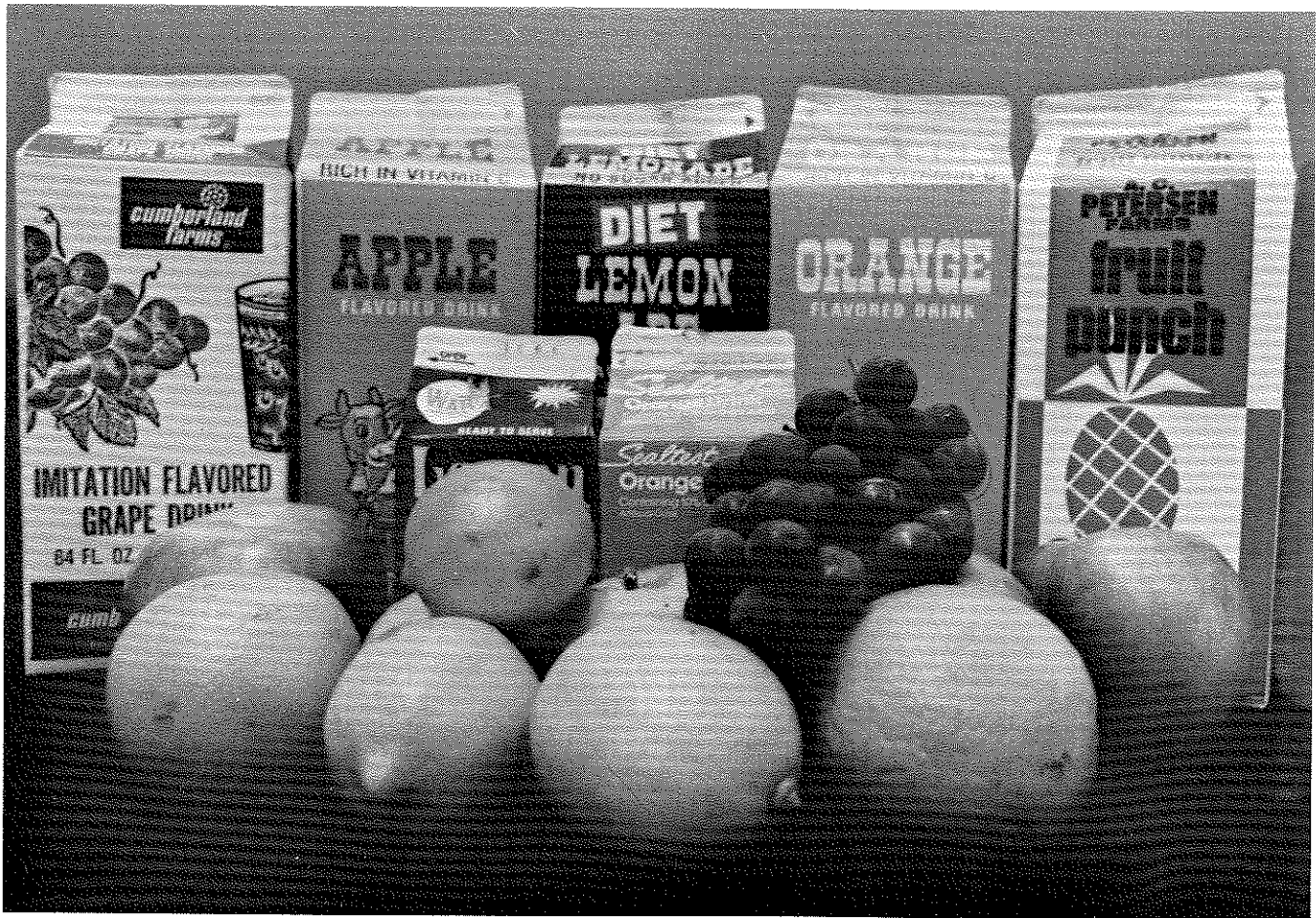


QUALITY OF JUICE DRINKS

*A Cooperative Study by the Connecticut Department of Agriculture
and The Connecticut Agricultural Experiment Station*

By Lester Hankin, Donald Shields, and J. Gordon Hanna



**BULLETIN 790 • THE CONNECTICUT AGRICULTURAL
EXPERIMENT STATION NEW HAVEN • OCTOBER 1980**

Lester Hankin and J. Gordon Hanna are on the staff of The Connecticut Agricultural Experiment Station in New Haven. Donald Shields is on the staff of the Dairy Division, Connecticut Department of Agriculture, in Hartford. Requests for additional copies should be addressed to Publications, The Connecticut Agricultural Experiment Station, P.O. Box 1106, New Haven, CT 06504.

QUALITY OF JUICE DRINKS

By Lester Hankin, Donald Shields, and J. Gordon Hanna

During warm weather non-carbonated fruit juice drinks are popular with persons of all ages. Refrigerated cases in food stores display a variety of flavors packaged in sizes ranging from half-pints to gallons. Small containers are also sold in vending machines. Many of the juice drinks, including iced tea, are bottled and distributed by bottlers of milk and other dairy products. Since juice drinks are popular and widely sold, we tested them for quality.

Non-carbonated juice drinks fall into several categories, including juice drinks, -ades, drinks and punch, flavored drinks, and artificially-flavored products. Examples of label names to fit each category are: orange juice drink, orange-ade, orange drink, orange flavored drink, and artificially-flavored orange drink.

In Connecticut the amount of fruit juice each category must contain is set by guides established by the Connecticut Department of Consumer Protection: juice drinks shall contain at least 30% juice; -ades, except lemon and lime, shall contain at least 15% juice; lemon- and lime-ades shall contain at least 12.3% juice; drinks and punches, except lemon and lime, shall contain at least 10% juice; lemon and lime drinks shall contain at least 6% juice; flavored drinks may contain less than 10% juice and

artificially-flavored products are not required to contain any juice.

As more water is added to juice, juice concentrates or powdered mixes to make drinks, -ades, punches, etc., additives such as artificial and natural flavors and colors may be added to enhance flavor and aesthetic appeal. In many cases a preservative is added to retard bacterial growth (benzoate) or fungal growth (sorbate) and enhance keeping.

In the present study we analyzed non-carbonated juice drinks, including some iced tea, for yeast, mold, and bacterial contamination, for acidity and content of juice, preservatives, carbohydrates and calories. We proceeded in a manner similar to our tests of yogurt (1).

METHODS

June through August, 1980, samples were collected either at food stores or at dairy plants and placed on ice for delivery to the laboratory. Seventy-four samples representing 27 different brands were examined. Included were four samples of iced tea. Only products found in refrigerated cases were taken for analysis. Unrefrigerated or canned products were not examined.

Preservatives, carbohydrates, caloric content, vitamin C content, acidity, and microbial analysis of juice drinks

2

Brand	Type and Flavor	Acidity (% citric acid)	Preservatives			
			Benzoate		Sorbate	
			% declared	% found	% declared	% found
A.C. Petersen Farms	Orange drink-10% orange juice	0.32	— ³	0.003	—	—
A.C. Petersen Farms	Lemonade	0.68	—	—	—	—
A.C. Petersen Farms	Fruit punch	0.33	—	0.007 ⁴	—	—
Cumberland Farms	Orange flavored drink	0.21	<0.1	trace ⁴	—	trace ⁵
Cumberland Farms	Lemon flavored drink	0.47	<0.1	trace	—	—
Cumberland Farms	Fruit punch flavored drink	0.21	<0.1	0.005	—	trace
Cumberland Farms	Imitation flavored grape drink	0.21	<0.1	0.017	—	—
Dairy Mart	Orange flavored drink-less than 5% juice	0.26	<0.1	0.026	—	—
Dairy Mart	Fruit punch flavored drink	0.32	<0.1	0.037	—	—
Dairy Lea Cooperative, Rainbow	Orange drink, contains less than 5% juice	0.20	<0.1	0.010	<0.1	0.013
Dairy Lea Cooperative, Rainbow	Grape drink, less than 5% juice	0.19	<0.1	0.015	<0.1	0.013
Daniels Farm Dairy	Orange drink, contains 10% juice	0.28	—	0.021	0.02	trace
Deary Bros.	Orange drink	0.38	—	0.020	—	trace
Deary Bros.	Lemonade	0.46	—	0.021	—	—
Deary Bros.	Fruit punch	0.23	—	—	—	—
DeCiantis Bros. Dairy	Lemon drink	0.34	—	0.016	—	trace
DeCiantis Bros. Dairy	Fruit punch flavored drink	0.42	<0.1	0.026	—	trace
Driscoll's Dairy	Orange drink	0.32	0.1	0.035	—	—
Driscoll's Dairy	Lemonade	0.43	—	0.004	—	—
Driscoll's Dairy	Imitation fruit punch	0.33	0.1	0.032	—	—
Garelick Farms	Lemonade, less than 5% juice	0.37	+ ⁷	0.039	+ ⁷	trace
Garelick Farms	Fruit punch, less than 5% fruit juices	0.36	+ ⁷	0.036	+ ⁷	trace
Greenbacker Schwink	Orange drink	0.33	—	0.004	—	—
Greenbacker Schwink	Lemonade	0.60	—	trace	—	—
Greenbacker Schwink	Fruit punch	0.23	—	0.021	—	trace
Guida's Dairy	Orange flavored drink, contains less than 5% juice	0.29	<0.1	0.054	—	—
Guida's Dairy	Fruit punch flavored drink	0.26	<0.1	0.092	—	—
Guida's Dairy	Grape flavored drink	0.25	<0.1	0.048	—	trace
Hood	Lemonade, all natural	0.28	—	—	—	—
Hood	Fruit punch, all natural flavors	0.39	—	—	—	—
Hood	Iced tea, lemon flavored, sugar added ⁸	0.66	—	—	—	—
Knudsen Bros.	Fruit punch flavored drink	0.30	0.1	0.039	<0.1	trace
Knudsen Bros.	Grape flavored drink	0.21	0.1	0.016	<0.1	0.001
Maple Hill Farms	Orange drink	0.30	—	0.004	—	—
Maple Hill Farms	Lemonade	0.49	—	—	—	—
Marcus Dairy	Orange drink, 10% juice, vit. C enriched	0.32	—	0.064	—	trace
Marcus Dairy	Lemonade	0.64	—	0.004	—	trace
Mill Pond Farm	Orange flavored drink, rich in vit. C	0.23	<0.1	0.031	—	—
Mill Pond Farm	Lemon-N-Lime flavored drink, rich in vit. C	0.23	—	0.020	—	—
Mill Pond Farm	Fruit punch flavored drink	0.26	<0.1	0.027	—	—
Minute Maid	Lemonade, natural	0.70	—	0.004	—	—
Minute Maid	Fruit punch, natural	0.38	—	0.003	—	—
Moser Farms	Orange flavored drink	0.23	<0.1	0.038	—	0.001
Moser Farms	Lemon flavored drink	0.38	0.1	0.005	—	0.032
Moser Farms	Lemon & Lime flavored drink	0.32	0.15	0.030	—	0.030
Moser Farms	Fruit punch flavored drink	0.22	<0.1	0.033	—	0.025
Moser Farms	Grape flavored drink	0.18	<0.1	0.031	—	0.026
Moser Farms	Iced tea, lemon flavored ⁹	0.14	—	0.027	—	0.030
Mountain Dairy	Orange drink	0.29	—	0.004	0.02	—
Mountain Dairy	Fruit punch	0.32	—	0.008	0.02	—
Sealtest	Orange drink, 10% juice	0.30	—	0.004	—	trace
Sealtest	Lemonade	0.70	—	0.006	—	0.002
Stew Leonard's	Orange flavored drink	0.24	—	0.003	—	trace
Stew Leonard's	Lemonade flavored drink, rich in vit. C	0.59	—	0.004	—	—
Stew Leonard's	Diet lemonade flavored drink	0.57	—	0.004	—	—
Stew Leonard's	Lemon-N-Lime flavored drink, rich in vit. C	0.31	—	0.003	—	—
Stew Leonard's	Fruit punch flavored drink, rich in vit. C	0.23	—	0.004	—	trace
Stew Leonard's	Grape flavored drink	0.32	—	trace	—	—
Stew Leonard's	Black cherry flavored drink	0.22	—	trace	—	trace
Stew Leonard's	Apple flavored drink, rich in vit. C	0.31	—	0.004	—	trace
Stew Leonard's	Iced tea, lemon and sugar added ¹¹	0.59	—	0.007	—	—
Stew Leonard's	Diet iced tea ¹²	0.24	—	—	—	—
Sunny Delight (Doric Foods)	Citrus punch	0.70	—	—	0.05	0.026
Tropicana	Orange-pineapple drink, 20% juice	0.52	—	0.011	—	0.009
Tropicana	Fruit punch, 20% juice	0.36	0.05	0.010	0.05	0.007
Tropicana	Grape drink, 5% juice	0.32	0.05	0.014	0.05	0.006
University of Connecticut	Punch flavored drink	0.22	—	0.002	—	trace
Wade's Dairy	Orange drink, 10% juice	0.32	<0.1	0.005	—	—
Wade's Dairy	Fruit punch flavored drink	0.24	0.1	0.005	—	—
Wade's Dairy	Grape flavored drink	0.19	0.1	0.004	—	—
Wellesley Farms	Fruit punch drink	0.30	+ ¹³	0.028	+ ¹³	0.057
Wawa Dairy Farms	Orange drink, less than 5% juice	0.34	0.1	trace	—	0.012
Wawa Dairy Farms	Lemon drink, 5% juice	0.30	0.1	0.004	—	0.013
Wawa Dairy Farms	Fruit punch, 5% fruit juice	0.24	—	0.006	0.1	0.01

Footnotes to table:

1. Only samples declaring vitamin C (ascorbic acid) were analyzed.
2. Vitamin C determined as L-ascorbic acid.
3. A dash (—) in the % declared column indicates none of the additive was declared and a dash (—) in the % found column indicates none was found.
4. A trace quantity of benzoate is less than 0.002%.
5. A trace quantity of sorbate is less than 0.001%.
6. Declared ascorbic acid (vitamin C) added but amount not stated.
7. Both benzoate and sorbate declared but amount not stated.

Carbohydrates gm/227 ml (8 oz.)	Calories No./227 ml (8 oz.)	Juice Content		Microbial Analysis			Declarations		Vitamin C ¹	
		% required	% found	Yeast No./ml	Mold No./ml	Bacteria No./ml	Artificial color	Artificial flavor	mg declared/ 8 oz.	mg found/ 8 oz. ²
24.7	99	10	11	<1	2	1	+	-	-	
24.4	98	12.3	11	<1	<1	23	-	-	-	
24.8	99	10	15	<1	<1	2	+	-	-	
26.2	105	<10	1	<1	<1	<1	+	-	-	
24.9	99	<10	3	<1	<1	<1	+	-	-	
28.0	112	<10	2	<1	<1	<1	+	-	-	
27.1	109	0	4	<1	<1	<1	+	+	-	
28.7	115	<10	2	<1	<1	1	+	-	-	
29.5	118	<10	2	<1	<1	<1	+	-	-	
19.1	76	10	5	110	<1	6,800	+	-	-	
19.3	77	10	6	<1	<1	<1	+	-	-	
21.9	88	10	8	<1	<1	11	+	-	-	
37.4	150	10	10	55	<1	160	+	-	-	
28.3	113	12.3	4	71	<1	710	+	-	-	
31.2	125	10	4	36	<1	38	+	-	-	
12.1	48	6	5	<1	<1	<1	-	-	-	
29.5	118	<10	5	<1	<1	<1	+	-	-	
23.6	94	10	12	<1	<1	<1	+	-	+6	0
21.9	88	12.3	8	<1	3	<1	-	-	-	
26.1	104	0	14	2	<1	<1	+	+	-	
36.0	144	12.3	2	<1	<1	1	+	-	-	
34.2	137	10	3	<1	<1	1	+	-	-	
24.9	100	10	9	4	<1	<1	-	-	-	
22.3	89	12.3	14	<1	1	<1	+	-	-	
22.0	88	10	5	1	<1	<1	+	-	-	
27.1	108	<10	3	<1	<1	47,000	+	-	-	
24.5	98	<10	3	<1	<1	5	+	-	-	
24.9	99	<10	3	<1	<1	5,400	+	-	-	
18.8	75	12.3	14	<1	<1	3	-	-	-	
32.0	127	10	14	<1	<1	<1	+	-	-	
27.0	108	0	0	<1	<1	<1	-	-	-	
23.7	95	<10	4	<1	<1	<1	+	-	-	
22.5	90	<10	2	<1	<1	<1	+	+	-	
22.5	90	10	9	27	<1	32	+	-	-	
19.3	77	12.3	14	360	<1	14	-	-	-	
29.8	119	10	8	1	<1	2	+	-	30	0
25.3	101	12.3	13	<1	<1	<1	-	-	-	
22.3	89	<10	1	<1	<1	1	+	-	-	
22.1	88	<10	1	1	<1	50	+	-	-	
22.1	88	<10	1	<1	<1	<1	+	-	-	
22.9	92	12.3	10	<1	<1	<1	-	-	-	
29.6	118	10	12	<1	<1	2	-	-	-	
16.3	65	<10	3	<1	<1	<1	+	-	-	
18.4	73	<10	8	<1	<1	<1	+	-	-	
17.9	72	<10	7	<1	<1	<1	+	-	-	
18.8	75	<10	4	<1	<1	<1	+	-	-	
20.3	81	<10	6	<1	<1	<1	+	-	-	
16.8	67	0	0	<1	<1	<1	+	-	-	
28.7	115	10	10	4	<1	<1	+	-	-	
29.9	119	10	14	<1	1	<1	+	-	-	
29.2	117	10	9	<1	1	<1	+	-	-	
26.8	107	12.3	15	<1	<1	<1	-	-	-	
25.7	103	<10	3	1	<1	<1	+	-	30	27.7
25.6	104	<10	11	<1	1	<1	-	-	30	37.8
<0.23	<1	<10	9	1	<1	<1	+	-	-	
25.8	103	<10	7	<1	<1	<1	+	-	30	37.8
26.1	104	<10	5	1	<1	5	+	-	30	34.8
24.9	100	<10	3	2	<1	<1	+	-	30	27.4
25.9	103	<10	4	1	3	<1	+	-	-	
26.2	105	<10	6	4	5	<1	+	-	30	0
16.3	65	0	0	<1	<1	<1	-	+	-	
0	<1	0	0	1	3	<1	+	+	-	
23.2	93	10	30	<1	<1	<1	+	-	80	69.9
24.8	99	10	20	<1	<1	<1	+	+	-	
27.6	111	10	29	<1	<1	<1	+	-	-	
27.2	109	10	9	<1	<1	<1	+	-	-	
32.3	129	<10	3	<1	<1	<1	+	-	-	
28.1	113	10	9	<1	<1	4	+	-	+6	0
27.7	111	<10	3	<1	3	<1	+	-	-	
20.9	84	<10	2	<1	<1	<1	+	-	-	
25.5	102	10	2	<1	<1	<1	+	+	-	
25.0	100	10	3	<1	<1	<1	+	-	-	
25.5	102	6	6	<1	<1	<1	+	-	-	
22.1	88	10	3	<1	<1	<1	+	-	-	

8. Caffeine content was 22.7 mg per 8 ounces.
 9. Caffeine content was 14.5 mg per 8 ounces. This sample declared BHA as a preservative.
 10. Declared 0.03% sodium saccharine per 8 ounces; found 0.031%.
 11. Caffeine content was 20.9 mg per 8 ounces.
 12. Caffeine content was 23.8 mg per 8 ounces. Declared 0.03% sodium saccharine per 8 ounces; found 0.057%.
 13. Both benzoate and sorbate declared but amount not stated.

All analyses were performed in the laboratories of The Connecticut Agricultural Experiment Station in New Haven. Carbohydrates, juice content, calories, vitamin C, and acidity were determined by methods described by the Association of Official Analytical Chemists (3). Preservatives, caffeine and saccharine were determined by high-pressure liquid-chromatography (4). Microbial analyses were performed using methods in Recommended Methods for the Microbial Examination of Foods (2).

RESULTS

Data on all samples are shown in the table and all results refer to this table.

The 74 samples of drinks listed alphabetically by brand name included 21 fruit punch, 18 orange, 16 lemon or lemonade, 8 grape, 3 lemon-lime, and one each of black cherry, apple, citrus, and orange-pineapple. Four iced teas were examined. Two samples were labelled as diet products. Fifty-nine samples declared use of artificial color; 8 declared artificial flavor.

Labels on 33 samples declared addition of sodium benzoate and 14 declared potassium sorbate. For all samples declaring benzoate less than the amount claimed was found. The same was true for samples claiming addition of sorbate. Benzoate was found (above a trace level) in 31 of 41 samples not declaring it. Sorbate was found in 10 samples that did not declare use of this preservative.

Ten labels declared that the product was fortified with vitamin C (ascorbic acid). These 10 were the only ones tested for vitamin C content and 5 met their claim.

Yeast contamination greater than 10 ml was found in six samples. Less than 10 yeast per ml is considered insignificant. No samples contained coliform bacteria, which indicates good packaging of samples not containing benzoate. Mold contamination was minimal; not more than 5 per ml was found in any sample.

Bacterial contamination of more than 10 colony-forming units per ml was found in only 11 samples. Eight of these samples did

not declare benzoate on the label.

The percent acidity expressed as citric acid indicates tartness. The average percent acidity of all samples was 0.34%. The lemonades and lemon-flavored drinks averaged 0.54% acidity, while the fruit punches and fruit punch flavored drinks averaged only 0.29%.

Carbohydrate or total sugars, except for diet products, ranged from 12.1 to 34.2 grams per 227 ml (8 ounces). Except for diet products, the number of calories per 227 ml ranged from 65 to 127. Calories were calculated as if all were from carbohydrate.

The amount of juice required for each product and the amount found is shown in the table. Fifteen of the 70 juice drinks, or about a fifth, did not contain the required amount of juice. The amount of caffeine found in the iced teas is shown in footnotes to the table. Saccharine content of the diet products is also shown in footnotes.

SUMMARY

In most cases, the juices examined were found to be of acceptable microbial quality. This suggests that where a preservative was used, microorganisms were controlled. Where a preservative was not used and the microbial quality was satisfactory, good manufacturing practices are indicated.

Where benzoate was declared, the amount of preservative was below the amount claimed. Benzoate was detected in 73% of the samples where it was not declared. Further, sorbate was detected in 13.5% of the samples not declaring it. The amount of sorbate and benzoate in these samples, however, was not higher than recommended for juice drinks.

The amount of carbohydrate varied. Therefore, interested persons can choose different drinks based on caloric content.

Twenty-one percent of the samples failed to meet Connecticut guidelines for required juice content.

Although not all available brands and flavors were tested, sufficient were examined to provide an overview of the products available to Connecticut consumers.

ACKNOWLEDGMENTS

We thank Molly Waite, Sherman Squires, Mary Alice Illig, Sunrae McLean, Alphonse Wickroski, and Richard Hastings for the various analyses, and we thank inspectors of the Connecticut Department of Agriculture for collecting some of the samples.

REFERENCES

1. Hankin, L. and D. Shields. 1980. Quality of Yogurt. The Conn. Agric.

Experiment Station Bull. No. 785. New Haven, CT.

2. Recommended Methods for the Microbiological Examination of Foods. 1966, 2nd ed., J.M. Sharf, ed. American Public Health Assoc., New York, NY.

3. Official Methods of Analysis. 1975, 12th ed., W. Horwitz, ed. Assoc. Official Analytical Chemists, Washington, D.C.

4. Schuster, R. and K. Wessely. 1977. HPLC-Analysis of Food Additives I. Preservatives. Hewlett-Packard Application Note AN 232-4.