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GRAPEFRUIT JUICE: FLORIDA DEPARTMENT OF CITRUS' SCHOOL KIDS FLAVOR EVALUATION PROJECT

SANTIAGO M. BARROS, WILLIAM S. STINSON
AND TAMMY FLANNERY
Florida Department of Citrus
Scientific Research Department
Citrus Research and Education Center
700 Experiment Station Road
Lake Alfred, FL 33850

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Abstract. **Studies into the demographics of consumers who purchase grapefruit juice, have shown results which are skewed toward the older consumer. Basically the younger generation purchases little if any quantities of grapefruit juice on a regular basis. Therefore there is a tremendous opportunity for the sale of grapefruit juice amongst the younger generation. The challenge is to manufacture a grapefruit juice or grapefruit juice product which appeals to the younger generation of consumers including school aged kids. A comparative test of canned and chilled grapefruit juice from concentrate involving school kids was recently conducted and the results of this test will be reported.**

The overall sales of grapefruit juice in the United States (U.S.) has been on the decline for some time. According to the Nielson tracking data shown on Fig. 1, grapefruit juice sales in Supermarkets, with over $2 million in annual sales, have seen over 20% decline. Grapefruit production as shown on Fig. 2, has decreased only 12% in the U.S. and only 12.6% in Florida over the same period of time (Florida Agricultural Statistics Service), meaning that an oversupply of grapefruit juice still exists thus limiting the overall economic return to the grower.

In a recent study of demographics of grapefruit juice consumers (Pensa, 2002), the results showed the demographics were skewed toward the older consumer. Basically the younger

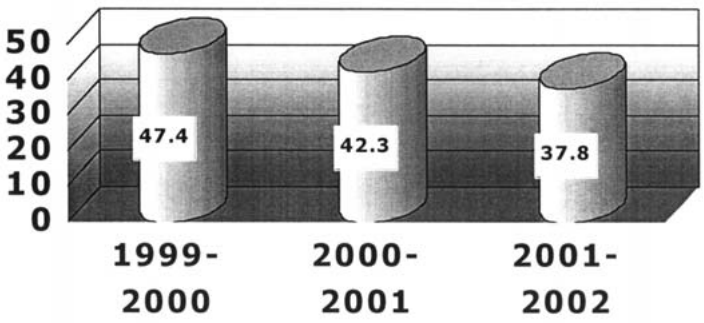

Fig. 1. Grapefruit juice sales. Nielson $2 mm Supermarkets.

generation purchases little if any quantities of grapefruit juice on a regular basis. This result shows that there is a tremendous opportunity for the sale of grapefruit juice amongst the younger generation. The challenge to the grapefruit juice manufacturing industry is to produce a grapefruit juice or grapefruit juice product which appeals to the younger generation.

In December of 2001, a meeting with United States Department of Agriculture (USDA), Agricultural and Marketing Service (AMS) and Florida Department of Citrus (FDOC) personnel was held in Washington, D.C., to discuss among other issues how to increase the use of grapefruit juice in schools. Out of this meeting an opportunity to have samples of 100% Florida grapefruit juice and samples of grapefruit juice blends evaluated as part of a USDA Commodity Food Evaluation test was offered. The USDA was conducting the test at a Washington D.C. elementary school in late January 2002. The results of these tests utilizing elementary school kids were very encouraging (Barros and Stinson, 2002).

As a follow up to the tests in Washington, D.C., several studies were conducted at Lakeland area schools. Included in the studies, was a study to evaluate if school children could discriminate between a USDA graded 54 flavor grapefruit juice and a USDA graded 56 flavor grapefruit juice. Secondly, to see if the children could discriminate between canned and chilled grapefruit juice. The results of those studies will be discussed within this publication.

Materials and Methods

Samples of commercial, reconstituted pigmented grapefruit juice packaged in cans and plastic containers was purchased at a local retail supermarket and graded by USDA-AMS, Fruit and Vegetable Division, Processed Product Branch inspectors in Winter Haven, Fla. The grapefruit juice packaged in plastic containers was acquired from the chilled products section of the supermarket.

Arrangements were made through the Polk County School System to have the testing done using elementary and middle schools in the Lakeland, Florida area. Three schools were selected to participate in this particular study. Two elementary and one middle school supplied the 147 kids for the juice evaluations. There were 78 elementary school kids (3rd thru 6th graders) and 69 middle school kids (7th and 8th graders). Specific arrangements, i.e. testing sites within the school and the students for the evaluations, were made at each school through their respective cafeteria managers.

Each student was given a questionnaire which included questions for one set of samples. Additional questions relating to the liking and use of grapefruit juice were also included in the questionnaire. The procedure to be followed during the evaluations as well as how to fill out the questionnaire was clearly explained to each group of students prior to testing. Before tasting of each sample, the students were asked to eat part of a cracker and then drink some water to cleanse their pallets. Each student evaluated two of the three 2-sample sets of juices for a total of 4 samples. Samples were lettered A-F. Samples E and F were duplicate of the 56 flavor canned and chilled products. The additional letters were used to minimize confusion among the students. All sets of juices received an equal number of evaluations. All testing was conducted in randomized ordering.

Samples of the juices evaluated were analyzed in the juice laboratory at the Citrus Research and Education Center in Lake Alfred, Fla. The analyses and procedures used are in common use by the citrus industry and have been previously referenced (FMC Corporation, 1983).

Results and Discussion

Table 1 depicts the analyses of the canned and chilled grapefruit juice from concentrate samples evaluated by the students. The basic differences between the juices of same type processing (i.e., canned) are the °Brix/% Acid (B/A) ratio and the bitterness compounds, limonin and naringin. Of note is that the limonin content in the 54 flavor canned juice is significantly lower than its 56 flavor counterpart. The B/A ratio of the 56 canned juice is approximately one half point higher. The largest difference between the chilled juice sam-

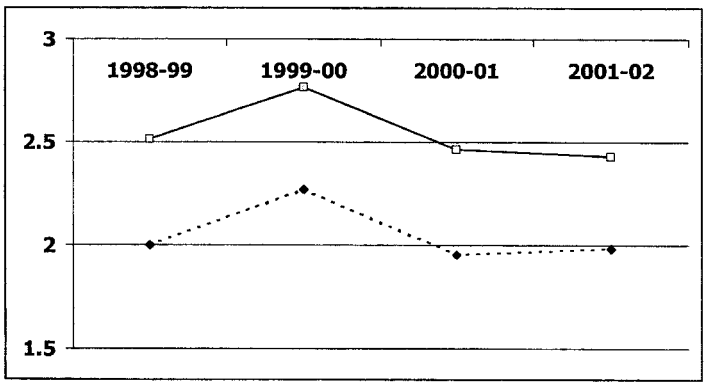

Fig. 2. Grapefruit: production for the United States and Florida 1998-99 through 2001-02.

Table 1. Grapefruit juice analysis. Kids flavor evaluation project.

	A 54 Canned	B 56 Canned	C 54 Chilled	D 56 Chilled
Brix-corrected	10.4	10.39	10.14	10.22
% Acid	1	0.95	1.18	1.09
Ratio	10.4	10.94	8.59	9.38
pH	3.33	3.34	3.21	3.20
% Oil	trace	trace	trace	trace
Viscosity	3.04	3.63	3.15	3.06
Pulp	4	4.5	4.5	5
Light transmission	5.4	4.6	5.7	6.4
Naringin-Davis test	694.1	717.2	727.7	727.7
Limonin (HPLC) ppm	7.51	12.1	12.1	11.1
Naringin (HPLC) ppm	397	368.8	403.4	414.5

ples was in their B/A ratios. The B/A ratio of the chilled grapefruit juices were lower than those found in the canned juice samples.

Figure 3 shows a copy of the questionnaire given to each student prior to their sample evaluations. Each juice sample in a set of samples was rated individually according to liking of the juice on the basis of a 5 point hedonic scale. After both juice samples in a set of samples were evaluated, the students were asked additional questions including, which sample he/she preferred.

Table 2 contains the results of the combined middle and elementary school flavor evaluations. The number of students and the % of students showing a preference for each sample evaluated are shown. Looking at the preference results between the USDA graded 54 and 56 flavor scores, the results indicate a preference for the 56 score for both the canned and chilled juices. In the case of the canned grapefruit juice, the 56 flavor score was significantly preferred at the 0.5 level, and for the chilled grapefruit juice, the 56 flavor scored product was significantly preferred at the 0.01 level. While the hedonic scores for the canned and chilled juices were higher for the 56 flavor scored juice 2.95 vs. 2.77 canned and 2.92 vs. 2.49 chilled, the overall rating for both of these sets of juices were lower than a 3.00 which falls in the "neither like it or dislike it" flavor category. All the juices evaluated fell within the "dislike it some" and the "neither like it nor dislike it" flavor categories.

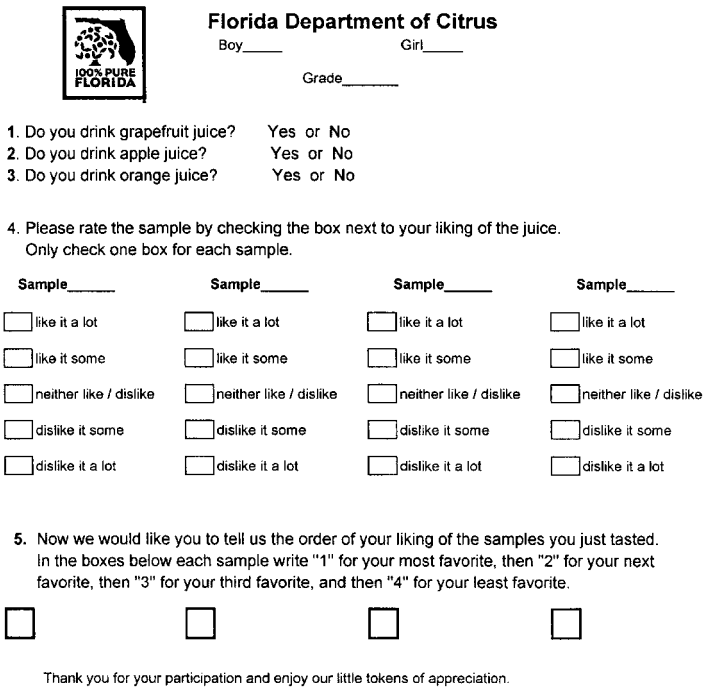

Fig. 3. Flavor evaluation form.

Table 2. Grapefruit juice analysis report. Combined middle school/elementary school data.

				Preference	
Sample	Set	From	Liking	#	%
A	I	Canned 54	2.77	36	39
B	I	Canned 56	2.95	56	61
C	II	Chilled 54	2.49	30	32
D	II	Chilled 56	2.92	65	68
E	III	Canned 56	3.39	52	55
F	III	Chilled 56	3.23	43	45

Table 3. Grapefruit juice analysis. Canned 56 vs Chilled 56—like rating.

Form	Compared to each other	When compared to 54 of like form	Average of all samples
Canned 56	3.39	2.95	3.17
Chilled 56	3.23	2.92	3.08

Table 3 shows the results of the evaluation of a USDA flavor graded 56 canned vs. a flavor graded 56 chilled grapefruit juice. Both juices received higher scores than when compared directly to their lower 54 flavor score counterparts. The canned 56 scored juice received a 3.39 hedonic flavor rating and the chilled received a 3.23 hedonic rating. Both of these scores fell between a "neither like it nor dislike it" and a "like it some" rating. Statistical analyses of these values showed no statistical difference between them, although the directional preference was for the canned 56 juice.

The results of this study indicate that kids can discriminate between a USDA flavor graded 54 and 56 grapefruit juice from concentrate with a preference for the 56 flavor graded product. The overall flavor scores indicate that the juices were at best just liked somewhat and that additional testing utilizing a fresh squeezed grapefruit juice or an optimized grapefruit juice blend may be in order to see whether either or both of these products demonstrate a higher form of appeal and thus would represent a target for grapefruit juice manufactures to aim for.

Literature Cited

A. C. Nielson, 2003. A.C. Nielson Scantrack Figures.

Barros, S. M. and W. S. Stinson. 2002. Grapefruit Juice/Juice Blends: School Kids Taste Test Results. Processing and Technology Conference, October 2002.

FMC Corporation, 1983. Procedures of Analysis: Citrus Products. Revision No. 6.

Florida Agricultural Statistics Service. 2003. Citrus Summary 2001-2002, Jan. 2003.

Pensa, R. 2002. US Citrus Juice Consumer and Consumption Trends, IFT Citrus Processing Short Course, in print.