

Quality of Milk and Patterns of Consumption by Children in Connecticut Schools and Camps

Lester Hankin, George Stephens, Donald Shields and Kathleen Cushman



The Connecticut Agricultural Experiment Station New Haven

During 1978 and 1979 the staff of the Connecticut Dept. of Agriculture, interested in the quality of milk served our children, collected samples in 271 schools in 45 towns. The flavor was evaluated by the staff of the Connecticut Dept. of Agriculture and chemical and microbial tests were performed by the Connecticut Dept. of Health Services. The results were analyzed by staff of The Connecticut Agricultural Experiment Station. Connecticut Dept. of Agriculture funds for this project were matched with Federal funds under the Federal-State Marketing Improvement Program of the Agricultural Marketing Service, U.S. Dept. of Agriculture, as provided by the Agricultural Marketing Act of 1946.

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Milk is one of the basic foods for children and adolescents since it provides the essential element calcium as well as vitamins, protein, and carbohydrate. The use of milk is stressed in school lunch programs by many groups and by the United States Department of Agriculture (USDA). The USDA participates both in the funding and in the distribution of some dairy products.

On days when school is in session about 10% of the milk sold in Connecticut (about 500,000 half-pints) is used in schools. However, the consumption patterns in public schools had not been examined. Although we had investigated the freshness of milk samples collected from schools in 1975 (3), the relation of quality to consumption was not studied. In the present study we examined the adequacy of refrigerated storage and the way in which the milk was dispensed. At some schools we also examined consumption, as distinct from preference. The same information was also obtained at day and residential camps for children.

Experimental

The study on student preferences and the quality of milk served in schools encompassed the period from September, 1978 through May, 1979, essentially one school year. A total of 271 public schools in 45 towns were studied. Milk usage was determined and samples taken from children's camps during June through August, 1979. To determine the amount of milk taken but not consumed, twelve elementary and six middle schools and one high school were examined during the Spring and Fall of 1979.

The amount of milk taken was determined by dividing the number of servings, i.e., half-pint cartons, by the school enrollment. The percentage of milk actually consumed was determined by dividing the amount of milk not consumed by the amount taken.

The samples were immediately placed in ice for transport to the laboratory. The temperature of the milk at collection and the age of the sample (days from bottling) were recorded. Ninety-two samples were taken at high schools and 315 at middle and elementary schools. Milk for analysis was taken at 19 residential and 15 day camps.

Bacterial analyses for total aerobic count and for coliform bacteria were made according to Standard Methods For the Examination of Dairy Products (8). Flavor was judged organoleptically by methods recommended by the American Dairy Science Association as modified for the Connecticut Milk Flavor Improvement Program (2, 4). Fat was determined by methods of the Association of Official Analytical Chemists (7). Data were analyzed using SPSS computer programs (6).



Results

Schools

Size of sample: Information was obtained in 45 of the 169 towns in the State of Connecticut. Included were 195 elementary schools, 36 middle schools, and 40 high schools. These schools had an enrollment of 152,248 students of the total statewide public school enrollment of 581,171. Thus, in this study 26% of the students in Connecticut public schools are represented. The smallest enrollment was 76 students (an elementary school in Wolcott); the largest was 2,804 students (a high school in Waterbury). About 78% of the elementary schools examined had enrollments of less than 500. For middle schools 47% had enrollments greater than 700, and for high schools 64% had enrollments greater than 1,000.

Total milk usage based on enrollment: The percentage of students taking milk according to population of the town and by type of school is shown in Table 1. Combining all the data for 152,248 students in 45 towns, 124,123 portions of milk were dispensed daily. Thus, 82% of all students took milk daily. Calculations based on total enrollment, however, do not take into account the 94% average daily attendance (personal communication from Connecticut Department of Education). The percentage of students in schools taking milk could therefore average as high as 85%. Town population affected per-

Table 1. Percentage of students in schools taking milk in relation to population of town.

Population of town	Number of towns	Number of students	% Taking milk
Under 5,000	11	3,985	82
5,000 to 9,999	10	14,827	82
10,000 to 24,999	10	26,182	83
25,000 to 49,999	6	22,395	84
50,000 to 99,999	5	39,865	79
Over 100,000	3	44,994	82
Totals	45	152,248	

centage of students taking milk little and the range was 79 to 84% (Table 1).

More students in middle schools (90%) took milk than did students in elementary (82%) or high schools (75%, Table 2). In succeeding tables all 45 towns and 271 schools may not be included because complete data were not always available at all schools.

Preference for type of milk: Some schools (26%) offered only whole milk (minimum of 3.25% fat) while others (74%) offered both whole and chocolate-flavored milk (0.5 to 2.0% fat). A few schools also offered lowfat milk (0.5 to 2.0% fat) and nonfat milk (not more than 0.5% fat). What is offered appears to be at the discretion of the school dietician or person in charge of the cafeteria. Starting with the 1979-80 school year, schools participating in the USDA school lunch program were required to

Table 2. Percentage of students taking milk by type and according to category of school and population of town.¹

Population of town	Number of schools	Enrollment	% of enrollment taking milk	Percentage taking			
				whole milk	chocolate milk	nonfat milk	lowfat milk
High Schools							
under 5,000	0	—	—	—	—	—	—
5,000 to 9,999	7	5,227	93.2	46	54	—	—
10,000 to 24,999	3	3,554	82.2	36	58	<1	6
25,000 to 49,999	3	3,680	89.0	47	47	5	—
50,000 to 99,999	7	11,345	68.5	38	60	2	—
over 100,000	7	12,663	75.2	27	70	3	—
TOTAL	27	36,469					
Middle Schools							
under 5,000	0	—	—	—	—	—	—
5,000 to 9,999	3	1,350	102.3	30	70	—	—
10,000 to 24,999	3	1,550	88.3	37	63	—	—
25,000 to 49,999	5	3,539	100.2	29	70	<1	<1
50,000 to 99,999	8	5,592	88.4	26	74	—	—
over 100,000	6	5,935	90.6	19	81	—	—
TOTAL	25	17,966					
Elementary Schools							
under 5,000	2	453	97.4	25	75	—	—
5,000 to 9,999	8	2,695	75.6	26	74	<1	—
10,000 to 24,999	13	6,424	77.7	28	72	—	—
25,000 to 49,999	9	3,844	74.5	36	64	—	—
50,000 to 99,999	47	17,047	81.9	25	75	—	—
over 100,000	48	19,973	84.5	21	78	<1	—
TOTAL	127	50,436					

¹Data only for schools offering both whole and chocolate-flavored milk and nonfat and lowfat milk.

offer nonfat or lowfat unflavored milk in addition to chocolate-flavored and whole milk.

Elementary and middle school students prefer chocolate-flavored milk over whole milk about in the ratio of 2.6 to 1.0, but high school students take chocolate-flavored milk over whole milk in the ratio of only 1.5 to 1.0 (Table 2). The data for students taking lowfat and nonfat milk are limited because few schools offered these products during the period of the study.

In some schools the ratio of students taking chocolate-flavored milk to whole milk was greater than 10 to 1.

Examples are three elementary schools in East Hartford, one elementary school in Waterbury, a middle school in New Haven, and a high school in Wolcott. Conversely, in seven schools more whole milk than chocolate-flavored milk was taken. The reasons for these marked differences in preference are not apparent.

One objective was determining if the percentage of students taking milk varied among towns (Table 3). Some unusual results are included in this table. The percentage of students in East Granby taking milk is low, but in Granby it is low in the high school and high in the

Table 3. Percentage of students taking milk according to type of school within town.

Town	Number of schools examined	Enrollment	Percentage taking milk		
			Total	High schools	Elementary and middle schools
Barkhamsted	1	342	95	—	95
Bethlehem	1	287	96	—	96
Canaan	2	908	90	97(1) ¹	47(1)
Chaplin	2	593	78	97(1)	67(1)
Colchester	1	900	97	—	—
Colebrook	1	100	140	140	—
Cornwall	1	115	74	—	74
Eastford	1	131	76	—	76
East Granby	4	912	65	57(1)	69(3)
East Haddam	2	1,113	78	82(1)	74(1)
East Hartford	20	9,168	80	86(3)	77(17)
East Windsor	4	1,753	82	87(1)	79(3)
Enfield	4	2,547	83	84(1)	81(3)
Glastonbury	8	5,649	81	80(1)	82(7)
Granby	2	1,457	52	23(1)	140(1)
Greenwich	15	9,541	75	76(1)	75(14)
Guilford	3	1,513	88	—	88
Haddam	3	2,206	101	117(1)	82(2)
Hamden	15	7,866	90	50(1)	106(14)
Hartford	29	22,841	74	63(3)	78(26)
Hartland	1	229	57	—	57
Harwinton	1	550	96	—	96
Litchfield	4	1,640	65	67(1)	64(3)
Manchester	7	3,835	82	—	82
Morris	1	166	100	—	100
New Britain	16	8,819	74	80(1)	71(15)
New Haven	13	6,876	94	74(2)	110(11)
New London	3	2,347	88	98(1)	77(2)
New Milford	4	3,216	76	84(1)	71(3)
Norfolk	1	202	87	—	87
North Canaan	1	385	94	—	94
Norwalk	6	4,471	67	50(1)	86(5)
Norwich	14	4,738	93	—	93
Rocky Hill	5	2,193	83	86(1)	82(4)
Simsbury	6	4,579	74	58(1)	85(5)
Somers	4	1,444	90	87(1)	94(3)
Tolland	4	2,712	81	83(1)	80(3)
Torrington	3	1,103	98	118(1)	74(2)
Wallingford	14	7,825	76	85(2)	72(12)
Waterbury	28	15,277	89	91(3)	89(25)
Watertown	6	3,686	86	87(1)	86(5)
Winchester	1	1,230	85	85	—
Windham	1	393	89	—	89
Wolcott	6	3,338	92	85(1)	96(5)
Woodbury	2	1,052	87	98(1)	70(1)
Totals	271	152,248			

¹ The number in parenthesis indicates number of schools represented.

lower grades. Granby and East Granby do not have a school lunch program. In Canaan, although the general percentage is high, the elementary and middle school students take much less milk than high school students. In some cases the percentage of students taking milk is greater than 100% because some students take more than one portion.

In the large cities of New Haven and Waterbury the percentage of students taking milk is high, but in Hartford the percentage is low. Although the reason for this marked difference is not apparent, one possibility is that the average daily attendance in Hartford might be lower than the state average.

Age and temperature of milk: The average age (number of days between bottling and collection) of milk offered for sale at schools was 3.5 days (Table 4) with a range of 0 to 13. The average code period (number of days between bottling and last day product may be offered for sale) for all dairies was 10.7 days with a range of 7 to 13. The mean temperature of all samples collected at school cafeterias at serving was 3.8°C (38.8°F), well within acceptability.

An attempt was made to determine if age of the milk being served varied with the population of the town in which the school resided (Table 4). For 11 towns with populations under 5,000 the average age of milk exceeded by about one day the average age of milk in larger towns. Examination of individual towns (Table 5) showed that older milk was found in both small and large towns.

Flavor and flavor score: The average flavor score for all samples separated by size of town is shown in Table 5. The mean was 36.8 out of a possible range of 40 to 30. A flavor score below 36 is unacceptable. Although the scores appear to be satisfactory, 13.8% of the samples had an unsatisfactory flavor. Some towns where the flavor score was low were East Hartford, Morris, and Tolland. In Table 6 the data were separated by school type within a town. In most cases the flavor score in both types of schools is similar. Age of milk varied between school type within the same town (e.g., Glastonbury, Watertown), but age of milk did not correlate well with unacceptable flavor. Both fresh and older milk sometimes had unsatisfactory flavor.

The types of flavors found in 401 samples are shown in Table 7. Fifty-nine percent of the 39 samples designated as "burnt" came from one dairy. A burnt flavor indicates unsatisfactory heating of paper cartons during sealing. Generally the "cooked" and "feed" flavors are acceptable since it is unlikely that students or consumers in general could detect any off-flavor in such samples. "Lacks freshness" indicates contamination by bacteria in the pseudomonad group (1, 5) and suggests that the milk is old.

Total aerobic bacterial count: The average total aerobic plate count of milk samples (Standard Plate Count per ml) is shown in Tables 4 and 5. Some plate counts exceeded the legal maximum of 25,000 per ml. In general the numbers are well within limits prescribed by law. How-

Table 4. Analysis of milk samples collected at schools according to population of towns.

Population of town	Avg. age of milk (days)	Avg. temperature at collection (°C/°F)	Avg. flavor score	Avg. aerobic count (per ml)
Avg. — all towns	3.5	3.8/38.8	36.8	1,706
under 5,000 (11) ¹	4.4	3.6/38.5	36.7	3,347
5,000 to 9,999 (10)	3.5	4.2/39.6	36.6	1,191
10,000 to 24,999 (11)	3.2	4.6/40.2	37.3(10)	3,328(10)
25,000 to 49,999 (6)	3.7	4.0/39.2	37.2	2,587
50,000 to 99,999 (5)	3.3	3.8/38.8	36.2	786
over 100,000 (3)	3.7	3.4/38.2	36.7	1,261

¹ The number in parenthesis after population of town indicates total number of towns from which samples were taken. In other columns the number in parenthesis indicates number of towns from which samples were taken if different from total.

It is not known whether the milk was kept long in the cafeteria before sale or whether there was a delay between bottling and delivery. We attempted to determine if certain dairies accounted for most of the older milk but found a fairly even distribution among dairies.

In all 45 towns milk was adequately refrigerated during storage. For 271 schools, 82.7% had separate storage facilities for milk. The remainder (17.3%) used the milk serving facilities for storage. However, 45.6% of the schools served milk from unrefrigerated areas. Of 39 samples unrefrigerated at serving, only six (15.4%) were found to be above 7.2°C (45.0°F).

ever, total numbers tell little of the types of bacteria present or whether the bacteria have the ability to produce off-flavors and aromas (4).

Coliform bacteria: The coliform test measures bacteria in the coli-aerogenes group, and if they are present in large numbers, post-pasteurization contamination is indicated. In this study of 263 samples, 22 (8.4%) were unsatisfactory, having a count of five or more per ml of milk.

Fat content: We found an average of 3.36% fat in 149 samples of whole milk. Whole milk must contain a minimum of 3.25% fat. The average percentage of fat

in 63 samples of chocolate-flavored milk was 1.25% (legal standard of 0.5 to 2.0%). For 12 samples of lowfat milk the average was 0.81% fat (legal standard of 0.5 to 2.0) and in five samples of nonfat milk the average was 0.34% (legal standard not more than 0.5%).

Statistical analysis: The only significant correlation was between the number of aerobic bacteria and the age of the milk ($r=0.4751$, $p=<.001$). As the milk aged, the number increased. The total number did not correlate with flavor score or the temperature of the milk.

Comments by cafeteria personnel: The workers at each school cafeteria were asked for comments or complaints about the milk offered. The 395 comments are shown in

Table 8. The most frequent complaint specified leaking cartons (27%). About 16% of the complaints were about off-flavored milk.

Milk taken but not consumed: We determined how much of the milk that was taken was actually consumed. At 19 randomly selected schools students deposited milk cartons as they left the cafeteria. The amount of each type of milk remaining in the cartons was measured. We did not find a statistical correlation between the amount of milk not consumed and the percentage of students taking milk.

Students in middle schools consumed more of the milk they took than did students in elementary schools. (Table

Table 5. Analysis of milk samples collected at schools in various towns.

Town	Avg. age of milk (days)	Avg. temp. at collection (°C/°F)	Avg. flavor score	Avg. aerobic count
Barkhamsted (1) ¹	1.0	7.2/45.0	39.0	690
Bethlehem (2)	5.0	3.3/38.0	36.5	566
Canaan (3)	2.7	3.7/38.7	38.0	4,200(1)
Chaplin (2)	3.5	1.9/35.5	35.0	141
Colchester (13)	3.5	3.7/38.7	37.6	612
Colebrook (2)	5.0	1.9/35.5	38.0	38,820
Cornwall (1)	6.0	3.9/39.0	37.0	24,000
Eastford (1)	6.0	4.4/40.0	34.0	700
East Granby (7)	3.4	3.9/39.0	37.3	412(4)
East Haddam (4)	2.3	4.6/40.3	37.3	1,581
East Hartford (28)	4.1	3.9/39.0	35.3	692(4)
East Windsor (10)	4.6	4.8/40.7	35.8	2,294
Enfield (7)	3.0	5.4/41.7	37.1	3,389
Glastonbury (15)	3.7	5.6/42.1	37.7	1,091(11)
Granby (5)	3.0	4.2/39.6	37.4	53,060(2)
Greenwich (17)	3.4	3.8/38.9	35.2	655(8)
Guilford (9)	5.0	4.4/40.0	37.9	33,490
Haddam (4)	3.0	3.2/37.8	37.5	131
Hamden (15)	2.5	4.0/39.2	37.3	857
Hartford (36)	4.9	3.4/38.2	36.4	216(14)
Hartland (1)	6.0	4.4/40.0	38.0	3,600,000
Harwinton (3)	3.7	0.7/33.3	37.0	22,130(2)
Litchfield (10)	3.6	4.4/40.0	36.7	886
Manchester (9)	2.6(8)	4.2/39.6	37.5	1,862
Morris (2)	9.0	3.3/38.0	32.0	109,400
New Britain (18)	2.8	3.5/38.3	37.2	574(6)
New Haven (19)	3.6	3.6/38.5	36.6	912(17)
New London (7)	4.3	2.7/36.9	37.7	1,647
New Milford (7)	3.7	6.2/43.1	37.6	802
Norfolk (2)	3.0	3.3/38.0	38.0	2,565
North Canaan (2)	3.0	2.2/36.0	38.0	2,397
Norwalk (6)	2.3	3.9/39.0	37.3	2,238(4)
Norwich (16)	4.8	3.2/37.7	37.0	30,750(5)
Rocky Hill (10)	1.8	4.2/39.5	37.2	—
Simsbury (7)	1.6	5.7/42.2(9)	36.8(9)	2,787
Somers (8)	3.1	5.4/41.8	36.6	619
Southbury (4)	—	1.7/35.0(3)	37.0(3)	8,884
Tolland (5)	1.2	3.9/39.0	35.4	791
Torrington (4)	3.0	3.5/38.3	36.5	453(3)
Wallingford (20)	3.5	5.1/41.1	37.1	2,067(11)
Waterbury (36)	2.6	3.3/38.0	37.1	1,020(2)
Watertown (9)	3.0	6.2/43.1	36.7	1,862(7)
Winchester (5)	3.0	2.9/37.2	37.6	2,504(4)
Windham (2)	3.5	3.3/38.0	37.5	270
Wolcott (8)	—	3.1/37.5	—	942
Woodbury (5)	5.0	4.8/40.6	35.2	4,563

¹ The number in parenthesis indicates number of samples analyzed.

9). The amount of milk not consumed in those cartons with milk remaining was about the same in both types of schools and for both types of milk, averaging about 95 ml in each half-pint (236 ml) carton.

From town-to-town the percentage of milk not consumed ranged from 5 to 25% for whole milk and from 2 to 20% for chocolate-flavored milk (Table 10). At most

schools the percentage of whole milk not consumed was about twice that of chocolate-flavored milk. In only one school (Moser) was more whole milk than chocolate-flavored milk consumed. The data for nonfat milk are too limited to make a statement.

In general it appears that students are not overly wasteful. We recognize that the type of meal can affect milk

Table 6. Age and flavor score of milk collected at schools according to town¹ and type of school.

Town	Avg. age of milk (days)		Avg. flavor score	
	Elementary and middle schools	High school	Elementary and middle schools	High school
Colchester	3.3(7) ²	3.8(6)	37.6	37.7
East Granby	3.6(5)	3.0(2)	37.2	37.5
East Hartford	3.8(28)	5.1(18)	35.5	34.8
East Windsor	5.0(8)	3.0(2)	35.5	37.0
Enfield	3.4(5)	2.0(2)	37.0	37.5
Glastonbury	4.1(13)	1.5(2)	37.6	38.5
Granby	3.3(4)	2.0(1)	37.5	37.0
Greenwich	3.5(15)	2.0(2)	35.0	36.0
Guilford	5.0(9)	—	37.9	—
Hamden	2.6(14)	1.0(1)	37.3	37.0
Hartford	5.0(28)	4.5(8)	36.4	36.4
Litchfield	3.9(8)	2.5(2)	36.3	37.5
Manchester	2.6(10)	—	37.5	—
New Britain	2.6(15)	3.7(3)	37.5	35.6
New Haven	3.6(13)	3.5(6)	36.8	36.2
New London	5.0(4)	3.3(3)	37.5	38.0
New Milford	3.6(5)	4.0(2)	37.4	38.0
Norwalk	2.4(5)	2.0(1)	37.2	38.0
Norwich	4.8(16)	—	37.0	—
Rocky Hill	1.9(7)	1.7(3)	37.4	36.7
Simsbury	1.6(5)	1.5(2)	37.6	38.0
Somers	3.5(6)	2.0(2)	36.5	37.0
Tolland	0.8(4)	3.0(1)	35.8	34.0
Wallingford	3.9(14)	2.3(6)	36.9	37.3
Waterbury	2.5(31)	2.6(5)	37.1	37.0
Watertown	3.0(6)	8.3(3)	37.2	36.0
Winchester	—	3.0(5)	—	37.6
Woodbury	5.0(2)	5.0(3)	33.5	36.3

¹ Only towns with at least 5 samples.

² The number in parenthesis indicates number of samples analyzed.

Table 7. Flavor criticism of milk samples collected at schools.

Flavor criticism	No. of samples	% of samples
no criticism	82	20.5
feed	171	42.6
lacks freshness	56	14.0
burnt paper or plastic	39	9.7
cooked and feed	28	7.0
cooked	12	3.0
vitamin flavor	5	1.3
musty	2	0.5
watery	1	0.2
oxidized	2	0.5
unsatisfactory (no specific criticism)	3	0.7
Total	401	

Table 8. Complaints or criticisms by cafeteria personnel concerning milk sold in school cafeterias.

Complaint or criticism	No. of citations	% of total citations
no complaints cited	123	31.1
leaking carton	106	26.8
off-flavor milk	63	15.9
frozen milk	29	7.3
burnt carton	17	4.3
illegible code date	16	4.1
dirty carton	15	3.8
difficult to open carton	9	2.3
carton not full	9	2.3
milk too warm	7	1.8
past code date	1	0.3
Total	395	

Table 9. Amount and percentage of milk taken but not consumed.

	Type of school		
	Elementary	Middle	High
Schools examined	12	6	1
% milk not consumed			
whole	15.8	6.5	4.2
chocolate-flavored	9.0	3.9 ¹	2.8
nonfat	19.8 ²	10.8 ³	3.1 ³
% of half-pint cartons with milk left			
whole	38.2	17.1	10.8
chocolate-flavored	23.3	10.1 ¹	8.1
nonfat	33.3 ²	28.6 ³	12.8 ³
Av. ml milk left per half-pint carton			
whole	97.6	90.3	110.5
chocolate-flavored	81.1	87.9 ¹	100.2
nonfat	140.0 ²	89.4 ³	57.0 ²

¹ Two schools did not offer chocolate-flavored milk.

² One school represented.

³ Four schools represented.

consumption. Further, we were not able to determine who left more milk, students who purchased milk to accompany lunch from home or those provided milk with a purchased lunch. This aspect merits further study.

Camps

Types: In the 26 residential and 16 day camps examined, 7,036 campers were enrolled. Thirty-four of the 42 camps were operated as non-profit enterprises. Camps were generally divided into those for two age groups,

four to 13 and 11 to 17, although there was considerable overlapping of ages. The camps were located in 38 towns in Connecticut (Table 11).

Analysis of samples: The samples collected from 34 camps in 25 different towns are described in Table 11. The average age of milk was 4.6 and 5.7 days in the residential and day camps. Thus, the milk in camps was older than that found in schools (3.5 days). Also, 63% of the samples at residential and 33% at day camps had unsatisfactory flavor whereas only 14% of the samples collected at schools had unsatisfactory flavor. The predominant criticism was "lacking freshness."

When collected, the average temperature of samples was 5.6°C (42°F) (Table 9) compared to 3.8°C (38.8°F) for school samples. Again, we must point out that there was no way of knowing whether the milk had been properly refrigerated during transport or storage at the camps.

The total aerobic bacterial count (Standard Plate Count per ml) of samples from camps averaged 13,130 (within legal standards) but was higher than in the samples from schools.

Sixty-two percent of the non-profit day camps participated in the USDA milk program. Interestingly 75% of the non-profit day camps participating in the USDA program limited the amount of milk taken by each camper while only half of the camps not participating (including for-profit enterprises) limited the quantity.

Since most camps provided no choice, preference for type of milk was not tested. The amount of milk consumed at residential camps was slightly higher than at day camps (Table 11), but 56% of the day camps limited the quantity of milk which could be taken.

Table 10. Data from individual schools for milk taken but not consumed.

School & Type ¹	Town	Grades in School	% not consumed		
			whole milk	chocolate-flavored milk	nonfat milk
Naubuc (E)	Glastonbury	1 to 4	23	11	—
Hopewell (E)	Glastonbury	1 to 5	14	7	—
Langford (E)	East Hartford	1 to 5	14	8	—
East Farms (E)	Waterbury	1 to 6	18	13	—
Anderson (E)	Waterbury	1 to 5	20	9	—
McDonough (E)	Hartford	1 to 6	9	8	—
Moser (E)	Rocky Hill	1 & 2	6	9	—
Warehouse Pt. (E)	East Windsor	1 & 2	15	5	—
Enfield St. (E)	Enfield	1 to 6	6	5	—
Hicks Memor. (E)	Tolland	3 & 4	25	10	—
Windham Cntr. (E)	Windham	2 to 5	16	7	—
Sherman (E)	New Haven	K to 4	23	17	20
Alcott (M)	Wolcott	7 & 8	7	—	19
Kelly (M)	Norwich	7 & 8	10	6	—
Swift (M)	Watertown	7 & 8	5	—	9
O'Brien (M)	East Hartford	6 to 8	9	2	—
Hammarskjöld (M)	Wallingford	7 & 8	5	3	6
James Memor. (M)	Simsbury	7 & 8	7	4	9
Hamden High (H)	Hamden	10 to 12	7	4	3

¹ E = elementary school; M = middle school; H = high school.

Table 11. Analysis of milk samples collected at residential and day camps.

Analysis	Type of camp	
	Residential	Day
Camps visited	26 ¹	16 ²
Enrollment	4,493	2,543
Ounces milk served per meal	10.8 (320 ml) ⁴	9.4 (279 ml)
Ounces milk served per meal (range)	3.3 to 18.0 ⁶ (97 to 532 ml)	7.1 to 16.0 ⁶ (208 to 473 ml)
Times milk offered per day (avg.)	2.5 (range 2 to 4)	1
Age of milk (days)	4.65 (17) ³	5.86(14)
Flavor score	35.1 (19)	35.8 (15)
% with unsatisfactory flavor	63	33
Temp. of samples (°C/°F)	5.7/42.2 (19)	5.4/41.8 (15)

¹ 16 camps were co-educational, 7 all male, 3 all female.

² 12 camps were co-educational, 2 all male, 2 all female.

³ The number in parenthesis indicates number of samples examined.

⁴ One-half pint = 8 fluid ounces or 236 ml.

⁵ All residential camps provided unlimited amounts of milk if offered at a given meal. Unlimited amounts of juice drink were generally provided if milk was not offered.

⁶ All day camps served milk only once per day. Nine of 16 day camps limited the amount of milk per camper.

Discussion

The average age of milk collected in schools in 1975 was 2.6 days (3) as compared to 3.5 days now. Increased age of milk found in schools could be attributed to change from daily delivery to every-other-day delivery to schools, and we have been told that not all milk destined for schools is delivered the same day it is processed.

Our data show that temperatures of storage equipment and of milk found in storage and serving equipment was satisfactory. However, we could not determine if the milk had been stored earlier at some higher temperature. Of concern is that about 50% of the schools served unrefrigerated milk. However, only 15.5% of the unrefrigerated samples were found to be above 7.2°C (45°F) suggesting that the milk had not been left unrefrigerated for a long period.

Now that preference patterns have been delineated, behavior can be investigated. For example, do students take chocolate-flavored milk at school because they are denied it at home? Do parents suggest the taking of chocolate-flavored milk at school because it contains less fat than whole milk? At those schools where milk consumption is low, is the taking of milk not encouraged? Does less milk taken by students in some schools relate to lactose intolerance? Would it help in those schools to provide modified milk, i.e., milk treated with lactase to lower the lactose content? Do students prefer chocolate-flavored milk because they do not like the taste (off-flavor?) of whole or lower fat unflavored milk?

The Connecticut State Department of Agriculture is now examining schools with below average milk consumption to determine whether low consumption is due to low quality of products. Thus, our study may serve dairy processors by helping them to provide a wholesome product, the school nutritionists and cafeteria workers by

examining problems concerned with keeping quality, and the students by assuring that they continue to receive milk of good quality.

NOTE: Requests by school administrators, dieticians, etc., who desire information on individual schools within towns listed in this Bulletin will be honored. Write to Dr. L. Hankin, The Connecticut Agricultural Experiment Station, Box 1106, New Haven, CT 06504.

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