all racial/ethnic groups, although there were disparities with higher consumption among Latinos. Among children ages 2–5, consumption of 2 or more servings of 100% fruit juice per day *decreased* among white children and *increased* among Latinos. For children ages 6–11, consumption of 2 or more servings of 100% fruit juice per day remained *stable* for white children and *increased* among Latinos and African-Americans.

Conclusions—The decrease in SSB consumption by California children from 2003 to 2009 is a promising trend. The increase in 100% fruit juice consumption among minority children during this period may be an unintended consequence of efforts to reduce SSB consumption.

Keywords

Sugar-sweetened beverages; 100% fruit juice; health disparities

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Introduction

The consumption of sugar-sweetened beverages (SSBs) has been associated with obesity^{1–3} dental caries,^{4–8} and the metabolic syndrome.⁹ There is also evidence that 100% fruit juice consumption may contribute to obesity^{10–13} and dental caries.^{4,6,7} Consequently, the Institute of Medicine (IOM) has advised that children avoid drinks with added sugar¹⁴ and the American Academy of Pediatrics (AAP) has recommended limiting children's juice consumption.¹⁵

Obesity¹⁶ and dental caries¹⁷ are more prevalent in Latino and African-American children compared to white children and in low-income versus higher income children.^{17,18} It is possible that differences in beverage consumption patterns may contribute to these disparities in health outcomes. Yet, relatively few studies have examined trends in beverage consumption by race/ethnicity.^{19–22} Further delineating the differences in beverage consumption among children from different racial/ethnic groups may help to explain demographic disparities in obesity and caries rates and inform targeted prevention efforts.

Over the past decade, California has passed legislation to ban SSB sales in schools and implemented public health campaigns focused on reducing SSB consumption by children.^{23,24} In contrast to the attention on SSB consumption, fewer efforts have targeted children's 100% fruit juice consumption. However, to our knowledge, no one has compared trends in SSB and 100% fruit juice consumption during this period. The objective of this study was to use data from the California Health Interview Survey (CHIS) to examine trends in children's consumption of SSBs and 100% fruit juice in California from 2003 to 2009, looking for differences by age group and race/ethnicity.

Methods

Data source

We analyzed data on SSB and 100% fruit juice consumption among California children ages 2 to 11 years in 2003, 2005, 2007 and 2009 using public use data files from the California Health Interview Survey (CHIS), the largest statewide health survey. CHIS is a telephone survey of households in California that employs a two-tiered geographically stratified random digit dial design and has been conducted every other year since 2001. CHIS conducts separate age appropriate surveys for children, adolescents and adults. Households are randomly selected; and of households with children, one child is randomly selected. For children under 12, the adult most knowledgeable about the child's health completed the survey. Weighting variables are provided to adjust for sample selection probabilities and non-response bias and to ensure that CHIS estimates conform to actual population demographics.²⁵ CHIS uses the California Department of Finance Population Estimates and Population Projections to determine population totals by age, sex, and race. Using the weighting variables, researchers can calculate statewide estimates for health indicators as well as estimates for the state's major racial/ethnic groups. In 2007, CHIS began including cell phones in addition to landlines. Interviews are conducted in English, Spanish, Mandarin, Cantonese, Vietnamese and Korean. In 2003, CHIS first added a question to the child survey that specifically examined SSB consumption.

Measures of outcome variables

In 2003 and 2005, parent's reported their child's consumption of sugar-sweetened beverages (SSBs) by responding to the following question "Yesterday, how many glasses or cans of soda, such as Coke, or other sweetened drinks, such as fruit punch or Sunny Delight did {he/she} drink? Do not count diet drinks." In 2007 and 2009, the question was nearly identical but the example of "Sunny Delight" was replaced with "sports drinks." In 2003, children's

consumption of 100% fruit juice was determined by the following question “Yesterday, how many glasses or small cartons of 100% fruit juice, such as orange or apple juice, did {CHILD NAME} drink?” In 2005, 2007 and 2009, the question was nearly identical, but “small cartons” was replaced with “boxes.”

The child’s race/ethnicity was determined by interview with the proxy respondent and was classified as one of the following: Latino or non-Latino: white, Asian, African-American, American Indian/Alaskan, Pacific Islander or mixed race. The adult proxy respondent was also asked to estimate the yearly household income and to report their highest level of education.

Analysis

We used the survey function in *Stata* (*Stata Version 12*, StataCorp LP) and the weights provided by CHIS to determine statewide estimates for each outcome of interest. We first determined mean servings of SSBs and 100% fruit juice per day in each survey year for children ages 2 to 5 and children ages 6 to 11. We used a test of trend to assess the significance of changes in mean consumption over time. We then created dichotomous variables for both beverages. As consumption of SSBs was low overall, we dichotomized consumption of SSBs into none or any and estimated the percent of children who were reported to have consumed any SSB. The American Academy of Pediatrics (AAP) recommends that children age 6 and under consume a maximum of 4 to 6 ounces of fruit juice per day and that children ages 7 and older consume no more than 12 ounces per day.²⁶ Thus, we also determined the percent of children consuming 2 or more servings of fruit juice in a day, which exceeds AAP recommendations for both age groups (assuming an 8 ounce serving).

To analyze trends over time in our two dichotomous variables, we pooled data from all four survey years and used logistic regression with consumption of any SSB and consumption of 2 servings of 100% fruit juice as outcome variables and year as a predictor variable. We used a test of trend to determine the significance of the trends. We first evaluated trends for our two outcome variable for children ages 2 to 5 and 6 to 11 with all children included in the model. We then added race/ethnicity to our model to look at differences by race using a race/ethnicity by year interaction term. We evaluated four race/ethnicity categories (white, Asian, Latino and African-American). We found significant differences in trends among the racial/ethnic groups and hence present results for each group separately.

We created multivariate models to adjust for the independent effects of parental education level, and household. We created four income categories: <Federal Poverty Line (FPL), 100–199% FPL, 200–299% FPL and >300% FPL. We also assessed four categories of parental educational achievement: less than a high school education, high school graduate, some post-secondary education and bachelor’s degree or beyond. These multivariate models include a race/ethnicity by year interaction term to compare trends in beverage consumption over time between racial/ethnic groups while controlling for parental education and household income. Our models assume that the effects of parental education and household income are constant over the four years but that the effect of race/ethnicity may change. We used an adjusted Wald test to determine the significance of trends within racial/ethnic groups over time and to determine whether there were significant differences in trends between different racial/ethnic groups.

Results

In our target age group (2 to 11 years), there were survey results for 7150 children in 2003, 9359 children in 2005, 8253 children in 2007 and 7649 children in 2009. The racial/ethnic

distribution of the participants was as follows: 37% Latino, 43 % non-Latino white, 10% non-Latino Asian, 4% non-Latino African-American, and 7% non-Latino mixed race or other. Results from all children ages 2 to 11 were included in the analysis of overall trends in SSB and 100% fruit juice consumption. Our racial/ethnic sub-group analyses and the multivariate analyses excluded children classified as mixed or other race.

Overall Beverage Consumption

In unadjusted analyses, mean daily servings of SSB (Table 1) decreased significantly for both age groups ($p<0.001$ for both trends). For children ages 2 to 5, mean servings of 100% fruit juice consumption did not change. However, for children ages 6 to 11 mean servings of 100% fruit juice increased ($p<0.001$). For both age groups, the percent consuming any SSB decreased significantly (Table 2). While consumption of 2 servings of 100% fruit juice did not change for children ages 2 to 5, it increased for children ages 6 to 11 (Table 2).

Beverage Consumption by Race/Ethnicity

In unadjusted analyses, the percentage of children consuming any SSB in both age groups declined in each of the four major racial/ethnic groups (Table 2). For children ages 2 to 5, the percent consuming 2 or more servings of 100% fruit juice declined among whites, increased significantly among Latinos and was stable for African-Americans and Asians (Table 3). For children ages 6 to 11, the percent consuming 2 or more servings of 100% fruit juice was stable for white and Asian children but increased for Latinos and African-Americans (Table 3).

Multivariate analyses: Consumption of any SSB

In our pooled multivariate analysis for children ages 2 to 5, Latino race/ethnicity was associated with higher odds of consuming any SSB (Table 4). Having a parent with education beyond a high school degree was associated with lower odds of consuming any SSB. The downward trend in the percent consuming any SSB remained significant for all four racial/ethnic groups in these adjusted models ($p<0.001$). However, the slope of the trend was less steep for Latino children compared to white children ($p=0.015$).

Among children ages 6 to 11, both Latinos and African-Americans had higher odds of any SSB consumption (Table 4). Having a parent with a bachelor's degree was associated with lower odds of any SSB consumption. The downward trend in the percent consuming any SSB remained significant for all racial/ethnic groups in the multivariate model with no differences in the trends among the groups.

Multivariate analyses: Consumption of 2 or more servings of 100% fruit juice

Among children ages 2 to 5, consumption of 2 or more servings of 100% fruit juice was associated with lower parental income in our pooled multivariate analysis (Table 5). There was a significant decrease in high juice consumption among whites from 2003 to 2009 ($p<0.001$) and a significant increase in high juice consumption among Latinos ($p=0.004$, p -value for comparison of trends between whites and Latinos <0.001).

Among children ages 6 to 11, high juice consumption was positively associated with Latino race/ethnicity in the pooled analysis (Table 5). Higher household income and having a parent with a bachelor's degree or greater was also associated with high juice consumption. There was no change in high juice consumption among whites from 2003 to 2009 and a significant increase among Latinos ($p<0.001$), African-Americans ($p<0.001$) and Asians ($p=0.017$). The difference in trends between white and Latinos ($p=0.002$) and whites and African-Americans ($p=0.005$) were both significant, while the difference in trends between whites and Asians neared significance ($p=0.067$).

Discussion

Our study revealed several key findings. First, SSB consumption among California children decreased from 2003 to 2009, a trend seen across racial/ethnic groups. There were, nonetheless, disparities with higher odds of SSB consumption among Latinos, African-Americans and children of parents with lower educational attainment. We also found that lower household income was independently associated with consumption of two or more servings of 100% fruit juice. Furthermore, consumption of two or more servings of 100% fruit juice *increased* among Latino children in both age categories and African-American children ages 6 to 11 while it *decreased* among white children ages 2 to 5 and remained the same among white children ages 6 to 11. These trends remained significant after controlling for parental education and household income.

Our study confirms the findings of Shi et al. which documented a decrease in the percent of California children consuming 2 or more servings of SSBs per day from 2003 to 2007 and demonstrates further reduction in SSB consumption in 2009.²⁷ The most recent study to examine national trends in SSB consumption over a similar time period found that children's consumption of any SSB decreased from 1999–2000 to 2007–2008. However, the magnitude of the decrease, from 78% to 66% consuming any SSB, was less than what we found.²⁸ Our results suggest that beverage consumption patterns in California may differ from the rest of the country. These differences might reflect California's efforts to reduce children's SSB consumption. The California legislature passed a ban on the sale of most SSBs in elementary and middle schools in 2003 and in high schools in 2005.²³ In addition, numerous municipalities and counties in California have adopted policies limiting or eliminating the sale of SSBs in county operated sites including recreational sites that serve children.²³ Finally, several county public health departments in California have developed public awareness campaigns, such as the *Soda Free Summer Campaign*, to directly educate parents and children about the health effects of SSBs.²³

While our finding that SSB consumption decreased among all groups was heartening, it is concerning that disparities in SSB consumption by race/ethnicity still persist. Several studies have demonstrated racial/ethnic disparities in SSB consumption among children consistent with our results.^{19,22,29} Taveras et al. found that Latino and African-American 2 year olds in Massachusetts were more likely to consume SSBs than white 2 year olds after adjusting for socioeconomic factors.¹⁹ A recent study of SSB consumption among 2 year olds in Oregon also found that Latino and African-American children had higher SSB consumption after adjusting for parental education and income.²⁹ In a study of children in grades 4 to 6 in Texas, Latinos and African-American children were more likely to consume SSBs after controlling for parental education.²² Similar to our results, a report from the National Poll on Children's Health also found that children from low-income families were more likely to drink two or more servings of 100% fruit juice than those from higher income families.³⁰

Policies that explicitly promote 100% fruit juice consumption may be contributing to income disparities in 100% fruit juice consumption. For example, 100% fruit juice is included in the supplemental food package that low-income families receive from the Woman Infant and Children's (WIC) program,³¹ and is included in the federally-funded Child Care Food Program³² and the National School Lunch program.³² Furthermore, in the California legislation on beverages in schools 100% fruit juice is classified as a "healthful beverage" with no restrictions on its sale. Given these official endorsements, low-income and minority parents may perceive 100% fruit juice as a healthy alternative to SSBs.

Other potential reasons for disparities in beverage consumption by race/ethnicity and socioeconomic status may include disparities in health literacy, disparities in access to well

child care³³ (which should include counseling on beverage consumption), and increased advertising of unhealthy beverages minority communities.³⁵ It is also possible that both public health messaging and provider counseling are not adequately tailored so that they resonate with Latino and African-American parents in California. Our results stress the need for comprehensive education on healthy beverage intake both from pediatricians and through public health campaigns and the importance of ensuring that messages reach all groups. Moreover, it is crucial that provider counseling and public health messages specifically include the recommendation that 100% fruit juice consumption should be limited and not used as a replacement for SSBs. Changes in federal and state policies which implicitly and explicitly promote 100% fruit juice consumption may also be necessary.

Our study has several limitations. The data on SSB and 100% fruit juice consumption was based on parental report, which is subject to social desirability bias. Furthermore, asking about consumption on the previous day only might not represent typical consumption and parents may not have been aware of what the child had consumed in daycare or at school. Given the variety of different beverage products available that contain varying percentages of fruit juice, it is possible that some parents did not understand the questions on SSBs and 100% fruit juice and may have misreported. In addition, the slight change in the wording of the SSB question from 2005 to 2007 could have led to a false drop in the percentage of children reported to have consumed an SSB in 2007. However, SSB consumption also trended downward from 2003 to 2005 and continued to trend downward from 2007 to 2009 suggesting a true overall downward trend across the four years studied despite the survey wording change. Finally, the results are only representative of California and may not be generalizable to the rest of the United States. However, because approximately one out every 8 children in the United States live in California,³⁶ the public health implications remain significant.

Conclusions

We have demonstrated a sharp decline in SSB consumption across racial/ethnic and groups in California suggesting that efforts to reduce children's SSB consumption may be having an impact. Nonetheless, disparities in SSB consumption by race/ethnicity and parental education level persist. Unfortunately, our study also suggests that efforts to reduce SSB consumption in California may have had an unintended consequence of increasing 100% fruit juice consumption among Latino and African-American children. Addressing this emerging disparity in children's beverage intake may be necessary to reduce disparities in caries and obesity rates among children in California.

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What's New?

Sugar-sweetened beverage (SSB) consumption decreased among California children from 2003 to 2009, but disparities in SSB consumption persisted. In this period, 100% fruit juice consumption decreased among white children while it increased among minorities.

Table 1

Mean servings of SSBs^a and 100% fruit juice consumed on the day prior by California children from 2003 to 2009

	2003		2005		2007		2009		p-value ^b
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	
SSBs									
Ages 2–5	0.66	(0.60–0.72)	0.5	(0.45–0.53)	0.29	(0.26–0.33)	0.21	(0.18–0.25)	<0.0001
Ages 6–11	0.91	(0.85–0.96)	0.71	(0.67–0.75)	0.54	(0.50–0.58)	0.43	(0.39–0.47)	<0.0001
100% Fruit Juice									
Ages 2–5	1.33	(1.26–1.44)	1.34	(1.28–1.39)	1.45	(1.38–1.51)	1.32	(1.24–1.39)	0.157
Ages 6–11	0.94	(0.88–0.99)	0.97	(0.92–1.02)	1.13	(1.07–1.10)	1.11	(1.04–1.18)	<0.0001

^aSSB—Sugar-sweetened beverage

^bp-value for test of trend from 2003 to 2009

Table 2

The percent of children ages 2–5 and 6–11 who consumed an SSB on the day prior by race/ethnicity

	2003		2005		2007		2009	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Ages 2–5*								
All	40	(38–43)	33	(30–35)	22	(20–24)	16	(14–19)
White	31	(26–35)	23	(20–26)	13	(11–16)	8	(5–10)
Latino	47	(43–51)	40	(36–44)	28	(25–31)	22	(18–26)
African-American	44	(32–57)	48	(35–61)	25	(16–34)	14	(4–24)
Asian	36	(28–45)	24	(19–30)	17	(11–23)	9	(4–15)
Ages 6–11*								
All	54	(52–56)	47	(45–49)	39	(37–41)	33	(30–35)
White	47	(43–50)	41	(38–45)	34	(31–37)	26	(23–29)
Latino	59	(56–63)	50	(46–54)	44	(40–48)	39	(35–44)
African-American	59	(50–67)	52	(43–62)	46	(36–56)	37	(24–50)
Asian	47	(40–55)	47	(41–54)	33	(26–40)	27	(20–34)

* p<0.001 for test of trend from 2003 to 2009 for all children and for each racial/ethnic groups in both age categories

Table 3

Percent of children ages 2–5 and 6–11 who consumed two or more servings of 100% fruit juice on the day prior in 2003, 2005, 2007 and 2009 by race/ethnicity

	2003		2005		2007		2009		p-value test of trend
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	
Ages 2–5									
All	37	(35–40)	37	(35–37)	42	(40–44)	38	(35–41)	NS
White	35	(31–38)	35	(31–38)	31	(28–34)	26	(22–30)	<0.001
Latino	41	(37–45)	42	(38–46)	50	(47–54)	48	(43–53)	<0.001
African-American	32	(21–43)	47	(35–58)	56	(46–66)	43	(26–60)	NS
Asian	24	(18–31)	17	(11–23)	31	(23–39)	18	(11–25)	NS
Ages 6–11									
All	25	(23–26)	24	(23–26)	31	(29–32)	31	(29–34)	<0.001
White	20	(17–23)	20	(17–23)	22	(20–25)	19	(17–22)	NS
Latino	31	(28–34)	27	(24–30)	36	(33–40)	41	(36–46)	<0.001
African-American	22	(15–30)	34	(24–43)	36	(23–45)	46	(35–58)	<0.001
Asian	12	(8–15)	21	(16–26)	26	(19–32)	18	(13–24)	NS

Table 4

Multivariate logistic regression: consumption of any SSB by children ages 2–5 and 6–11. Model included race/ethnicity, household income, parental education and a race/ethnicity by year interaction term

	Ages 2–5		Ages 6–11	
	OR	CI	OR	CI
Race/ethnicity (white reference)				
Latino	1.35	1.03–1.76	1.46	1.18–1.81
African-American	1.43	0.86–2.36	1.54	1.08–2.21
Asian	1.29	0.85–1.96	1.06	0.77–1.47
Parental income (<FPL reference)				
100–199% FPL	0.97	0.80–1.19	1.13	0.96–1.34
200–299% FPL	0.92	0.73–1.17	1.32	1.08–1.6
300% FPL	0.85	0.68–1.05	1.1	0.93–1.3
Parental education (<High School reference)				
High school diploma	0.93	0.76–1.15	1.03	0.86–1.23
Some secondary education	0.79	0.64–0.98	0.9	0.76–1.08
Bachelor's degree or greater	0.47	0.37–0.60	0.66	0.55–0.79
Year (2003 reference)				
White				
2005	0.67	0.50–0.89	0.82	0.68–0.99
2007	0.35	0.26–0.47	0.62	0.51–0.74
2009	0.19	0.13–0.28	0.42	0.35–0.51
Latino				
2005	0.79	0.64–0.98	0.70	0.57–0.86
2007	0.45	0.36–0.57	0.56	0.45–0.69
2009	0.34	0.25–0.46	0.46	0.36–0.58
African-American				
2005	0.79	0.63–0.98	0.76	0.5–1.3
2007	0.45	0.36–0.57	0.61	0.36–1.04
2009	0.34	0.25–0.46	0.43	0.22–0.84
Asian				
2005	0.60	0.37–0.97	1.01	0.68–1.52
2007	0.38	0.21–0.69	0.57	0.37–0.89
2009	0.19	0.09–0.40	0.43	0.26–0.70

Table 5

Multivariate logistic regression: consumption of 2 or more servings of 100% fruit juice by children ages 2–5 and 6–11. Model included race/ethnicity, household income, parental education, year and a race/ethnicity by year interaction term

	Ages 2–5		Ages 6–11	
	OR	CI	OR	CI
Race/ethnicity (white reference)				
Latino	0.99	0.78–1.25	1.3	1.03–1.65
African-American	0.70	0.40–1.22	0.96	0.59–1.58
Asian	0.57	0.38–0.85	0.5	0.32–0.78
Household income (<FPL reference)				
100–199% FPL	0.85	0.71–1.02	0.85	0.72–1.0
200–299% FPL	0.72	0.58–0.89	0.72	0.58–0.89
300% FPL	0.55	0.46–0.67	0.59	0.5–0.71
Parental education (<High School reference)				
High school diploma	1.18	0.96–1.45	0.93	0.78–1.12
Some secondary education	1.13	0.93–1.39	0.91	0.75–1.1
Bachelor's degree or greater	0.95	0.75–1.19	0.79	0.65–0.95
Year (2003 reference)				
White				
2005	1.01	0.81–1.25	1.03	0.81–1.3
2007	0.85	0.68–1.04	1.22	0.96–1.54
2009	0.66	0.51–0.85	1.02	0.8–1.29
Latino				
2005	1.07	0.85–1.35	0.87	0.71–1.07
2007	1.49	1.19–1.88	1.37	1.11–1.69
2009	1.31	1.0–1.7	1.75	0.95–3.23
African-American				
2005	1.75	0.87–3.5	1.75	0.95–3.23
2007	2.78	1.43–5.4	2.03	1.12–3.67
2009	1.7	0.7–3.98	3.08	1.64–5.79
Asian				
2005	0.67	0.37–1.22	2.13	1.31–3.47
2007	1.49	0.88–2.5	2.8	1.67–4.69
2009	0.71	0.39–1.27	1.81	1.04–3.16