*Journal of Food Protection Vol. 40, No. 3, Pages 158-159 (March, 1977)*


*A Research Note*

# Acceptability of a Whey-Based Quiescently Frozen Novelty

**J. W. STULL[1], R. R. TAYLOR[1], R. C. ANGUS[2], and T. C. DANIEL[3]**

*Department of Nutrition and Food Science,*
*Department of Agricultural Economics, and*
*Department of Psychology, The University of Arizona,*
*Tucson, Arizona 85721*

(Received for publication May 24, 1976)

**ABSTRACT**

In one experiment, an observer panel of young people aged 6 to 14 years indicated no difference in preference for quiescently frozen novelties formulated with water or ones containing untreated cottage cheese whey as the entire formulation liquid. In another experiment, nine whey-based, orange flavored, novelties were evaluated by a panel of seven female and eight male children aged 10 to 12 years at triplicate sessions 2 to 4 days apart. Samples were coded differently at each session. Untreated cottage cheese whey supplied at the formulation liquid. Sucrose: dextrose (3.6:1) at total concentrations of 17, 23, or 29% and pH values of 3.2, 3.5, or 3.8 were evaluated on a 10-point degree of certainty scale from "like" to "do not like." Theory of signal detection (TSD) analysis shows that products with 23% total sweetener at pH 3.2 or 3.5 were rated equally acceptable. These products were rated significantly more preferable than the others. There were no significant differences in ratings made at each session or between individual panel members.

Use of fluid cottage cheese whey as a food ingredient has considerable interest. In addition to nutrient content, its biological oxygen demand (B.O.D.) contribution to industrial waste either is or will be subject to a disposal charge in most areas (*13*). Furthermore, its relatively high water content (ca. 94%) results in high cost handling, storage, transportation, and processing procedures (*1*).

While various processed forms of whey are developed or proposed as food ingredients (*14*), limited information concerning liquid whey use is available. Its use as an ingredient for flavored beverages has been investigated (*5, 6*). In these reports, a 100% substitution of cottage cheese whey for water as the liquid component resulted in equal acceptability. Demott (*2*) made a beverage with cottage cheese whey produced by the direct acidification process. It was concluded that such a whey drink might very well be marketable.

A formulation using acid whey as a base for salad dressings has been reported (*11*). Panelists scored these samples at 5 or above on a 7-point hedonic scale, where 7 represented a value of "like extremely."

The possible use of liquid cottage cheese whey in a quiescently frozen novelty formulation has not been previously reported and has interesting possibilities. Since water ice type novelties are consumed to the greatest degree by young persons (*12*), it was considered important to evaluate certain composition variables relating to acceptability by this age group. Limited information is published concerning use of young persons in taste panel observations (*4, 7, 10*).

The present study reports the flavor acceptability of such novelties using either cottage cheese whey or water as the formulation liquid. A second objective was to evaluate the ability of preteenage young persons to evaluate the acceptability of whey-based novelties of various sweetener concentrations and pH values. Experiment 1 involves a 100% cottage cheese whey substitution for water in the ingredient array. Experiment 2 reports the observations concerning various sweetener concentrations and pH values.

## MATERIALS AND METHODS

Novelties with either untreated liquid cottage cheese whey or water as the liquid ingredient were prepared (Table 1). The pH was adjusted after heat treatment by addition of 50% aqueous citric acid. After blending dry and liquid ingredients, heating to 71 C, and cooling to 4 C, the mixture was flavored with a natural, concentrated orange flavoring containing artificial coloring and added as recommended by the manufacturer. Fifty-ml aliquots were frozen on wooden color coded novelty sticks at -35 C. In preparation for serving, samples were tempered at -17 C.

TABLE 1. *Composition of novelties*

| Sample | Total Sweetener[a](%) | Stabilizer[b](%) | Liquid | pH |
|---|---|---|---|---|
| *Experiment 1* | | | | |
| 1 | 17 | 0.27 | Water | 3.2 |
| 2 | 17 | 0.27 | Whey | 3.2 |
| *Experiment 2* | | | | |
| 3, 4, 5 | 17 | 0.27 | Whey | 3.2, 3.5, 3.8, respectively |
| 6, 7, 8 | 23 | 0.26 | Whey | 3.2, 3.5, 3.8, respectively |
| 9, 10, 11 | 29 | 0.25 | Whey | 3.2, 3.5, 3.8, respectively |

[a]3.6 parts sucrose and 1 part dextrose.
[b]A guar gum/pectin colloid.

In Experiment 1, the observer group was 779 persons (approximately an equal number of males and females) aged 6 to 14 years. In Experiment 2, the observer panel was eight male and seven female

[1]*Department of Nutrition and Food Science.*
[2]*Department of Agricultural Economics.*
[3]*Department of Psychology.*

persons aged 10 to 12 years. The individuals were not aware of the composition characteristics or the variables in the samples. Following oral instructions regarding tasting procedures and decision recording, panel members were either seated in a cafeteria (Experiment 1) or in a large laboratory (Experiment 2) providing suitable spacing between individuals. Sufficient proctors were stationed to control distractions, maintain adherence to instructions, and provide general surveillance of sample serving.

In Experiment 1, the observers were presented two samples with random color coding on the novelty sticks. The observers reported their decisions on a form, "I liked the one with the *(red, green)* stick best." In Experiment 2, the nine samples were presented in random order at a uniform interval of about one every 2 min. Every panel member made replicate evaluations of the nine samples at three sessions 2 to 4 days apart with different randomization and the numbering at the sessions. The panel reported their decisions in this trial on the basis of a 10-point scale from "absolutely certain that I like" to "absolutely certain I do not like."

## RESULTS AND DISCUSSION

### *Experiment 1*

A preference selection for the product formulated with water (Sample 1) was made by 396 observers while the remainder (383) indicated a preference for the whey formulation (Sample 2). This indicates that, under the conditions of this observation, young people (aged 6 to 14 years) cannot detect the difference between water ice novelties formulated with water or ones containing untreated, liquid cottage cheese whey.

### *Experiment 2*

The rating scores in this experiment were analyzed using a methodological abvance based on the theory of signal detection (TSD) (*3*). The product with medium sweetener concentration and pH (23% and 3.5, repectively) was used as the standard of comparison in the TSD analysis. Mean ratings in the various observations were then used to calculate $d_m$ values for all other samples. The $d_m$ value indicates the effect of composition variables on the observer's ability to distinguish between like vs. do not like decisions. The lower the $d_m$ value, the greater the observers' perference. Detailed explanations of the computational procedures for TSD are presented by several sources (*3, 8, 9, 15*).

Preference ratings for the nine samples indicate that products with 23% sweetener and either pH 3.2 or 3.5 were rated equally acceptable (Table 2). These two products were rated significantly more acceptable than the others ($P < .05$).

TABLE 2. *Mean $d_m$ ratings of whey-based novelties of various sweetener concentrations and pH values*

| Sweetener (%) | pH 3.2 | pH 3.5 | pH 3.8 |
|---|---|---|---|
| 17 | 10.0 | 6.2 | 5.2 |
| 23 | 0 | 0 | 3.5 |
| 29 | 4.2 | 3.8 | 2.1 |

At the 29% sweetener concentration, the effect of the pH variable on preference ratings was apparently masked to a degree as seen by the relatively narrow disperson of the three $d_m$ values. The panel rated the products with more sweetner higher than those at the 17% concentration ($P < 0.05$).

As compared to the significantly high preference for a low or medium pH in the products with 23% sweetener, the sample at the low pH with only 17% sweetener was the least preferred. At the lower sweetener level, a medium or high pH (3.5 or 3.8, respectively) resulted in a more preferable combination ($P < 0.05$).

This work indicates that a panel of preteenage children can make sensory preference discrimination decisions concerned with sweetener: pH variables in whey-based frozen novelties. Such a panel can make accurate evaluations in up to nine samples at a time as shown by TSD analysis.

### ACKNOWLEDGMENTS

Technical Paper No. 2471 of the Arizona Agricultural Experiment Station. The authors express appreciation for the technical assistance of Mr. C. W. Braun and Dr. W. C. Brown.

### REFERENCES

1. Boxer, S. 1974. Pot of whey gold—? Dairy Record 75:50.
2. Demott, B. J. 1975. Acceptability of flavored drinks made with cottage cheese whey produced by the direct acidification process. J. Milk Food Technol. 38:691.
3. Green, D. M., and J. A. Swets. 1966. Signal detection theory and psychophysics. John Wiley & Sons, Inc., New York.
4. Hillman, J. S., J. W. Stull, and R. C. Angus. 1962. Consumer preference and acceptance for milk varying in fat and solids-not-fat. Tech. Bull. 153, Ariz. Agric. Exp. Stn., Tucson, Arizona.
5. Nelson, F. E., and W. C. Brown. 1969. Whey utilization in fruit juice drinks. Presented at the 64th Annual Meeting of the American Dairy Science Association, June 22-25, at Minneapolis, Minn.
6. Nelson, F. E., and W. C. Brown. 1971. Whey as a component of fruit-flavored drinks. Presented at the 66th Annual Meeting of the American Dairy Science Association June 20-23, at East Lansing, Mich.
7. Stier, E. F. 1973. A college age sensory panel can predict food acceptance by grammar school children. Presented at the 33rd Annual Meeting of the Institute of Food Technologists, June 10-13 at Miami Beach, Florida.
8. Stull, J. W., R. C. Angus, R. R. Taylor, A. N. Swartz, and T. C. Daniel. 1975. Rich flavor discrimination in ice cream by theory of signal detection. J. Dairy Sci. 57:1423.
9. Swets, J. A. 1973. The relative operating characteristic in psychology. Science 182:990.
10. Taylor, K. M., and A. K. Wilson. 1975. American cheese alternate acceptable in child-feeding program. Food Prod. Dev. 9:62, 65, 66.
11. True, L. C., L. C. Williams, and T. J. Ouslig. 1972. Utilization of acid whey as a base for salad dressings. Cultured Dairy Prod. J. 7(3):14.
12. U.D.I.A. 1973. The household market for ice cream and related products. April 1972-March 1973. United Dairy Industry Association, Rosemont, Illinois.
13. U.S.E.P.A. 1971. Dairy food plant wastes and waste treatment practices. U.S. Environmental Protection Agency, Washington, D.C.
14. Webb, B. H. 1969. New dairy product development. J. Dairy Sci. 52:1693.
15. Wheeler, L. T., T. C. Daniel, G. W. Seeley, and W. Swindell. 1971. Detectability of degraded visual signals: A basis for evaluating image-retrieval programs. Optical Sciences Center Technical Report 72, The University of Arizona, Tucson, Arizona.