UW Dairy Pipeline

Spring, 1991 Vol. 3 No.1 A Technical Update for Dairy Manufacturers

Use of Nonfat Dry Milk in Cheesemaking

by Bill Wendorff, Ph.D.

Cheesemakers have been standardizing cheese-milk for more than 60 years (3) to better control the composition of their finished cheese. In Wisconsin, milk standardization has been legal for about 40 years (12). More recently, the introduction of reduced-fat cheeses has created an even greater need to standardize cheese-milk.

Milk for cheesemaking is standardized either by removing cream from the milk or adding nonfat dry milk (NDM), skim milk, or condensed skim milk. In any case, the goal is to establish the most efficient proportion of casein per pound of fat in milk of any test. The methods of milk standardization for cheesemaking are well detailed by Johnson (5,6).

The use of NDM in standardizing milk can provide cheesemakers with several benefits:

1) Produce more pounds of cheese per pound of fat purchased.
2) Increase the output per vat and daily plant production.
3) Maintain consistent composition of cheese.
4) Allow for more efficient production of reduced fat cheeses.
5) Allow the storage of milk solids-not-fat from peak production periods for use during periods of low production.

What's Inside:

The potential increases in cheese yield per 100 pounds of milk and in production per vat have encouraged many cheesemakers to evaluate the use of NDM. The ultimate economic advantage obtained from adding NDM to cheesemaking milk will depend on the price of the NDM and the price of the final cheese. However, factors other than economic ones should be considered when using NDM in cheesemaking. Some of these are quality of the NDM, and the effect of added NDM on cheese body, texture, flavor, and keeping quality.

Previous Uses

The addition of NDM to cheese-milk has been used successfully for a variety of cheeses. Cottage cheese producers have been fortifying skim milk with up to 4% added low-heat NDM for many years with good results. For the best quality curd, they found that milk for medium and large size curd should be 10% to 12% solids, whereas milk for small curd size should contain 9.5% to 11% solids. Quality of the low-heat NDM is critical, since NDM processed with higher heat treatments produces curd with a weaker body.

Hansen and Theophilus (3) recommended the use of dry skim milk to standardize milk for the manufacture of Cheddar cheese in 1930. They found that high fat test milk, with added NDM, produced cheese that was the same quality as cheese from low fat test milk.

In 1931, Price and Germain (13) reported that the ideal casein to fat ratio for milk to be used for Cheddar cheese is 0.7. They found that for each pound of high-quality, low-heat NDM added to whole milk, they gained about 0.7 pound of cheese. Higher heat NDM caused delays in rennet action and produced some defects in cheese flavor and body. NDM additions of greater than 2.5% to cheese-milk produced cheese that did not mat properly and crumbled during cheddaring.

In several other studies (7,11), researchers found that with NDM addition to milk, cheese yields were improved and fat losses reduced, but the resulting cheeses had weaker bodies and had a slower rate of curing and flavor development. Kosikowski (7) reported that lactose was appreciably higher in standardized milk and in whey from standardized milk, but not in the young Cheddar cheeses produced from the standardized milk. The quality of Cheddar cheese from standardized milk was similar to that from normal milk, except the textures of the standardized cheeses were slightly more crumbly or short.

Researchers working on the use of NDM to standardize milk for Domiati cheese found that yields were increased with the use of NDM, but the flavor intensity and free fatty acids were decreased (10). Proteolysis was also slightly reduced with standardized milk.

More recently, NDM has been used extensively in the production of mozzarella cheese, especially low moisture part-skim mozzarella cheese (2,9). Olson (9) reported that adding 1%-2% NDM to cheese-milk produced acceptable cheese with typical characteristics. With part-skim mozzarella, he recommended removal of fat or addition of skim milk along with NDM fortification.

Quality of NDM

NDM is produced by vacuum evaporation of skim milk and spray-drying of the skim milk concentrate. Grades of NDM (extra, standard, and instant) are based on specifications for fat, moisture, titratable acidity, and solubility indices (1). NDM is also classified on the basis of the heat treatments it receives during manufacture. Low-heat NDM is manufactured with a minimum pasteurization treatment and limited heating during concentration and spray-drying to maintain good curd-forming properties. The NDM is tested for proper heat treatment by the modified Harlan-Ashworth method for undenatured whey protein nitrogen. To be classified as a low-heat NDM, it must contain not less than 6.0 milligrams of undenatured whey protein nitrogen per gram. NDM with undenatured whey protein nitrogen values below 6.0 mg/g will increase rennet coagulation time, exhibit reduced cheese yields, and produce curd with crumbly body.

To maintain the best flavor and functional properties in NDM for cheesemaking, the NDM should not be stored more than nine months. Researchers (8) found that 10% of the lysine was lost in NDM stored at 50˚F for one year. In manufacture of Camembert cheeses, yields were lower and whey exudation was greater with increasing age of NDM.

Adding NDM to Cheese-Milk

For standardization of milk for full-fat cheeses, e.g., Cheddar or Colby, small amounts of low-heat NDM can be added directly to the milk with the use of a powder horn. Fortification by this method should be limited to less than 2% NDM addition. Higher levels will result in cheese with poor body and texture. Accurate standardization with direct addition of NDM requires the use of a fixed casein-to-fat (C/F) ratio since altering either the fat or casein will have significant effects on the FDM (fat in dry matter) of the cheese.

If NDM is added directly to cheese-milk, it is necessary to compensate for this in titratable acidity determinations since additional casein, citrates, albumin, and phosphates are added with the NDM. The cheesemaker will have to determine the new titratable acidities for his specific manufacturing process. *(For information on measuring titratable acidity, see "Measuring Cheese Acidity" in the Dec. 1990* UW Dairy Pipeline *— Ed.)*

NDM should be handled carefully in the plant to prevent dust from spreading throughout the plant. If the dust is wetted, it provides an opportunity for the growth of undesirable microorganisms. NDM should be added to the cheese-milk prior to pasteurization so that the full pasteurization of the standardized cheese-milk can provide for protection against pathogenic bacteria. Care must be taken to prevent incorporation of air and creation of foam during addition of NDM. This could result in "burn-on" in the plate pasteurizer. Foam on a vat of milk will form a porous curd that breaks up during cutting and stirring.

For reduced-fat and part-skim cheeses, it is recommended that the NDM be reconstituted with warm water prior to addition to the milk. A good proportion is one pound of NDM to 4-8 pounds of 80˚F clean, safe, drinking water. Be sure all lumps of NDM have been properly dispersed or strained

from the reconstituted skim milk solution to prevent lodging and burn-on in the plate pasteurizer. Reconstituted NDM should be allowed to properly hydrate several hours prior to cheesemaking to ensure that proteins are fully hydrated and functional in the cheesemaking process.

When standardizing to a specific C/F ratio, the reconstituted NDM concentrate can be used very effectively to increase cheese yields per pound of fat and maintain a consistent product composition. For some reduced-fat cheeses, removal of some fat along with the NDM addition may be the best standardization method.

Absolute accuracy in standardization requires analysis of milk for fat and casein. Since casein analysis is fairly complicated, one can estimate its percentage in milk. Casein is approximately 78% of the total protein in milk. The casein level also varies with the fat content of milk. For milk with 3.6% fat, the casein content is about 2.5%. For every 1% change in fat content, the casein level will change about 0.4%. The casein content of NDM averages 28%.

An excellent coverage of standardization methods is outlined by Irvine (4), Johnson (6), and Olson (9).

Final Considerations

NDM can be used profitably in making most varieties of cheese, especially if the prices of NDM and cheese are favorable. Most varieties of cheese can tolerate up to 2% added NDM in the cheese-milk without experiencing problems in body or texture. However, levels of addition above 2% NDM may lead to crumbly body and poor texture in the cheese. Pre-blending NDM with warm water and then blending that concentrate with cheese-milk may make it possible to use a slightly higher level of NDM solids in the milk. NDM should not be used in cheeses that are dependent on eye-formation, e.g., Swiss, Gouda, etc. The NDM may cause weak spots in the curd which would result in poor eye formation.

With added casein in the milk, the cheese will generally retain a higher level of moisture, leading to the potential for higher lactose in the curd. Be sure that too much lactose does not remain in the curd since that could lead to high levels of lactic acid being produced and formation of calcium lactate crystals in the cheese. To eliminate this potential defect, a short wash procedure should be included in the make procedure to reduce the lactose in the curd.

In conclusion, the use of NDM in standardizing milk can lead to increased cheese yields and more uniform composition. However, the amount of NDM used should not be so high as to adversely affect the body and functional characteristics of the cheese. Plant trials should be run to determine the effective range of NDM that can be used in a specific variety of cheese produced by the plant. The plant can then determine if NDM addition or cream removal is the most economical means of standardizing its milk for profitable cheese production.

References

1) Anon. 1990. Standards for grades of dry milk including methods of analysis. *American Dairy Products Inst., Rev. Bulletin #916*, Chicago, IL

2) Barbano, D.M. 1984. Mozzarella cheese composition, yield, and how composition control influences profitability. *21st Annual Marschall Invit. Ital. Cheese Seminar,* Sept. 12-13, 1984, Madison, WI *

3) Hansen, H.C. and D.R. Theophilus. 1930. Standardizing of milk with skimmilk powder for the manufacture of Cheddar cheese. *Idaho Agr. Expt. Sta. Bul. 174*

4) Irvine, D.M. 1966. Standardization of milk for cheesemaking. *Can. Dairy & Ice Cream J.*, Dec. 1966 pp. 24-27

5) Johnson, M.E. 1984. Methods of standardizing milk for cheesemaking. *21st Annual Marschall Invit. Ital. Cheese Seminar,* Sept. 12-13, 1984, Madison, WI *

6) Johnson, M.E. 1989. Milk composition standardization — techniques and impact. *4th Annual Center for Dairy Research Conference*, March 29-30, 1989, Madison, WI *

7) Kosikowski, F.V. 1981. The use of low heat whole milk powder, concentrates, and retentates in cheesemaking. *Second Biennial Marschall Inter. Cheese Conf.*, Sept. 15-18, 1981, Madison, WI pp. 385-392 *

8) Luquet, F.M., L. Mouiller, J.F. Boudier and J.P. Vincent. 1982. Aging of dried skimmed milk - symptoms and consequences. *Bulletin, Int. Dairy Fed.* 142:154-155 (phone: 708/446-2402)

continued next page...

...NDM, from page 3

9) Olson, N.F. 1972. Increasing the yield of mozzarella cheese by fortification of milk. *9th Annual Marschall Invit. Ital. Cheese Seminar*, May 1-2, 1972, Madison, WI *

10) Omar, M.M., M. Ashour, S.M. Farahat, A.A. Abdel-Baky and A.A. El-Neshawy. 1983. Chemical changes during the ripening of Domiati cheese made from dried milk. *Food Chem.* 11(2):95-103

11) Peters, I.I. 1959. The manufacture and ripening of cheese from reconstituted milk. *J. Dairy Sci*. 42:908

12) Price, W.V. and H.E. Calbert. 1951. Standardizing milk for cheese making. *Cir. 408*, Univ. of Wisconsin

13) Price, W.V. and L. Germain. 1931. Standardization of milk for the manufacture of American cheese. *Wis. Agr. Expt. Sta., Bul. 108*

* For a copy of this reference, send your request and a self-addressed 9 x 12 envelope to Sarah Quinones, Center for Dairy Research, 1605 Linden Dr., Madison, WI 53706

UW Dairy Manufacturer's Conference
The Mead Inn, Wisconsin Rapids, WI
Wednesday, May 22, 1991

The UW Department of Food Science, the UW Cooperative Extension, and CDR present the second annual UW Dairy Manufacturer's Conference May 22, 1991 at the Mead Inn, Wisconsin Rapids. Cost is $35 if registration is postmarked by May 8, $40 if postmarked after May 8. The program is as follow:

9:00 a.m. Registration, Coffee and Rolls

9:30 a.m. Opening Remarks, *Dr. Bill Wendorff, UW Dept. of Food Science*

Current Issues for the Cheese Industry

9:35 a.m. "Current Regulatory Concerns," *Steve Steinhoff, Wisconsin Dept. of Agriculture*

10:05 a.m. "Nutritional Labeling of Dairy Products," *Emerita Alcantara, Dairy Council of Wisconsin*

10:35 a.m. Break

10:45 a.m. "What's the Real Cost of Milk Protein," *Dr. George Shook, UW Dept. of Dairy Science*

11:15 a.m. "Improving Flavors in Reduced-Fat Cheeses," *Dr. Robert Lindsay, UW Dept. of Food Science*

11:45 a.m. Lunch

Roundtable Discussion: Building Quality into the Dairy System

1:00 p.m. "Milk Supply," *Dr. Alan Bringe, UW Dept. of Dairy Science*

1:30 p.m. "Facilities," *Terrance L. Kennedy, P.E., Mead & Hunt, Inc.*

2:00 p.m. Break

2:10 p.m. "Utilities," *Neil VanDyke, Foth & VanDyke*

2:40 p.m. "Equipment," *Dennis Stopen, Damrow Co.*

3:10 p.m. Questions and Answers: Open Discussion on Above or Other Topics

For additional program information call Dr. Bill Wendorff at (608) 263-2015. For registration information call the CALS Conference Office at (608) 263-1672.

Dairying Down Under —

Marketing Trends in the Australian Dairy Industry

By P.C. Vasavada, Ph.D.

In the land of koalas, kangaroos, kookaburras, and "Crocodile Dundee," changing demographics and consumer preferences are steering the Australian dairy industry on a course that increasingly mirrors current trends in the United States.

While on sabbatical at the Commonwealth Scientific and Industrial Research Organization - Dairy Research Laboratory (CSIRO-DRL) in Melbourne, I found the Australian dairy industry is investing in aggressive marketing and innovative product development to satisfy changing consumer expectations for nutrition, variety, taste, and convenience. As in the United States, Australian consumers have become more health-conscious, and are demanding dairy foods low in fat, calories, and salt.

New Product Innovation

It is clear that the Australian dairy industry is keen on meeting these new expectations by providing a variety of dairy products that appeal to a broad spectrum of consumers. Many new Australian dairy products share an emphasis on healthy eating.

For example:

- Bonlac Foods Ltd. recently introduced a reduced-fat dairy spread called **Less**. This product contains 40 percent fat and six percent protein. Butter, by comparison, contains 80 percent fat and 1.5 percent protein.
- Farmers Union Foods introduced **Fruche**, a product made from cottage cheese, light sour cream, and fruit. It is similar to quark (an unripened fresh cheese), and has a relatively long shelf-life.
- Kraft Foods Ltd. introduced **Light Cheddar**, a reduced-fat processed cheese product containing 50 percent less fat than most natural cheddars. In addition, Bega Cheese Co. launched **So-Light**, a 25 percent reduced-fat Cheddar promoted as being "made from all natural Cheddar with the superior taste of our traditional tasty."
- Three brands of NutraSweet sweetened yogurt, Danone **Diet-Lite**, **Diet-Ski**, and **Weight Watchers**, were introduced last year following approval of NutraSweet for use in yogurt.

Australia also has a variety of specialty milks, such as **Rev**, a low-fat, high-calcium milk, and **Skinny**, a skim milk product. Other notable fluid milk products are:

- **Fit 4**, an ultrafiltered milk high in calcium and low in fat, from Southland Dairies PhysiCal and Tasmaid Foods. Fit 4 was introduced in a Tetra-Top plastic and paperboard carton with a reclosable lid. This innovative packaging offers an added marketing advantage.
- **Lacto Lo**, a reduced lactose milk introduced in Queensland for people with lactose intolerance. Lacto Lo is manufactured using a patented process designed to reduce the lactose content of milk by 50 percent.

Research and Development

The Australian dairy industry has undergone considerable change in recent years. Research and development is now considered the industry's best investment.

New product innovation is encouraged through a newly-formed Dairy Research and Development Corporation. The current industry attitude was reflected in the theme "Investing in New Technology," selected for the 1990 annual state conferences of the Dairy Industry Association of Australia. I was invited to participate in the ADSA conferences in Perth, Western Australia; Melbourne, Victoria; and Adelaide, South Australia where an emphasis on adopting new technologies for "value-added" products was evident.

More on dairy foods quality, safety, and research down under will appear in future issues of the Pipeline.

Dr. Vasavada is a professor of Food Science in the Dept. of Animal and Food Science at UW-River Falls. He serves as a specialist in milk quality and dairy foods microbiology with the UW-Extension.

The Curd Clinic

Question: Some buyers of my Cheddar cheese measure the lactobacilli level in the cheese to determine if it is likely to develop calcium lactate crystals. I would like to conduct my own lactobacilli counts so I can confirm the buyers' results. What is the proper procedure for obtaining a lactobacilli count, and what does it really tell me about my cheese?

Answer: Lactobacilli levels in Cheddar cheese are measured by making a standard plate count of a cheese sample using a selective medium. However, results can vary widely, depending on the history of the cheese, the medium used to grow the culture, and the growth conditions. The actual number of bacteria colonies detected by the test is meaningful only when compared to other counts plated under identical conditions.

A recent CDR study demonstrated one way lactobacilli counts may be used to estimate the potential for calcium lactate crystal formation in cheese. Researchers grew cultures from one-month-old cheese on a medium of acidified Difco Rogosa SL agar in a carbon dioxide jar at 37°C for two or three days. The medium was acidified to a pH of 5.4 ± .2, according to manufacturer's instructions.

Using these procedures, the CDR studies determined that cheeses with more than 100,000 non-starter lactic acid bacteria per gram after one month of storage are candidates for crystal formation. This number is a valid cut-off for identifying potential crystal problems **only** if the plating methods and growth medium described above are duplicated exactly.

In addition, the age of the cheese sample tested is critical, since the population of non-starter lactic acid bacteria increases with age. Different cheese buyers may test the cheese at different ages and establish their own lactobacilli limits accordingly. Cheese tested at an age of 10 days may have fewer than 10,000 lactobacilli per gram, while counts of more than 1 million per gram are common with nine-month-old cheeses.

A common misconception is that all lactobacilli contribute equally to the formation of calcium lactate crystals. In reality, only a small percentage of the numerous species of lactobacilli present in cheese are responsible for rapid crystal development. Calcium lactate crystals are composed of a one-to-one ratio of two kinds of lactic acid - L(+) lactic acid and D(-) lactic acid. Most lactobacilli ferment lactose to form a lactic acid mixture containing anywhere from 60 percent to 100 percent of the L(+) variety, while streptococci starters used for Cheddar cheese form only L(+) lactic acid. Some species of lactobacilli, however, are capable of converting the L(+) lactic acid to D(-) lactic acid. Called racemase-positive lactobacilli, these organisms are the primary culprits in producing the high D(-) lactic acid levels that lead to crystal problems.

Some lactobacilli are better adapted than others to the harsh acidic environment in the cheese. The weaker species may be inhibited in a selective plating medium such as acidified Rogosa SL, but may thrive in a less selective, non-acidified medium. Because the ability of racemase-positive lactobacilli to tolerate various levels of acidity is unknown, use of a standardized pH in the plating medium is necessary to obtain a meaningful count. Failure to properly acidify the medium may yield a bacteria population count orders of magnitude greater than specifications permit, even though the cheese tested may be relatively low in racemase-positive bacteria.

The optimal medium for plating racemase-positive lactobacilli has not yet been determined. A too-selective medium may discourage the growth of significant strains of bacteria, while testing with an unselective medium may allow numerous non-racemic bacteria and even starter bacteria to be included in the plate count. Research to help clarify this issue is currently underway at CDR. We are investigating the susceptibility of various lactobacilli to heat and acid injury, and their ability to recover and grow on various media. The study will also identify the conditions most useful for controlling the growth of racemase-positive strains.

To reduce the lactobacilli populations in your cheese, minimize contamination by maintaining a clean plant. Also, cool your cheese rapidly after pressing and during ripening to restrict the growth of contaminants, and keep cheese temperature below 45˚F throughout storage. Further steps to reduce the likelihood of crystal formation in your cheese are outlined in the WMMB Research Review Special Report, *Controlling Calcium Lactate Crystallization*. For a copy of the report call Sarah Quinones at 608-262-2217.

Curd Clinic Doctor for this issue is Dr. Mark Johnson, CDR senior scientist.

Please send your questions to:
Sarah Quinones, CDR
UW Dairy Pipeline
1605 Linden Dr.
Madison, WI 53706
FAX: 608/262-1578

Dairy Implications of the 1990 Farm Bill

by W.D. (Bill) Dobson, Ph.D.

President Bush signed into law the five-year 1990 Farm Bill on November 28, 1990. Federal budget constraints imposed as part of a broader deficit reduction effort shaped the dairy provisions of the bill. In particular, to keep budget outlays at levels called for in a budget reconciliation act, the dairy price support level has been effectively frozen at $10.10 per cwt for milk of average milkfat test for 1991-1995. The $10.10 support price is 25 percent lower (50 percent lower in real terms) than the peak dairy price support for 1981. In addition, milk producers will be required to pay part of the cost of dairy price supports through assessments of $.05 per cwt in 1991 and $.1125 per cwt during 1992-1995. Producers who do not increase milk production over year-earlier levels can obtain refunds of assessments.

Milk producers may be hit with additional assessments beginning in 1992. The secretary of agriculture must present to Congress a milk supply inventory management plan if government purchases of dairy products for price support purposes are forecasted to exceed seven billion pounds of milk equivalent (total solids basis) for any year during 1992-1995. If Congress rejects the secretary's plan or the plan is not fully effective for reducing milk supplies, then producers will be assessed to cover the costs of government purchases of dairy products exceeding seven billion pounds of milk equivalent.

What does this mean for the dairy industry? It means the dairy price support program has evolved into a rather low safety net. Still, all is not necessarily gloomy in such an environment. At times during the next few years the supply-demand balance may produce favorable returns to dairy farmers. In addition, product differentiation efforts of the Wisconsin Milk Marketing Board, cooperatives, and proprietary handlers will increase the demand for dairy products and partially insulate dairy farmers from falling dairy commodity prices.

But, despite such developments, manufacturing milk prices are likely to be near support levels for extended periods during the next few years. To survive such prices, additional Wisconsin dairy farmers will need to find ways of cutting production costs and supplementing farm income through off-farm work and other means.

Bill Dobson is a UW-Madison professor of Agricultural Economics

CDR Resource Center

These video selections and more are available for loan or purchase from the CDR Library. Call Sarah Quinones at 608-262-2217 or FAX 608-262-1578 for information.

Controlling the Physical Properties of Mozzarella Cheese, Paul Kindstedt, Ph.D.
Dairy Chemistry Course, Pat Fox, Ph.D.
Getting the Most out of Your Whey Components, UW Dairy Manufacturer's Conference Proceedings
Eliminating Crystal Formation in Packaged Cheese, UW Dairy Manufacturer's Conference Proceedings

The Effect of Income, Household Composition, and Ethnicity on Cheese Expenditures

By Brian W. Gould, Ph.D.

Public concern over the quantity and type of dietary fat intake has become one of the major factors affecting the current structure of diet in the United States. One of the many commodity groups dramatically affected by these changes is dairy foods, particularly full-fat products.

In contrast to the declining consumption observed in the butter and beverage milk markets, the per capita demand for cheese has grown significantly over the last 30 years. In light of this increase, an understanding of how demographic factors such as ethnicity, household size, and income affect cheese consumption will help the industry predict future demand.

Recent research at the Center for Dairy Research has focused on determining the importance of household characteristics on the level of at-home cheese expenditures. Data from more than 5,000 households were used in this research effort.

Current Cheese Consumption

Since 1967, per capita cheese consumption has more than doubled. This is surprising since many cheese varieties are relatively high in dietary fat. Although the importance of Italian cheeses has increased in recent years, the distribution among varieties of cheese consumed has remained relatively constant. Cheddar remains the leading cheese type in total per capita consumption, despite experiencing a general decline since 1971 (Figure 1).

Data and Methodology

The principle source of U.S. household expenditure data used for market analysis is the Bureau of Labor Statistics' Continuing Consumer Expenditure Survey (CCES). This data has been collected annually since 1979. For the CCES survey, each participating household is asked to keep one-week diaries of food expenditures.

A major problem with using this data for analyzing factors affecting cheese consumption is that for many cheese varieties the purchase cycle may be longer than the one-week survey period. Unlike many food commodities, cheese is a semi-durable good in the sense that, for many varieties, consumption may occur over many weeks or months after initial purchase. For example, the chances are only one in four that a household that normally purchases a four-week supply of cheese once a month will be observed to purchase cheese during a one-week survey.

Thus, a zero reported expenditure value may occur in a household that nonetheless does consume cheese. A method of estimating the frequency with which typical households buy cheese is therefore needed to accurately survey cheese consumption.

Figure 1. Distribution of Cheese Disappearance by Major Cheese Categories

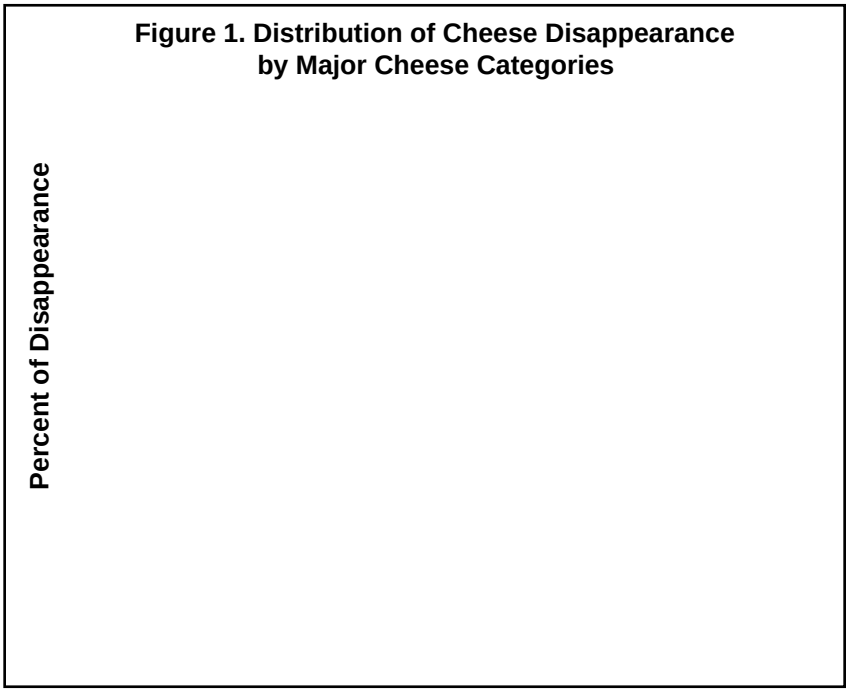

Table 1: Mean Cheese Expenditures over 1 Week During 1987 by Household Type, Purchasers and Nonpurchasers

Household Type	% Households Purchasing	Mean Expenditure: All Households	Mean Expenditure: Purchasing Households
All Households	41.3	$1.50	$3.63
White	43.7	$1.60	$3.65
Black	25.7	$.90	$3.49
Asian	21.0	$.62	$2.95

Source: Bureau of Labor Statistics (1989)

Our research has focused on resolving this methodological issue. Using 1987 CCES data, an economic model was formulated to determine the relationship between household characteristics, the level of cheese consumption, and the probability that a cheese-consuming household will purchasing cheese over a survey period. This model made it possible to formulate accurate estimates of cheese consumption in relation to several demographic factors. Some of the findings are summarized below.

Results

Table 1 shows how mean household cheese expenditures vary for white, black and Asian households. Over the one-week survey period, 41.3% of all households had purchased cheese for consumption at home, while only 21.0% of Asian households purchased cheese. For those households that did purchase cheese, the mean expenditure did not vary appreciably across household type. White households that purchased cheese had a mean expenditure of $3.65. This compares with $3.49 and $2.95 for black and Asian households respectively.

The effect of changes in household income and age/sex composition on the level of household cheese expenditures were also studied. The age-sex composition of the household members are represented by Dairy Product Adult Equivalents (DPAE), a variable that describes how each household member contributes to total dairy product at-home expenditures, relative to a pre-defined standard. In the present study, one DPAE was defined as a male between the ages of 17 and 22.

A DPAE value of 1.3, for example, would describe an individual whose consumption results in a 30% increase in cheese expenditures relative to the expenditures of a typical male between the ages of 17 and 22. Weighting the various household members in this way provides a more precise profile of household composition than could be obtained by simply counting the individuals in the household. If we were to take a simple head count, we would be making the unrealistic assumption that all household members — a newborn infant, a male teenager, or a 60-year-old woman — contribute equally in term of food intake.

Data in Table 2 are expressed in elasticity values, which describe the degree of change produced in certain variables by a 1% change in some other variable. The elasticity values listed in the table reflect the percentage change in household cheese

continued next page...

Table 2. Effect of Income, Household Composition and Ethnicity on Cheese Expenditures

Household Type	Expenditure Elasticity: Household Income	Expenditure Elasticity: Dairy Adult Equivalent
A	.222	.659
B	.125	.832
C	.239	.839
D	.132	1.019
E	.309	1.028
F	.140	1.177
G	.226	.693

NOTE: The following household types were analyzed:
A: white households that do not use food stamps
B: white households that use food stamps
C: black households that do not use food stamps
D: black households that use food stamps
E: Asian households that do not use food stamps
F: Asian households that use food stamps
G: total population

...Expenditures, from page 9

expenditures brought about by a 1% change in either the level of household income or a 1% change in the value of household DPAE.

An elasticity value greater than 1 is referred to as an elastic response, and reflects a more than proportional increase in cheese expenditures to either of these variables. A value less than 1 reflects an inelastic response — one in which the change in cheese expenditures is proportionally smaller than the changes in the other variables.

The data indicate that changes in the age/sex composition of the household have a greater impact on expenditures than household income, and that expenditure changes in response to changes in DPAE vary widely depending on the ethnicity of the household (low value=.659 for white households, high=1.117 for Asian households that use foodstamps). However, the differences in the income elasticities between household types is very small, and, for all ethnic household types, the values themselves are inelastic. This is consistent with other studies that have analyzed cheese and dairy product expenditures.

Summary

Changes in household size (in terms of DPAE) appear to have a greater impact on cheese consumption than does income. The ethnic background of the household was also found to be strongly related to consumption patterns, with Asian families being least likely to purchase cheese and showing the lowest expenditure level. This information is useful in selecting effective cheese marketing strategies.

Brian Gould is an associate scientist with CDR and the UW-Madison Department of Agricultural Economics.

This and That . . .

Egyptian dairy researcher **Dr. Moustafa El-Shenawy** has returned to CDR to collaborate with **Dr. Mark Johnson** on a project to determine the heat-resistance of lactobacilli in dairy products. The two scientists hope to answer questions concerning the source of defect-causing types of lactobacilli in cheese, and how to prevent them from growing. The work applies to all types of lactobacilli, including the racemase-positive strains responsible for calcium lactate crystal formation, and will help clarify the significance of lactobacilli plate counts grown on various media (see *Curd Clinic*, pp. 6). An associate professor of dairy microbiology at the National Research Center-Academy of Scientific Research and Technology in Cairo, Egypt, El-Shenawy arrived at CDR in January, and is scheduled to continue his work here through October.

CDR's **Visiting Scientist Mentor Program** will welcome three top dairy scientists to UW-Madison during the next four months. Upcoming participants in the program, which is designed to facilitate interaction between accomplished senior dairy foods researches and younger scientists, are **Dr. Peter Walstra, Dr. Peter M. Linklater,** and **Dr. W. James Harper**. Back for his second visit as a CDR mentor, **Dr. Harper** is a food industry consultant, an honorary fellow of the New Zealand Dairy Research Institute, and professor emeritus at The Ohio State University. He has been a pioneer in the dairy food industry throughout his 50-year career. He helped lay the foundations of today's modern CIP systems, and was the first to develop a continuous cheesemaking procedure. His early work in ultrafiltration and whey proteins was the basis for much of the high functionality whey protein concentrates in world trade. In addition to participating in the Mentor Program, **Dr. Linklater** is a speaker at this year's CDR Cheese Research and Technology Conference, where he will speak on *Computer-aided cheese manufacture*. He is the former program manager of dairy manufacturing research for the Australian Dairy Research and Development Corporation, and a retired senior lecturer at the University of New South Wales in Australia. His major research interest is in cheese technology. **Dr. Walstra** is a professor and chair of the Department of Food Science at Wageningen Agricultural University in The Netherlands, home of the world's leading research and teaching program in the physical and chemical properties of milk. He is considered the world's foremost dairy physicist, and has written key textbooks on the subject. Dr. Walstra will teach a graduate-level course, *Physical Properties of Dairy Products*, at UW-Madison from July 22 to Aug. 22.

UW Management Institute Adds 20 New Courses

A national leader in providing quality education for the community, the UW Management Institute offers a broad range of courses for individuals seeking to strengthen their management skills.

More than 8,500 practicing managers, executives, and other professionals attended Management Institute courses last year. The institute is keeping pace with the still growing demand for management and business training by offering an expanded curriculum in 1990-1991. The institute has added 20 new courses, bringing the total number of courses offered to more than 175.

Management Institute courses are divided into a number of programs, or series. Each series concentrates on challenges common to a specific management area, such as finance, marketing, or human resources, to name a few.

Programs focusing on the various management levels, from office administration training to executive conferences, are also offered.

Courses last two or three days and range in cost from $495 to $795. Fees include printed program materials, luncheons, and refreshments during breaks. Most Management Institute programs are held at the Wisconsin Center, 702 Langdon St., Madison.

General categories of Management Institute courses are as follows:

- The Middle Management Series
- Basic Management Certificate Series
- Office Administration Certificate Series
- Finance and Accounting
- Human Resource Management and Development
- Information Management
- Marketing, Sales and Customer Service
- Product Service Management
- Production/Operation Management
- Purchasing Management
- Quality Management
- Transportation, Warehousing and Physical Distribution

For more information or a catalog, call 608-262-2155 or write :

Management Institute
The School of Business
University of Wisconsin-Madison
432 N. Lake St.
Madison, WI 53706
FAX: 608-262-4617

New Product Seminar April 10-11

Improving your company's ability to bring new products to the marketplace faster is the focus of "New Product Development: Shorten the Cycle, Maximize the Yield," a two-day seminar offered April 10-11 in Milwaukee by the UW-Milwaukee Center for Continuing Engineering Education.

The course will provide professional instruction useful to anyone who is directly or indirectly involved in new product development or marketing. Topics include improving competitive advantage, implementing parallel development cycles, building effective teams, planning, improving revenue and profits, and industrial case studies.

Dr. Philip A. Himmelfarb, product planning consultant and developer of 17 commercially viable products, chairs the seminar. The president and founder of Philip Adams & Associates, a Wisconsin consulting firm specializing in new product evaluation, planning, and development, Himmelfarb has also worked with several major food corporations in manufacturing start-up and research and development. He has taught courses in technology management at Marquette University, and is currently working on a book on new product development.

Guest speaker for the seminar is Stanley V. Jaskolski, vice president of technical management at Eaton Corporation's Corporate R&D Center. He will describe "Project Frost," his innovative and successful approach to fast new product development and manufacturing start-up.

Cost for the course is $575, and includes course notebook, refreshments, and lunches. For more information call Richard Albers at (414) 227-3125.

Calendar of Events

March 6-7 ***CDR Cheese Research and Technology Conference***. Holiday Inn, Madison, WI. For registration information contact the CALS Conference Office at 608-263-1672.

March 18-22 ***Wisconsin Cheese Technology Short Course***. Contact Bill Wendorff, 608-263-2015.

April 8-10 ***UW Basic Cheesemaking Short Course***. Held at UW-River Falls. Contact P.C. Vasavada, (715) 425-3150.

April 24 **Cheese Technology Preview Seminar — pH Techniques, Milk-clotting Technology, and Biofilms in the Dairy Plant Environment.** Speakers are Ed Zottolla, Univ. of Minnesota (biofilms); Robert Selman, Pfiser Inc. (curd formation and cheese yield); and Fritz Buss, Nelson-Jamison Inc. (determining pH). 1 p.m. to 5 p.m., Inn Towner Hotel, Madison. Call Sarah Quinones at (608) 262-2217 for information, or the CALS Conference Office (608) 263-1672 to register.

The *UW Dairy Pipeline* is published by the Center for Dairy Research and the University of Wisconsin Extension to update the Wisconsin dairy manufacturing industry on recent research and technology developments. We welcome your questions and ideas on how to make this a more effective publication.

Sarah Hundt Quinones, Managing Editor
David Gaeuman, Editor

Send correspondence to:

The UW Dairy Pipeline
CDR, 1605 Linden Dr. , Madison, WI 53706
Phone: 608/262-2217 or 608/262-8015
FAX: 608/262-1578

Technical Reviewers:
Mark Johnson, Senior Scientist, CDR
Norman Olson, Director, CDR
Tom Szalkucki, Administrative Officer, CDR
Bill Wendorff, Asst. Professor, Dept. of Food Science

May 22 ***UW Dairy Manufacturer's Conference***. Wisconsin Rapids. See page 4 for program. Contact Bill Wendorff, (608) 263-2015.

CDR
CENTER FOR DAIRY RESEARCH
University of Wisconsin-Madison
1605 Linden Drive
Madison, Wisconsin 53706

Nonprofit Org.
U.S. Postage
PAID
Madison, WI
Permit No. 658