

Intake of Soft Drinks, Fruit-Flavored Beverages, and Fruits and Vegetables by Children in Grades 4 Through 6

Karen Weber Cullen, DrPH, RD, LD, Danielle
M. Ash, MS, RD, LD, Carla Warneke, MS,
and Carl de Moor, PhD

Soft drinks supply about 20% to 24% of
calories for 2- to 19-year-olds¹ and contribute

to excess calorie consumption²⁻⁴ and tooth decay.⁵ Noncarbonated sports drinks and fruit drinks also provide sugar and calories. The average American consumed 55.9 gallons of soft drinks and 6.1 gallons of fruit drinks in 1999.⁶ Soft drink consumption was negatively related to milk and fruit juice consumption,³ but the relationship between beverage consumption and consumption of other food groups is unknown. Here we describe the intake of sweetened beverages, fruits, vegetables, and calories by children in grades 4 through 6.

METHODS

This study was approved by the University of Texas M.D. Anderson Cancer Center institutional review board. Informed consent was obtained. As described elsewhere, parochial school students in grades 4 through 6 in Houston, Tex, completed food records in the classroom for 3 to 7 days.⁷ The food records were hand-coded to obtain servings of fruits, high-fat and regular vegetables, and beverages (milk, 100% fruit juice, soft drinks, and

fruit-flavored drinks).⁸ Servings of soft drinks and fruit-flavored drinks were added together as "sweetened beverages." Caloric intake was obtained by means of Nutrition Data Systems software, version 2.91 (University of Minnesota, Minneapolis). No diet drinks were consumed, and water consumption was not recorded.

We calculated mean daily fruit, vegetable, soft drink, fruit-flavored drink, and total sweetened beverage consumption; percentage of total beverages accounted for by sweetened beverages; and calories. We evaluated differences in beverage consumption in ounces, ounces per 1000 calories (to control for food intake), and as a percentage of beverage intake and differences in consumption by tertiles of sweetened beverage intake.

RESULTS

Of the 504 students (207 boys and 297 girls) who participated, 25% were African American, 32% were European American, 33% were Mexican American, and 10% were

Asian American. They completed a mean of 4.3 days of food records. Average daily intake of total beverages was 20 (\pm 9.6) ounces; 51% of daily intake consisted of sweetened beverages.

Mexican-American students reported the highest soft drink consumption, African American students reported the highest fruit-flavored drink consumption, and African American and Mexican American students reported the highest total sweetened beverage consumption (Table 1). Sixth-grade students consumed more soft drinks and sweetened beverages than fourth-grade students. Students whose parents had a high school education or less consumed more soft drinks and total sweetened beverages than students whose parents had more education.

Students in the highest tertile of all beverage categories consumed significantly more calories and less fruit than those in the lowest tertile (Table 2). Students in the highest soft drink and total sweetened beverage tertiles also consumed more high-fat vegetables.

TABLE 1—Mean (SD) Daily Consumption of Sweetened Beverages Reported by Students in Grades 4 Through 6 (n = 504): Houston, Tex, 1998

	Soft Drinks, Mean (SD)			Fruit-Flavored Drinks, Mean (SD)			Total Sweetened Beverages, Mean (SD)		
	Ounces	Ounces per 1000 Calories	% Total Beverages	Ounces	Ounces per 1000 Calories	% Total Beverages	Ounces	Ounces per 1000 Calories	% Total Beverages
Ethnicity									
African American (n = 125)	5.8 (6.9)***	4.0 (4.6)***	28 (27)**	5.8 (4.8)***	4.2 (3.9)***	34 (27)***	11.6 (8.0)***	8.2 (5.5)***	62 (28)***
Asian American (n = 52)	4.2 (5.0)	2.8 (3.3)	22(23)	4.0 (4.4)	2.8 (3.1)	23 (23)	8.2 (6.3)	5.6 (4.7)	46 (29)
European American (n = 160)	5.2 (6.2)	3.1 (3.8)	23 (24)	2.8 (3.6)	1.7 (2.2)	16 (20)	8.0 (7.0)	4.8 (4.2)	39 (28)
Mexican American (n = 167)	8.2 (7.6)	5.5 (5.0)	34 (26)	3.9 (3.9)	2.7 (2.8)	21 (23)	12.0 (8.0)	8.2 (5.2)	55 (28)
Grade									
4th (n = 193)	5.2 (6.7) *	3.5 (4.5)	24 (25)*	4.0 (4.3)	2.7 (3.0)*	22 (23)	9.2 (7.8) *	6.2 (5.4) *	46 (30)*
5th (n = 151)	6.7 (6.8)	4.3 (4.4)	30 (26)	3.6 (3.6)	2.4 (2.5)	21 (22)	10.3 (7.5)	6.6 (4.7)	51 (27)
6th (n = 160)	7.0 (7.2)	4.5 (4.5)	31 (26)	4.5 (4.6)	3.2 (3.7)	26 (27)	11.5 (7.7)	7.8 (5.1)	57 (29)
Mother's education									
High school or less (n = 120)	7.9 (8.0)**	5.3 (5.1)**	35 (28)**	3.5 (3.8)	2.5 (3.2)	20 (23)	11.5 (8.3)	7.9 (5.3)*	54 (28)
Some college (n = 144)	5.8 (6.2)	3.9 (4.2)	27 (26)	3.9 (3.8)	2.8 (3.1)	24 (24)	9.7 (6.7)	6.7 (4.9)	51 (28)
College degree or higher (n = 222)	5.4 (6.4)	3.4 (4.5)	24 (25)	4.3 (4.5)	2.8 (3.2)	24 (25)	9.7 (7.9)	6.3 (5.1)	48 (30)
Father's education									
High school or less (n = 128)	7.6 (7.7)**	5.0 (4.9)**	33 (26)**	3.8 (3.7)	2.0 (2.7)	22 (22)	11.4 (7.9)*	7.6 (5.1)	55 (28)**
Some college (n = 127)	6.3 (6.2)	3.4 (3.9)	31 (25)	3.8 (3.8)	2.6 (2.7)	24 (24)	10.1 (6.7)	6.6 (4.1)	51 (28)
College degree or higher (n = 214)	5.3 (6.5)	3.5 (4.4)	24 (25)	4.1 (4.6)	2.8 (3.5)	23 (25)	9.3 (8.0)	6.3 (5.6)	48 (30)

* $P < .05$; ** $P < .01$; *** $P < .001$ (analysis of variance).

TABLE 2—Mean (SD) Daily Consumption of Calories, Fruit, Regular Vegetables, and High-Fat Vegetables Reported by Students in Grades 4 Through 6 (n = 505), by Tertile of Soft Drinks, Fruit-Flavored Drink, and Total Sweetened Beverage Consumption: Houston, Tex, 1998

	Consumption, oz/d, Mean (SD)								
	Soft Drinks			Fruit-Flavored Drinks			Total Sweetened Beverages		
	1st Tertile (n = 172): 0	2nd Tertile (n = 272): 7.1 (3.3)	3rd Tertile (n = 60): 20.4 (5.8)	1st Tertile (n = 172): 0	2nd Tertile (n = 272): 3.61 (1.7)	3rd Tertile (n = 60): 10.6 (3.4)	1st Tertile (n = 172): 0	2nd Tertile (n = 272): 7.3 (3.4)	3rd Tertile (n = 60): 19.3 (5.9)
Calories	1430 (543)***	1610 (557)	1731 (374)	1470 (511)*	1604 (560)	1597 (534)	1332 (526)***	1549 (553)	1669 (502)
Fruit, servings	0.54 (0.81)*	0.46 (0.70)	0.23 (0.37)	0.61 (0.97)**	0.41 (0.58)	0.39 (0.57)	0.86 (1.1)***	0.45 (0.71)	0.33 (0.48)
Regular vegetables, servings	0.83 (0.73)	0.86 (0.74)	0.64 (0.61)	0.72 (0.71)*	0.91 (0.77)	0.87 (0.73)	0.76 (0.74)	0.87 (0.75)	0.75 (0.65)
High-fat vegetables, servings	0.11 (0.27)***	0.21 (0.32)	0.30 (0.37)	0.17 (0.29)	0.22 (0.34)	0.20 (0.32)	0.12 (0.27)*	0.17 (0.29)	0.25 (0.31)

* $P < .05$; ** $P < .01$; *** $P < .001$ (analysis of variance).

DISCUSSION

More than 50% of total beverages consumed by these fourth- to sixth-grade students were sweetened beverages. Students with the highest consumption of total sweetened beverages consumed more calories, about 330 extra per day, than those who did not consume sweetened beverages. High-fat vegetable consumption was also greater for those in the highest tertiles of soft drink and sweetened beverage consumption. The extra calories consumed may contribute to risk for obesity.^{2,9,10}

Fruit consumption was approximately 57% lower for those students in the highest tertile of soft drink consumption and 62% lower (one half serving) in the highest tertile of sweetened beverage consumption, compared with fruit consumption by those in the lowest tertiles. Phytochemicals found in fruit reduce risks for chronic diseases.¹¹ Low consumption in childhood may persist into adulthood.¹² Perhaps sweetened beverage consumption is a marker for poor dietary habits or reflects meal sources with few fruit selections and many high-fat food selections (e.g., fast-food restaurants). No other reports have evaluated the relationship between sweetened beverage consumption and food intake. This warrants further research with longitudinal studies, because of the obesity problem and chronic disease risks.^{9,10,13}

African American and Mexican American students consumed the most fruit-flavored

and soft drinks. The proportion of children in this study who consumed soft drinks was similar to that found in national data.^{3,14} Differences in beverage consumption by ethnicity have been noted,^{3,15} and higher soft drink consumption with higher age has been documented.^{3,7,14}

In the present study, lower parental education was associated with higher consumption of soft drinks and sweetened beverages. National data showed no differences in soft drink consumption by income,¹⁶ but fruit-flavored drink consumption was highest for those at the lowest income level. Future research on the influence of family income on children's beverage consumption is warranted, particularly since low-income children and adults have high rates of obesity.^{9,10,13}

Limitations of this study include the fact that dietary data were self-reported and the limited generalizability of the sample (fourth- to sixth-grade parochial school students from one city). The cross-sectional nature of the data limits our ability to attribute causality (e.g., choosing sweetened beverages reduces fruit intake). Future research should determine whether similar differences exist in other population groups and whether parental beverage consumption habits influence children's habits. Water is a popular drink, and future studies should measure consumption of water as well as other beverages.

In this study, students with high sweetened beverage consumption reported low

fruit and high calorie intakes. Consumption of more healthful beverages, such as low-fat milk or water, should be encouraged at home and at meals consumed away from home. ■

About the Authors

Karen Weber Cullen is with the Children's Nutrition Research Center, Baylor College of Medicine, Houston, Tex. Danielle M. Ash is with Blessing Hospital, Quincy, Ill. Carla Warneke and Carl de Moor are with the Department of Behavioral Science, University of Texas M.D. Anderson Cancer Center, Houston.

Requests for reprints should be sent to Karen Weber Cullen, DrPH, RD, LD, Children's Nutrition Research Center, Baylor College of Medicine, 1100 Bates St, Houston, TX 77030 (e-mail: kcullen@bcm.tmc.edu).

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Note. The views expressed here are those of the authors and do not necessarily reflect those of the US Department of Agriculture.

Contributors

K.W. Cullen conceptualized the study, oversaw its implementation, and wrote the brief. D.M. Ash, C. Warneke, and C. de Moor participated in data analyses and manuscript preparation.

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Human Participant Protection

The research protocol was approved by the institutional review board of the University of Texas M.D. Anderson Cancer Center.

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