2007 Soda and Sweetened Beverage Consumption Among Children and Adults in California: What Factors Really Make a Difference?

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Background

• The 2007 *California Children's Healthy Eating and Exercise Practices Survey* (*CalCHEEPS*) and the 2007 *California Dietary Practices Survey* (*CDPS*) provide state-level surveillance of dietary intake, physical activity, overweight and related factors for children, 9-11 years, and adults, 18+ years, respectively.

• *CalCHEEPS* is conducted using a demographically balanced market research panel through a 2-day food and activity diary and a follow-up telephone interview collecting attitudes/beliefs and environmental factors from a subset of diary respondents, with an oversample of low-income households.

• *CDPS* uses Computer-Assisted-Telephone-Interviews (CATI) in English and Spanish. Random-digit-dial (RDD) and the Medi-Cal Eligibility Data System (MEDS) Food Stamp Central Database are used to sample general and low-income populations, respectively.

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Methods

• Regression analysis were adjusted for gender, age, race/ethnicity, and household poverty status.

• Backwards stepwise regressions used SSB intake as the dependent variable. Candidate independent variables (IVs) from the *CalCHEEPS* (food diary and phone interview) and *CDPS* datasets were examined to identify significant contributors to SSB intake.

•For *CalCHEEPS*, these IVs included parent education, fruit, juice, vegetables, fried vegetables, fried vegetables, milk, high calorie low nutrient food (HCLN), school breakfast, fast food, physical activity (PA), screen time, nutrition lessons, parent modeling, and classroom rewards. Variables not entered into the models include school lunch and measures of family norms and rules, as well as home and school environments.

• IVs from *CDPS* included education, fruit, juice, vegetables, milk, HCLN food, fast food, smoking, asking about calorie information on menus, having a family rule about fast food, having a family rule about junk food, screen time, and having a worksite vending machine. Variables not entered in the model include meeting physical activity recommendations, perception of weight, trying to lose weight, and fast food/restaurant access near work.

•The final simultaneous regression models including only the significant independent variables are presented in Tables 2, 3, and 5.

Results: *CalCHEEPS*

Table 1: Drinking Soda and Sweetened Beverages Was Significantly Related to the Independent Variables Tested in *CalCHEEPS*, by Instrument

	Mail Survey (n = 819)				Telephone Interview (n = 322)			
	n	Percent	Servings of SSB[1]		n	Percent	Servings of SSB[1]	
Gender								
Boy	407	49.8	1.15		150	46.7	0.89	
Girl	411	50.2	0.98		171	53.3	0.98	
Age								
9 Years	218	26.6	1.08		79	24.5	0.89	
10 Years	421	51.5	1.09		180	56.0	1.04	
11 Years	180	21.9	1.00		63	19.5	0.72	
Race/Ethnicity								
White	270	32.9	0.87[a]	**	105	32.6	0.86	
Latino	380	46.4	1.22[b]		150	46.5	1.07	
African American	48	5.8	1.29[ab]		19	6.0	1.10	
Asian/Other	122	14.9	0.92[ab]		48	14.9	0.63	
Household Poverty								
Food Stamp Household	71	8.7	1.21		38	11.8	1.18	
≤ 130% FPL - No Food Stamps	123	15.0	0.97		41	12.8	0.78	
> 130% to ≤ 185% FPL	129	15.7	1.12		33	10.4	0.64	
> 185% FPL	496	60.6	1.06		209	65.1	0.98	
Parent Education								
≤ High School for Both Parents	132	16.1	1.38[b]	***	45	14.0	1.40[b]	**
> High School for One Parent	320	39.1	1.11[ab]		116	35.9	0.88[a]	
> High School for Both Parents	367	44.8	0.91[a]		161	50.1	0.85[a]	
Had School Breakfast								
Yes	175	21.4	1.24	*	70	21.8	0.79	
No	644	78.6	1.02		252	78.2	0.98	
Ate Fast Food								
Yes	126	15.4	1.29	*	41	12.9	1.20	
No	693	84.6	1.02		280	87.1	0.90	
Had Nutrition Lesson								
Yes	470	57.4	1.11		188	58.3	1.02	
No	349	42.6	1.01		134	41.7	0.83	
Parents Eat High-Fat Foods								
Disagree a lot					116	36.0	0.72[a]	***
Disagree a little					72	22.5	0.81[a]	
Agree a little					104	32.3	1.27[b]	
Agree a lot					29	9.1	0.95[ab]	
Teacher Rewards w/Treats								
Yes					154	48.0	1.13	**
No					167	52.0	0.76	

	n	Mean	Pearson's Correlation		n	Mean	Pearson's Correlation	
Servings of SSB	819	1.07	N/A		322	0.94	N/A	
Servings of Fruit	819	1.21	0.053[3]		322	1.32	0.112	*
Servings of Fruit Juice	819	0.56	-0.042		322	0.54	-0.114	*
Servings of Vegetables	819	1.18	-0.080	*	322	1.28	-0.191	***
Servings of Fried Vegetables[2]	819	0.16	0.145	***	322	0.14	0.119	*
Servings of Milk	819	1.86	0.122	***	322	1.80	0.061	
Servings of Sweets	819	1.71	0.209	***	322	1.83	0.308	***
Servings of Chips/Fried Foods	819	0.76	0.178	***	322	0.71	0.215	***
Hours of Physical Activity	819	1.34	-0.014		322	1.39	0.027[3]	
Hours of Screen Time	819	1.35	0.102	**	321	1.32	-0.012	

[a] ANOVA: The box signifies that differences observed are statistically significant. Categories sharing a common superscript (a,b,c) are not statistically different from each other (Tukey's test at a procedure-wise error rate=.05). * p < .05, ** p < .01, *** p < .001.
[2] This primarily includes french fries and other fried potatoes.
[3] Spearman's rho was significant (not presented here).
Gray boxes indicate that the question is not present on the survey.
SSB = Soda and Sweetened Beverages.
FPL = Federal Poverty Level.

Table 2: Demographic, Socioeconomic, and Dietary Risk Factors Were Significantly Related to Drinking Soda and Sweetened Beverages, Diary

	Simultaneous OLS Regression (n = 819)		
	Coeff.		*(SE)*
Constant	*1.212*		*(.623)*
Explanatory Variables			
Gender	-.127		(.083)
Age	-.039		(.059)
Race/Ethnicity[1]		**	
White (reference)	ref		
Latino	.375	***	(.097)
African American	.432	*	(.186)
Asian/Other	.157		(.128)
Household Poverty Status[1]		ns	
Parent Education	-.212	***	(.061)
Servings of Vegetables	-.077	*	(.035)
Servings of Fried Vegetables	.326	**	(.114)
Servings of Milk	.106	**	(.034)
Servings of Sweets	.154	***	(.031)
Servings of Chips and Other Fried Foods	.188	***	(.049)
Model Fit			
R-Square	.134***		

[1] Race/ethnicity and household poverty status entered as blocks. The F test was used to obtain the p-values for the global tests of significance for each block in the model. No significance was found for household poverty status (ns = not significant).
* p < .05, ** p < .01, *** p < .001.
OLS = ordinary least squares.
SE = standard error.
FPL = federal poverty level.

Table 3: Socioeconomic, Dietary, and Environmental Risk Factors Were Significantly Related to Drinking Soda and Sweetened Beverages, Phone

	Simultaneous OLS Regression (n = 322)		
	Coeff.		*(SE)*
Constant	*.760*		*(.526)*
Explanatory Variables			
Gender	-.003		(.110)
Age	-.023		(.084)
Race/Ethnicity[1]		ns	
Household Poverty Status[1]		ns	
Parent Education	-.189	*	(.087)
Servings of 100% Fruit Juice	-.160	p=.051	(.082)
Servings of Vegetables	-.099	*	(.045)
Servings of Sweets	.178	***	(.038)
Servings of Chips and Other Fried Foods	.204	**	(.067)
Teacher Rewards Students with Treats	.258	*	(.110)
Parents Eat High-Fat Foods	.110	*	(.055)
Model Fit			
R-Square	.229***		

[1] Race/ethnicity and household poverty status entered as blocks. The F test was used to obtain the p-values for the global tests of significance for each block in the model. No significance was found for race/ethnicity or household poverty status (ns = not significant).
* p < .05, ** p < .01, *** p < .001.
OLS = ordinary least squares.
SE = standard error.
FPL = federal poverty level.

Results: *CDPS*

Table 4: Drinking Soda and Sweetened Beverages Was Significantly Related to the Independent Variables Tested in *CDPS*

	Phone Survey (n = 1,332)		Servings of SSB[1]	
	n	Percent		
Gender				
Male	650	48.8	1.43	***
Female	683	51.2	.093	
Age				
18-24	187	14.0	1.62[a]	***
25-34	287	21.6	1.32[ab]	
35-50	451	33.9	1.20[bc]	
51-64	258	19.4	1.01[b]	
65+	149	11.2	0.55[c]	
Race/Ethnicity				
White	687	51.5	1.12[a]	**
Latino	367	27.6	1.29[ab]	
African American	83	6.2	1.70[b]	
Asian/Other	196	14.7	0.96[a]	
Household Poverty Status				
Food Stamp Household	550	41.2	1.38[b]	**
≤ 130% FPL – No Food Stamps	161	12.1	1.19[ab]	
> 130% to ≤ 185% FPL	85	6.4	1.02[ab]	
> 185% FPL	536	40.3	0.99[a]	
Education				
Less Than High School	245	18.4	1.39[ac]	***
High School Graduate	348	26.1	1.52[c]	
Some College	374	28.1	1.12[b]	
College Graduate	366	27.4	0.76[a]	
Drank Milk				
Yes	793	59.5	1.19	
No	539	40.5	1.15	
Ate Breakfast Pastry				
Yes	202	15.2	1.60	***
No	1130	84.8	1.10	
Ate Deep-Fried Food				
Yes	259	19.5	2.21	***
No	1073	80.5	1.58	
Ate Fried Snack Food				
Yes	283	21.3	1.55	***
No	1049	78.7	1.07	
Ate Dessert				
Yes	543	40.8	1.29	*
No	789	59.2	1.10	
Ate Fast Food				
Yes	176	13.2	1.85	***
No	1156	86.8	1.07	
Smoke				
Yes	345	25.9	1.76	***
No	988	74.1	0.97	
Ask About Calorie Info				
Yes	256	19.2	0.97	*
No	1076	80.8	1.23	
Junk Rule				
Yes	1072	80.5	1.08	***
No	260	19.5	1.58	
Fast Food Rule				
Yes	1030	77.3	1.05	***
No	303	22.7	1.59	
Worksite Vending Machine				
Yes	318	23.9	1.47[b]	**
No	281	21.1	1.17[a]	
Not Employed	733	55.0	1.05[a]	

	n	Mean	Pearson's Correlation
Servings of Soda and Sweetened Beverages	1,332	1.18	NA
Servings of Vegetables	1,332	2.51	-.068
Servings of Fruit	1,332	1.89	-.149
Servings of 100% Fruit Juices	1,332	0.87	.009
Hours of Screen Time (Television)	1,332	4.11	.134

[a] ANOVA: The box signifies that differences observed are statistically significant. Categories sharing a common superscript (a,b,c) are not statistically different from each other (Tukey's test at a procedure-wise error rate=.05). * p < .05, ** p < .01, *** p < .001.
SSB = Soda and Sweetened Beverages.
FPL = Federal Poverty Level.

Table 5: Demographic, Socioeconomic, Dietary, and Environmental Risk Factors Were Significantly Related to Drinking Soda and Sweetened Beverages

	Simultaneous OLS Regression (n = 1,331)		
	Coeff.		*(SE)*
Constant	*1.101*	***	*(.238)*
Explanatory Variables			
Gender	.377	***	(.093)
Age[1]		ns	
Race/Ethnicity[1]		ns	
Education[1]		**	
Less than High School (reference)	ref		
High School Graduate	-.021		.132
Some College	-.349	*	.149
College Graduate	-.483	**	.165
Household Poverty Status[1]		ns	
Worksite Vending Machine		**	
Yes	0.354	**	.120
No	.063		.121
Not Employed (reference)	ref		
Ate Fast Food	.446	**	.140
Fast Food Rule	-.214	ns	.111
Hours of Television	.074	**	.025
Servings of Fruit	-.055	**	.021
Smoke	.453	***	.110
Ate Breakfast Pastry	.275	*	.127
Ate Deep-Fried Food	.297	*	.121
Ate Fried Snack Food	.229	*	.111
Ate Dessert	.194	*	.092
Model Fit			
R-Square	.153***		

[1] Age, race/ethnicity, education, household poverty status, and worksite vending machine entered as blocks. The F test was used to obtain the p-values for the global tests of significance for each block in the model. No significance was found for blocks indicated by ns = not significant.
* p < .05, ** p < .01, *** p < .001.
OLS = ordinary least squares.
SE = standard error.
FPL = federal poverty level.

Discussion

***CalCHEEPS* identified several factors related to children's SSB intake (Tables 2 and 3):**

- Latino and African American children drank over 1/3 of a serving more SSB than White children.
- Higher parent education and children's vegetable intake were protective: for each gain in parent education level children drank nearly 1/4 serving fewer SSB and every serving of vegetables eaten related to a reduction of nearly 1/10 serving of SSB. Fruit juice* was marginal.
- Consumption of fried vegetables**, milk**, sweets, and chips/other fried foods were each associated with drinking more SSB daily, ranging from 1/3 to 1/10 serving. The positive association between SSB intake and milk was contrary to expectations.
- Classroom rewards and parent modeling were risk factors for drinking more SSB. Children whose: (1) teachers rewarded students with HCLN treats drank over 1/4 serving more SSB daily; (2) parents ate high-fat foods drank 1/10 serving more SSB at each level of agreement.

***CDPS* identified several factors related to adult's SSB consumption (Table 5):**

- Men drank over 1/3 serving more SSB than women.
- Higher education was protective against drinking SSB. College graduates drank nearly 1/2 serving less SSB than adults with less than a high school education.
- Fruit was also protective against drinking SSB. Adults who ate more fruit drank less SSB; however, vegetables, fruit juice, and milk showed no relationship.
- HCLN food consumption was associated with greater intake of SSB. Adults who ate breakfast pastries, deep-fried foods, fried snack foods, and dessert drank between 1/5 and 1/3 of a serving more SSB.
- Smoking and fast food consumption were independently associated with SSB intake. Adults who smoked or ate fast food on the previous day drank nearly 1/2 serving more SSB.
- The presence of worksite vending machines was positively associated with SSB intake. Adults with worksite vending drank nearly 1/3 more SSB daily compared to those without vending machines.

* Phone only; ** Diary only

Conclusions

• To maximize effectiveness, SSB initiatives and interventions should prioritize populations with lower education levels, a chief predictor of SSB consumption.

• When addressing dietary intake and practices, public health and nutrition education professionals can incorporate strategies that promote eating more fruits (adults) and vegetables (children), while reducing fried vegetable, HCLN food, and fast food consumption.

• SSB initiatives and interventions are needed for adult smokers. Unhealthy behaviors often cluster together indicating a need for efforts that address multiple high risk behaviors at the same time.

• Working with schools to limit the use of HCLN foods as classroom rewards, encouraging parents to reduce HCLN food modeling, and providing healthy worksite vending options are critical environmental changes to support the success of SSB initiatives and interventions.

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