

Adult Preferences of Solids-Enriched Milk*

Maine Agricultural Experiment Station Publications # 1071

by

George K. Criner, Assistant Professor
Dept. of Agricultural and Resource Economics
University of Maine at Orono

Therese M. Work, Assistant Food Scientist
Dept. of Food Science
University of Maine at Orono

Ruth H. True, Food Scientist
Dept. of Food Science
University of Maine at Orono

Introduction

Recently there has been an effort in the United States to increase the component standards of fluid milk. This movement is based partially on the belief, held by many, that larger quantities of milk would be consumed if the component standards for milk were higher. The objective of this study is to test the hypothesis that adults prefer the proposed higher standards milk over the current FDA standards, for whole and 2-percent milk. In addition to presenting the results of the taste tests an additional purpose of the paper is to provide some background material on the milk component issue.

Background

The U.S. government indirectly supports the price of milk paid to farmers through supply removals. Although the government does not remove fluid milk from the market

it does purchase and store the processed milk products such as butter, cheese, and powdered milk. The cost of acquiring the processed milk stockpile is substantial. In 1983 the government purchased 2.7 billion dollars worth of dairy products (Economic Report to the President, 1984). These holdings of processed milk products are to be released whenever market prices rise to certain levels. Although there have been some minor market releases of these government holdings the bulk of the surplus goes to foreign sales and donations, domestic donations to the needy, and for use in school lunch and other institutional programs.

A factor contributing to the surplus of U.S. manufactured dairy products is the continuing decline in the U.S. per capita consumption of fluid milk. Between 1970 and 1982 the U.S. per capita consumption of fluid milk and cream, on a fluid milk equivalent basis, declined from 263.5 pounds to 216.9

*The research reported was funded by the Maine Dairy Promotion Board and the Maine Agricultural Experiment Station.

pounds. This decline is a result of two factors, first, individuals in almost all age groups are drinking less milk, and secondly, the age composition of the U.S. population is changing to a higher proportion of individuals who drink less milk (Bunch, 1985).

On a per person basis individuals of 6 to 18 years of age consume more fluid milk than any other age group (Milk Industry Foundation, 1982). As Table 1 reveals, both the absolute and the relative size of this age group have declined.[1] While the 5 to 17 age group is projected to make some modest absolute gains in numbers by the year 2000, the group of individuals 18 and older is projected to more than double by the year 2000 (from the "Middle Series" of: U.S. Department of Commerce).

Table 1.
U.S. Population of Individuals
5 to 17 Years in Age

Year	Number	% of U.S. Total Population
1970	52,596	26.7
1975	51,047	24.7
1980	47,224	21.7
1983	44,749	20.0

Source: U.S. Department of Commerce, "Statistical Abstract 1985," page 27.

If the dairy industry desires to stabilize or even increase the per capita consumption of fluid milk, future attention must be given to adult consumers. Adult consumers, as a whole, may have a somewhat unfavorable attitude towards fluid milk. In a 1955 Utah study based on a survey of 1,200 adults, Christensen found that as "people grow older fewer continue to drink milk, and those who do consume less" (Christensen, 1958). Of the 1,200 adults surveyed 272 or 23 percent stated that they did not drink milk. Thirty-six percent of this non-milk drinking group listed the following reasons for not drinking

milk: medical reasons, being overweight, high in calories, or adults do not need milk (Christensen, 1958). In 1972 New York State adults were questioned concerning their attitudes towards milk (Eiler and Forker, 1972). Although a majority of the adults felt that milk was necessary for good adult health, the adults as a whole felt milk was high in fats, cholesterol and calories.

The non-water components of milk are generally considered to consist of butterfat (BF) and solids-not-fat (SNF). Nationally the Food and Drug Administration sets standards for these milk components for whole, low fat, and skim milk. These standards are either component ranges or minimums depending on type of milk and component. The California milk component standards are higher than the national standards, and during the past several years there have been attempts to increase the national standards to levels at or near the California levels. The FDA and the California milk component standards are presented in Table 2.

One argument for increasing the national standards to the California levels is that adults, and particularly adult women who need more calcium, may directly or indirectly consume more milk components. A recent U.S.D.A. study stated that "It is reported that more than 75 percent of U.S. women over age 35 have calcium intake below the Recommended Dietary Allowance (RDA) of 800mg." and that "... other age-sex groups also have inadequate calcium consumption" (U.S.D.A., 1984). In many cases the increases in the SNF component of milk can only be brought about by adding either non-fat dry milk or a similar "condensed" form of milk. Under such a situation an adult whose volume consumption of milk remains constant would be consuming more milk components as the standards were raised from the current national standards to the California standards.

Several studies support the hypothesis that milk with increased component standards are preferred over the lower standards milk (Corley, Janzen, and Kerr, 1965; Hillman, Stull, and Angus, 1963; and Devero, 1973). Unfortunately, most of these and similar studies are over twenty years old, and as

the U.S.D.A. points out, since these works have been completed ". . . research and casual observations suggest that tastes and preferences of American consumers have changed significantly" and that "New consumer preference work is needed which examines the preferred composition of fluid milk products by different groups of consumers" (U.S.D.A., 1984).

Methodology

A local milk processor was contracted to produce four milks: 2-percent, whole, enhanced 2-percent and enhanced whole. The actual components of the enhanced and non-enhanced 2-percent and whole milk are presented in Table 3. By comparing Tables 2 and 3 it may be seen that the milk formulated for the preference sensory tests closely approximated the FDA and California standards with the exception of the solids-not-fat component of the 2-percent milk.

Table 2

**Food and Drug Administration and California
Butterfat (BF) and Solids-Not-Fat (SNF) Standards**

Fluid Milk Products	Food and Drug Administration Standards		California Standards	
	BF	SNF	BF	SNF
Whole milk	3.25%	8.25%	3.5% <u>a/</u>	8.7% <u>b/</u>
Lowfat milks	0.5-2.0%	8.25%	1.9-2.1%	10.0%
Skim milk	<0.5%	8.25%	< or = 0.25%	9.0%

a/ Allowed to equal 3.4 provided total solids are 12.2.

b/ Allowed to equal 8.6 provided total solids are 12.2.

Source: U.S.D.A., ERS, NED "Nationwide Adoption of the California Solids Standards for Fluid Milk Products: Issues and Impacts."

The whole milk and the 2-percent formulations were evaluated in separate studies. The enhanced and non-enhanced samples were coded and presented, two pairs at a time, in a complete block design with eight replications (Cochran and Cox, 1957), randomized with the restriction that each sample be presented first and equal number of times. For

each pair of samples (A1 A2: B1 B2) the panelists were instructed to identify which sample they preferred for flavor and to indicate the degree of difference (large, moderate or slight) between the two. Two ounces of each milk formulation were served in opaque plastic cups.

Table 3
Composition of the Milk Used in the Preference Tests

Fluid Milk Product	Standards	BF ¹	SNF	TS
Whole	Non-Enhanced	3.26	8.47	11.73
Whole	Enhanced	3.40	8.73	12.13
2-percent	Non-Enhanced	2.20	9.67	11.87
2-percent	Enhanced	1.97	8.58	10.55

¹Analyzed using the Roesse-Gottlieb method modified by Mojonnier and Troy (Mojonnier and Troy, 1925).

The data for flavor preference (+1 = preferred, -1 = not preferred) were analyzed by the variance method (Snedecor and Cochran) using the GLM procedures in the SAS software package (SAS). The treatment x judge interaction was used as the error term to test for a significant treatment F ratio. For degree of difference between the paired samples, scores of 5 = large, 3 = moderate, and 1 = slight were assigned to the preferred sample. Scheffe's procedure was followed for analyses (Scheffe).

Results

Thirty-seven adults participated in the whole milk test. For both tests it was decided to use no less than 30 judges since the minimum is generally thought to be 24 to 30 (see for example: ASTM p. 6). Overall there was no statistically significant preference for either whole milk. However, examination of the data revealed that some adults were consistent in their preference while others were not. Of the 37 adults, only 12 were consistent in their preferences. Of those 12 who could detect a difference in the milks eight chose the whole milk and

five chose the enhanced whole milk as being preferable.

Thirty-one adults participated in the preference test of the 2-percent and the enhanced 2-percent milk. Overall there was no preference for either 2-percent milk. In this comparison a much higher portion of adults were consistent in identifying a preferred milk. Twenty-two adults could consistently detect a difference in the milk with 12 preferring the enhanced 2-percent and 10 preferring the non-enhanced 2-percent.

Conclusions

In the sensory tests of this study many adults were unable to consistently detect a preferred milk between the two milk samples. For both the whole and the 2-percent milk there was no overall preference for the enhanced or the FDA (non-enhanced) milk. Thus, the tests do not support the hypothesis that adults prefer the proposed higher standards milk over the current FDA standards for whole and 2-percent milk. While this by itself is not encouraging for proponents of increased milk standards, another factor needs to be

considered. The authors believe that the adult consumers have trained themselves in some cases to prefer a thinner milk. It is believed that many adults equate a rich taste with a fattening milk. If adult consumers could be educated that a rich taste could be obtained from additional solids and not butterfat, then perhaps they would prefer solids-enhanced milk.

Implications

This study provides evidence against the hypothesis that adults prefer thicker, richer milk over milk with lower component levels. Unfortunately these findings may pose more questions than they answer. For instance, have some adults over time taught themselves to prefer a thinner milk over a richer milk due to their association of butter fat intake with health problems? If this is so, then adults might actually prefer the enhanced, richer milk over the thinner milk if they were told that the richness was due to added solids-not-fat instead of butter fat. If adults have conditioned themselves for a thinner milk, are they likely to recondition themselves to a thicker milk? A final and perhaps more disturbing question for the food industry is whether the milk enhancement push has been primarily an attempt to dispose of burdensome milk surpluses or is based on adult health and taste preferences.

Endnote

[1] A complete alignment of the age categories was not possible given the different data sources. It was felt, however, that the age brackets (5 to 17 and 6 to 18) were close enough for discussion purposes.

References

American Society for Testing and Materials (ASTM). 1968. "Manual of Sensory Testing Methods." American Society for Testing and Materials. Special Technical Publication No. 434, Philadelphia, PA.

Bliss, C. I. 1960. "Some Statistical Aspects of Preference and Related Tests," Appl. Stat. IX(1), pp. 8-19.

Bunch, Karen. 1985. "Whole Milk is No Longer the Beverage of Choice," National Food Review, U.S. Department of Agriculture, ERS, NFR-29, pp. 21-24.

Christensen, Rondo A. 1958. "Consumer Preferences for Milk," appears in Farm and Home Science, Utah State University, Agricultural Experiment Station, Logan, Utah, Vol. 2, No. 2, June 1958.

Cochran W. G. and G. M. Cox. 1957. Experimental Designs. John Wiley and Sons, New York, New York.

Corley, E. M., J. J. Janzen, and H. W. Kerr, Jr. 1965. "Consumer Preference for Modified Whole Beverage Milks in South Carolina," South Carolina Agricultural Experiment Station Bulletin 522, Clemson University.

Devero, J. E. 1973. "Effects of Varying Nonfat Solids and Fat on Consumer Acceptance of Milk Beverages," Journal of Dairy Science, 56:2, Feb. 1973, pp. 286-91.

Economic Report to the President (1984), "Economic Report to the President," Washington, D.C.: U.S. Government Printing Office.

Eiler, Doyle A. and Olan D. Forker. 1972. "Testing for Differences in Consumer Attitudes Toward Milk in New York State." Contributed Paper at Northeast Agricultural Economics Council Meeting, Morgantown, West Virginia, June 25-27, 1973.

Hillman, J. S., J. W. Stull, and R. C. Angus. 1963. "Consumer Preference and Acceptance for Milk Varying in Fat and Solids-Not-Fat," Technical Bulletin 153, Agricultural Experiment Station, University of Arizona, May 1963.

Milk Industry Foundation. 1982. "1982 Milk Facts," Annual publication of the Milk Industry Foundation, Washington, D.C.

Mojonnier, Timothy and Hugh Charles Troy. 1925. Instruction Manual for Setting up and operating the Mojonnier milk tester.

Mojonnier Bros. Co., 4601 West Ohio St.,
Chicago, IL.

SAS Institute, Inc. SAS User's Guide. 1979
Edition. Statistical Analysis System,
SAS Institute, Inc., Box 8000, Cary, NC
27511.

Scheffe, Henry. 1952. An Analysis of Vari-
ance for Paired Comparisons.
J. Amer. Stat. Assoc. 47:381-400.

Snedecor, G. W. and W. G. Cochran. 1967.
Statistical Methods. Sixth ed. The Iowa
State University Press, Ames, Iowa.
593 pp.

U.S. Department of Agriculture, Economic
Research Service. 1984. "Nationwide
Adoption of the California Solids Standards
for Fluid Milk Products: Issues and Im-
pacts." Washington, D.C.

U.S. Department of Commerce. 1985. "Sta-
tistical Abstract of the United States,"
U.S. Department of Commerce, Bureau of
Census, Washington, D.C.: U.S. Government
Printing Office.