Impact on Milk Consumption and Nutrient Intakes From Eliminating Flavored Milk in Elementary Schools

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American children are overweight and undernourished. It is critical that school meals provide foods that help children achieve a healthy, balanced diet, and in recent years, some schools have removed flavored milk. The primary goal of this study was to quantify the impact of changes in flavored milk availability on school children's milk consumption. A secondary goal was to explore potential implications on nutrient intakes at school meals and cost to schools as a result of changes in milk consumption. Measurements of milk sold and the cumulative ounces of milk discarded at school breakfast and lunch were recorded on an average of 12 observation days at 49 elementary schools that had changed flavored milk availability over the past 2 years. When flavored milk was removed on 1 to all days of the week, there was a 26.0% reduction in milk sales and an 11.4% increase in the percentage of milk discarded, resulting in a 37.4% decrease in milk consumption. The Jefferson County school district in Colorado was further evaluated to determine what foods could hypothetically replace the nutrient deficit from lower milk consumption without adding extra calories, fat, or sugar. Alternate foods commonly served at the schools were selected, and the nutrient changes were examined using the US Department of Agriculture National Nutrient Database. The resulting changes in cost were also determined using actual food prices from this school district. It would require 3 to 4 additional foods, resulting in more calories and fat, to replace the nutrient deficit from this decline in milk consumption, a cost increase of up to $4600 more per 100 students per year in their district. Removing flavored milk from schools had significant unintended consequences on children's milk consumption, which could negatively impact nutrient intake and should be further evaluated. Nutr Today. 2013;48(3):127–134

In light of growing childhood obesity rates, food and nutrition intake at school has become a focus of policy makers, school administrators, parents, and media. Given that children spend a majority of their week in school, and school meals can provide more than 50% of children's daily nutrient needs,[1] it is important to ensure children are getting the food they need to build a healthy, balanced diet. The 2010 Dietary Guidelines for Americans echo the call to action for communities and schools to improve the nutritional quality of foods sold in schools.[2] It is important that the nutritional quality of foods served is balanced with kid-friendly, appealing options to ensure children consume the foods provided.

The Dietary Guidelines recommend 2.5 daily servings of low-fat or fat-free milk and milk products for children 4 to 8 years old, but they consume only 2 servings on average. Similarly, 9- to 18-year-old children fall short of the recommended 3 daily servings of low-fat or fat-free dairy by consuming only 1.6 servings of dairy on average.[2–4] In fact, 42% of 4- to 8-year-olds, more than two-thirds of boys aged 9 to 13 years (68%) and 14 to 18 years (68%), and more than three-quarters of girls 9 to 13 years (84%) and 14 to 18 years (92%) consume less than the recommended daily servings of milk and milk products.[5] The Dietary Guidelines and health professional organizations including the American Academy of Pediatrics and the American Heart Association recognize low-fat and/or fat-free milk, white and flavored, as nutritious options to help children meet their dairy and nutrient needs.[2,6,7] Milk is an important source of 3 of the 4 nutrients the Dietary Guidelines identified as nutrients of public health concern: calcium, vitamin D, and potassium.[2] Milk is also a good or excellent source of vitamins A and B_{12}, phosphorus, protein, riboflavin, and niacin (niacin equivalents).[8]

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Flavored milk, which provides the same nutrients as white milk, is a popular beverage choice for children, with more than two-thirds of milk chosen at school lunch being flavored.[9,10] Recently, however, flavored milk has been limited or removed from several schools. Whereas soda/soft drinks/energy drinks and fruit drinks are leading contributors of added sugar and deliver a substantial amount of calories with few nutrients, flavored milk contributes a minimal amount of added sugar (<5% of intake) in children's diets and contains several essential nutrients.[2,11,12] Research has shown that children who drink flavored milk fare better on many nutritional fronts, including greater total dairy intake and higher calcium, phosphorus, magnesium, potassium, and vitamin A intake, but not higher added sugar or total fat intake than nonmilk drinkers.[13–15] Removing flavored milk from schools is likely to impact children's milk consumption and could result in children selecting other less nutritious beverages. This could negatively impact total dairy consumption as well, widening the intake gap for this food group in which most school-aged children do not meet recommended intake.

Flavored milk contributes a minimal amount of added sugar (<5% of intake) in children's diets and contains several essential nutrients.

The research question of the role of flavors in helping individuals consume milk dates back to the 1940s, but little research has been conducted since then. Three small studies conducted in Chicago examined the role of flavored milk in the diets of factory workers and urban families and found that greater milk was consumed when flavors were offered.[16–18] A study by Cooper et al[19] in 1994 found a significant increase (28%) in total milk consumption at school, including white milk and chocolate milk, when low-fat chocolate milk was offered at lunch. Little research has been conducted to determine the nutritional impact of removing flavored milk from schools. A study conducted in a school district in Connecticut assessed the impact of flavored milk removal in kindergarten to 12th grade and found that milk sales declined in all schools and across all age groups. The average weighted decline in milk sales was 60% between a 3-month period in 2007 when flavored milk was offered and the same 3-month period in 2008 when only white milk was sold. The decline was the greatest in grades 3 to 5 and 6 to 8, where 67% less milk was sold.[20]

The purpose of this study was to quantify the impact on school children's milk consumption as a result of changing the availability of flavored milk in schools. This is the first study to determine changes in actual milk consumption when flavored milk is removed from elementary schools by measuring the amount of milk sold, the amount of milk discarded, and the resulting level of consumption in school districts across the country.

WILL CHILDREN DRINK AS MUCH MILK IF FLAVORED MILK IS REMOVED FROM SCHOOLS?

Recruitment

At the beginning of the 2009 school year, a short Internet questionnaire was sent to more than 1900 school nutrition directors who had responded to the Annual School Survey conducted by the Prime Consulting Group, Inc, for the Milk Processor Education Program, the National Dairy Council, and the School Nutrition Association to determine the availability of flavored milk at their schools. Responses were received from 499 school nutrition directors. Nearly all of these schools (99%) offered flavored milk; however, 19% of elementary and 20% of secondary students had experienced a reduction in flavored milk options (eg, offered less days, less flavors are offered) over the previous 2 years. Those schools that indicated that flavored milk is not available on at least 1 day per week (limiting flavored milk options to only some days of the week [1–4 days] or not offering flavored milk) were invited to participate in this observational study.

Fifty-one elementary schools from 7 school districts in California, Colorado, and Illinois participated. On average, 52% (range, <5%–95%) of the children qualified for free or reduced meal prices according to the US Department of Agriculture income eligibility guidelines.[21] Forty-three schools (5 districts; average daily attendance of 419) had eliminated flavored milk on 1 to 4 days of the week, and 8 schools (2 districts; average daily attendance of 409) had completely eliminated flavored milk in school meals. White milk was offered on all days of the week at all of the schools. The type of milk offered varied depending on the school, with nearly all districts serving low-fat and/or fat-free white milk. One district served 2% white milk. The flavored milk served was low-fat and/or fat-free in all of the districts.

Measurement

Data collection occurred between September 2009 and January 2010 with an average of 12 observation days per school. The school nutrition director at each district confirmed that measurement days were representative of typical meal operations. The cafeteria staff were trained by the researchers on the data collection method prior to the start of the study. This included recording the number and type of milks sold and the total amount discarded

at breakfast and lunch. Each school was provided with standardized 5-gallon waste collection buckets with marked measurement amounts for each trash station, and on each measurement day, 1 staff person monitored the waste area through each meal period. The total amount of milk sold (by carton, ounces, and flavor) and the cumulative ounces of milk discarded at each meal were recorded by the staff. Two schools were excluded from the study analysis because of noncompliance with the study protocol. Participating districts/schools received financial compensation to offset the extra work required to complete the measurement protocol.

A within-school analysis was conducted to calculate milk consumption at each school by subtracting the total amount of milk discarded at the end of the meals from the total number of ounces of milk sold (8-fl oz cartons/bottles). Statistical analyses using Student *t* test were conducted to test the hypothesis that total milk consumption was not different when only white milk was offered compared to when both flavored milk and white milk were offered in the sample of 49 schools. The secondary analysis examined schools that limited flavored milk to some days of the week (ie, compared days with white milk only versus days with white and flavored milk offered), and therefore the 8 schools from 2 districts that had previously eliminated flavored milk from school meals were not included in this analysis.

Results

As shown in Table 1, the amount of milk sold on days that only white milk was offered was 26.0% lower ($P < .001$), and consumption was 37.4% lower ($P < .001$), which is a difference of 96 units (8-fl oz cartons or bottles) of milk consumed per day per school compared with days that both flavored milk and white milk were offered. The 37% decrease in milk consumption when flavored milk was not offered reflects both the 26.0% decline in milk purchases and an 8.4% increase in the amount of milk discarded at the end of the breakfast and lunch periods combined. Approximately a quarter (25.4%) of milk purchased was discarded even when flavored milk was offered. Eleven percent more milk was discarded when only white milk was offered than when both flavored and white milk were offered ($P < .001$).

IF FLAVORED MILK IS OFFERED ON SOME DAYS OF THE WEEK, WILL MILK CONSUMPTION BE MAINTAINED?

The results of the secondary analyses, which included only schools in which both white and flavored milk were offered on some days and only white milk was offered on the other days, are shown in Table 2. When flavored milk was not offered, 19.5% less milk was sold ($P < .001$), and 33.9% less milk was consumed ($P < .001$), which is an average difference of 87 units (8-fl oz cartons or bottles) of flavored milk consumed per day per school. The 33.9% difference in milk consumption reflects both the 20% less milk sold and 20% more milk discarded ($P < .001$) at the end of the breakfast and lunch periods. The amount of milk discarded when only white milk was offered was 13.6% more than when both flavored milk and white milk were offered ($P < .001$). Therefore, changes in milk sales, the amount of milk discarded, and milk consumption were similar on days when only white milk was offered, regardless if the school offered flavored milk on some days of the week or not at all.

WHAT SCHOOL FOODS COULD REPLACE THE NUTRIENT DEFICITS FROM DECREASED MILK CONSUMPTION?

Previous studies that have examined the ability to replace dairy's nutrients with other recommended calcium-containing foods have indicated that given the multiple nutrients that milk and milk products provide in the American diet, it can be difficult and unrealistic to meet nutrient needs with dairy replacement foods.[3,22] One of the participating school districts in Jefferson County, Colorado, was used to examine potential implications of lower milk intake due to flavored milk removal on the delivery of nutrients to elementary school students. Nutrient losses from decreases in milk consumption were determined using the US Department of Agriculture National Nutrient Database (SR 22), and replacement foods for each nutrient were selected from the list of foods that are ordered for this school on a regular basis to represent typical food choices. Additional goals in selecting replacement foods were that they contain little to no added sugar and avoidance of replanning of the entire meal pattern. The degree of replacement achieved for calcium, potassium, vitamin D, magnesium, phosphorus, vitamin A, and protein with consideration of total fat, saturated fat, calories, and total sugar was calculated. The following foods were used to provide each nutrient. In the case of vitamin D, there were very few foods other than milk that were common to the school menu.

When flavored milk was removed on 1 to all days of the week, there was a 26.0% reduction in milk sales and an 11.4% increase in the percentage of milk discarded, resulting in a 37.4% decrease in milk consumption.

TABLE 1 All Schools: Average Milk Consumption on Days When Flavored Milk Is Offered Versus Days When It Is Not Available in 7 Districts

	Schools in Which Flavored Milk Was Removed From the Cafeteria on ≥1 Days[a]			
	Flavored + White Milk Available on the Day of Measurement	Only White Milk Available on the Day of Measurement	Flavored + White vs White Only	
Condition at Breakfast + Lunch	Mean (SEM)	Mean (SEM)	*P*	% Change
Milk (in fluid ounces)				
Sold	2705 (75)	2001 (42)	<.001	26.0
Discarded	662 (23)	772 (19)	.11	8.4
Consumed	2044 (61)	1279 (31)	<.001	37.4
% of purchased milk discarded	25.4 (0.07)	36.8 (0.7)	<.001	11.4
Milk (8-fl oz cartons/bottles)				
Sold	338	250		
Discarded	83	90		
Consumed	256	160		
No. of schools	41	49		
No. of observations	228	347		

[a]Includes 8 schools (2 districts) where flavored milk was previously eliminated (ie, did not offer flavored milk) and 41 schools that offer flavored milk up to 4 days per week.

TABLE 2 Within Schools: Average Milk Consumption on Days When Flavored Milk Is Offered Versus Days When It Is Removed in Schools From 5 Districts

	Schools in Which Flavored Milk Is Available at Least 1 Day per Week[a]			
	Flavored + White Milk Available on the Day of Measurement	Only White Milk Available on the Day of Measurement	Flavored + White vs White Only	
Condition at Breakfast + Lunch	Mean (SEM)	Mean (SEM)	*P*	% Change
Milk (in fluid ounces)				
Sold	2705 (75)	2177 (55)	<.001	19.5
Discarded	662 (23)	826 (25)	<.001	19.9
Consumed	2044 (61)	1351 (40)	<.001	33.9
% of purchased milk discarded	25.4 (0.07)	39.0 (0.8)	<.001	13.6
Milk (8-fl oz cartons/bottles)				
Sold	338	272		
Discarded	83	103		
Consumed	256	169		
No. of schools	41	41		
No. of observations	228	250		

[a]Forty-one schools from 5 districts where flavored milk was offered on up to 4 days of the week (eg, white milk only [Tuesdays/Thursdays] and flavored milk offered [Mondays/Wednesdays/Fridays]).

- **calcium**: cheese (part-skim mozzarella and cheddar), low-fat fruit yogurt, and fortified orange juice
- **vitamin D**: light tuna canned in water and fortified orange juice
- **potassium**: baked beans, baked sweet potato wedges, fortified orange juice, low-fat fruit yogurt, banana, edamame, and cooked cod
- **magnesium**: baked beans, peanut butter, cooked spinach, banana, edamame, cooked cod, and sunflower seed butter
- **vitamin A**: cooked carrots, baked sweet potato wedges, cooked spinach, cooked broccoli, cantaloupe, cheddar cheese, and egg
- **phosphorus**: baked beans, sunflower seed butter, cooked spinach, part-skim mozzarella and cheddar cheeses, and low-fat fruit yogurt

The cost of the replacement foods was determined using actual food costs for this district and compared with the weekly average milk cost when white and flavored milk were offered ($119.00 per 100 students). For perspective, food costs in this region of Colorado are within 3% of the national average.[23]

The approximate 35% decline in total milk consumption resulting from flavored milk removal in the elementary schools examined corresponded to an estimated 1.4 fewer servings of milk per student per week. The foods listed above were evaluated individually and in combinations in an effort to replace the nutrient losses that would occur with lower milk consumption from removal of flavored milk from elementary schools. Replacing the essential nutrients from a 35% decline in milk consumption could not be met without adding 3 to 4 additional food items to the menu. This resulted in additional calories (16–141 kcal) and fat (2–20 g of total fat and 2–11 g of saturated fat) for the net savings of 15 to 28 g of sugar per week from removal of flavored milk (Table 3). There were also added costs associated with the replacement foods. Depending on the food combination, it costs between $62 and $127 more per week per 100 students to replace the nutrient losses from a 35% decline in milk consumption. This would cost this district an incremental $2200 to $4600 annually per 100 students.

It would require 3 to 4 additional foods, resulting in more calories and fat consumed, to replace the nutrient deficit from a 35% decline in milk consumption, a cost increase of up to $4600 more per 100 students per year in their district.

SUMMARY AND IMPLICATIONS

Milk, both white and flavored, has been an important component of school meals for decades. More than two-thirds of milk consumed at school is flavored milk and primarily low-fat or fat-free.[9,10] Although many schools have recently removed or limited flavored milk because of pressures and concerns about added sugar, little research has examined the impact that this change has on children's milk and nutrient intake. The results of this study were not consistent with the view that children will drink the same amount of white milk if flavored milk is not offered. Not only did children purchase 26% less milk when the flavors were limited or removed, they also threw away 11.4% more of the milk purchased, resulting in an average 37.4% decline in total milk consumption. Examination of foods that could be offered to replace the nutrient losses that would occur with a 35% reduction of flavored milk consumption in one of the school districts found that 3 to 4 additional foods would be required over the course of a week. This would result in an increase in calories and fat consumed and would cost this school district up to $4600 (per 100 students) more per year in food costs. It is likely that most schools would need to replan their entire menu sequence if they wanted to deliver the essential nutrients lost due to lower milk consumption.

This is the first study to our knowledge that has estimated changes in total milk consumption when flavored milk is limited or removed from schools using both daily milk sales and the amount of milk discarded at the end of the meal. The participating schools were ethnically and economically diverse, decreasing the likelihood that student characteristics impacted the results. The limited number of previous studies that examined the role of flavored milk options in total milk consumption were conducted in a smaller number of schools, and milk sales were used as a proxy for milk consumption. Given that the present study was an observational study, additional research is needed to further examine milk consumption at school and the impact on total dietary intake if flavored milk is removed in larger samples representative of the US population. Randomized, case-control intervention studies will be helpful to further examine the impact of flavored milk removal in schools. Direct dietary assessment using food recalls or dietary records would be valuable to determine the impact on food and nutrient intake by individual students. Additionally, it is important to put this into the perspective of student total daily intakes to evaluate how changes in milk offerings at school affect diet quality and nutrient adequacy. Finally, research to measure the acceptability and intake of alternative foods chosen to replace milk's nutrients would be important to establish if the trade-off is warranted.

In conclusion, removing flavored milk from schools can have significant unintended consequences on children's milk

TABLE 3 Food Options to Replace the Nutrient Deficit From a 35% Decline in Milk Consumption With Removal of Flavored Milk From Elementary Schools

	Protein, g	Vitamin D, IU	Calcium, mg	Potassium, mg	Magnesium, mg	Phosphorus, mg	Vitamin A, IU	Calories, kcal	Total Sugar, g	Total Fat, g	Saturated Fat, g
Amount of nutrients[a] to be replaced per week from reduced consumption of milk[b] (1.4 servings per student per week)											
	10.6	3.6	363	653	50	382	688	294	51.3	3.5	2.0
Replacement foods: 2 oz skim mozzarella cheese sticks, 1 cup orange juice fortified with vitamin D and calcium, baked sweet potato wedges											
Added cost[c] per 100 students: $62.33 per week, $2244 per year											
Nutrients	17.7	3.7	987	1033	68	441	22 286	366	34.0	9.5	5.8
Over/under	7.1	13	624	380	18	59	21 618	72	-17.3	6.0	3.8
Replacement foods: 1 cup orange juice fortified with calcium and vitamin D, 2 oz light tuna canned in water and drained, 2/3 cup edamame frozen prepared, 2/3 cup spinach cooked from frozen											
Added cost per 100 students: $98.63 per week, $3551 per year											
Nutrients	27.3	6.1	677	1334	219	390	11 595	310	22.9	5.6	2.0
Over/under	16.7	2.5	314	681	169	8	19 927	16	-28.4	2.1	2.2
Replacement foods: 3 oz tuna light canned in water and drained, 1 oz cheddar cheese, 6 oz low-fat yogurt with fruit, ½ cup frozen cooked carrots											
Added cost per 100 students: $127.33 per week, $4584 per year											
Nutrients	36.6	4.1	497	497	701	502	12 750	413	35.5	12.4	5.5
Over/under	26.0	0.5	134	48	15	120	12 082	119	-15.8	8.9	5.5
Replacement foods: 2 oz cheddar cheese, 1 medium egg, 1 cup orange juice fortified with vitamin D and calcium, ½ cup diced cantaloupe											
Added cost per 100 students: $93.43 per week, $3363 per year											
Nutrients	22.0	4.4	938	766	57	503	3525	435	27.5	23.6	13.4
Over/under	11.4	0.8	575	113	7	121	2857	141	-23.8	20.1	11.4

[a]Nutrient information was obtained from the US Department of Agriculture National Nutrient Database for Standard Reference, Release 22.

[b]Low-fat (1%) chocolate milk was used as this is representative of the most common milk offered in schools.

[c]Based on actual food costs of the Jefferson County, Colorado, school district that participated in the study. Average weekly cost per 100 students when flavored and white milk was offered was $119.00.

consumption. Because lower milk intake could result in a reduction in essential nutrient intake, an alternative to help cut calories and added sugar could be offering newer formulations of flavored milk that contain 140 calories or less and 23 g of sugar or less per serving. Given that school-aged children do not currently meet the daily recommended intakes for dairy foods and also fall short on many of the nutrients that milk provides, evaluating school menus for other options to reduce added sugar in children's diet may be warranted.

Removing flavored milk from schools had significant unintended consequences on children's milk consumption, which could negatively impact nutrient intake and should be further evaluated.

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