FINAL REPORT
The Contributions of Dairy Foods to Nutrient Intakes and Health in the US

L. Berner and J. Groves
Cal Poly State University, San Luis Obispo

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E. Principal Investigator (s):
Louise A. Berner, PhD, Professor
Food Science and Nutrition Department
Cal Poly State University
San Luis Obispo, CA 93407
lberner@calpoly.edu
805-756-2565; fax 805-756-1146

F. Co-Principal Investigator (s):
John E. Groves, PhD, Professor
Statistics Department
Cal Poly State University
San Luis Obispo, CA 93407
jgroves@calpoly.edu

G. Cooperator(s): none

H. Prepared by:
Louise A. Berner, PhD – Principal Investigator
Food Science and Nutrition Department
Cal Poly State University
San Luis Obispo, CA 93407
(805) 756-2565; fax (805) 756-1146; lberner@calpoly.edu

I. EXECUTIVE SUMMARY:

The purpose of this project was to examine dairy foods eating patterns and to assess the contributions of dairy foods to nutrient intakes and other health-related characteristics of people in the US. All of our analyses were of data from USDA's Continuing Survey of Food Intakes by Individuals (CSFII) 1994-96, and most of the analyses also included the CSFII 1998 Supplemental Children's Survey. The CSFII included two 24-hour dietary recalls with detailed information on the location and timing of each eating occasion. In addition, subjects were asked many questions about socioeconomic status, living situation, self-reported health and weight, supplement use, and so on. We looked at data from respondents age 2 and over who had two complete days of dietary data, and excluded pregnant and lactating women. Analyses were done for the total population as well as for age and gender subgroups. Sampling weights were applied to all data so that results presented are nationally representative. We used SAS Version 8 for data management and some descriptive statistics, and SAS-Callable SUDAAN for additional statistical analyses.

We generated descriptive data on the mean, 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles of intake of several dairy categories. Our descriptive data on intake are for the food categories of total dairy; fluid milk and types of fluid milk; yogurt; cheese; and cheese from mixtures. We had to develop a strategy to determine cheese intake from mixtures because the data are not provided directly in the CSFII datasets. The descriptive data were particularly important for us as we moved to other research questions. For example, we learned that it would not be useful to look at how nutrient intakes varied by quartile of yogurt or specific milk (nonfat, lowfat, etc.) intake, because too many in the population did not consume those specific foods during the two-day survey period. On the other hand, we confirmed that it *would* be useful to compare nutrient intakes by quartile of total dairy, total milk, and cheese intake.

Based on our analyses, we found that cheese eaten in foods recorded as food mixtures (such as pizza, tacos, etc.) contributed up to 60% of total cheese intake depending on age group. It is of obvious importance to include "ingredient" use of cheese when assessing cheese intake.

We also examined patterns of dairy foods intake by meal and location (away vs. home meals). A key finding was the large proportion of intake of fluid milk at the breakfast meal (~50% for children 2-8 and ~60% for children and adults over age 9), even among school-age children who presumably are offered milk as part of school lunch programs. At the same time, fluid milk was very heavily consumed at home rather than away-from-home. It was not surprising that fluid milk consumption was greater in the home than away, and that cheese consumption was more evenly distributed between home and away meals. However, the proportion of fluid milk consumed away from home was disappointingly small: just 3-23%, depending on age/gender.

Part of our interest was in examining diverse dietary patterns compared with non-diverse patterns, particularly those with limited amounts of dairy. We defined a diverse pattern as having at least one daily serving from each food group, and also defined numerous "non-diverse" patterns with less than one daily serving of one or more food groups. A diverse pattern was followed by about a quarter of the population. Patterns lacking fruit, dairy, or dairy plus one or more other food groups were the most common non-diverse patterns, followed by 23%, 16%, and 25% of the population, respectively. When we looked at nutrient contributions of the common non-diverse patterns compared with diverse diets (controlling for energy intake in our statistical model), we found that people following the former had much lower intakes of many micronutrients. For the patterns lacking dairy, results were particularly striking for calcium but also for phosphorus, riboflavin, and zinc.

We also wanted to examine the relationship between dairy product intake and body mass index, given the common perception that dairy foods are "fattening" as well as recent interest in research that suggests the opposite. Our analyses of this cross-sectional CSFII data show that intake of total dairy and cheese were not related to BMI in adolescents and adults. (We did not examine children because of the unreliability of parent-reported weight and height values.) In women, there was no relationship between weight status and cheese intake but there was a significant *inverse* relationship between BMI and total dairy intake. The perception of dairy foods as "fattening" was not validated, and in women the data suggest high dairy consumers actually had lower BMI.

A major area of study was to better quantify the relationship between dairy foods and nutrient intakes. All of our statistical models included energy intake as a covariable so we weren't just looking at an effect of higher food intake. When we looked at nutrients by quartile of dairy intakes, we found an overwhelmingly positive effect of total dairy, milk, and cheese on calcium intake and the same positive effect of total dairy and milk (though not cheese) on a whole array of micronutrients including zinc, iron, potassium, magnesium, riboflavin, folate, and vitamin A. It was of interest that people in the higher quartiles of milk and total dairy intake had higher intakes of iron and folate, since dairy foods are not good sources of these nutrients. Clearly, people with high total dairy and/or milk intakes made other wise dietary choices as well. At the same time, although saturated fat was significantly increased with increasing quartile of dairy intake, total fat was not and in some cases was actually lower in people with higher dairy intakes. Cholesterol intake was consistently lower in people with higher dairy intakes, suggesting that consumers eat dairy foods in place of higher-cholesterol foods in their diets.

We also looked directly at the contribution of dairy foods and ingredients to calcium, fat, saturated fat, and cholesterol intakes by using the recipe files available as technical support files from CSFII. Dairy foods and ingredients (including butter) provided about 50% of the calcium, 19% of fat, 32% of saturated fat, and 22% of cholesterol in US diets. We examined what happens as people get an increasing proportion of those nutrients from dairy. Total calcium intake increased dramatically as the proportion of calcium from dairy increased, indicating that consumers do not somehow compensate for low dairy intakes by eating other rich sources of calcium. Saturated fat intake increased modestly, with an estimated increase of 0.6 en% for a 10% increase in the proportion of saturated fat from dairy. Fat did not change as the proportion of fat from dairy increased, suggesting that people compensate for fat in dairy by making other lower fat choices. And, consistent with our other findings, cholesterol intake declined as the proportion of cholesterol from dairy increased. Again, apparently dairy foods are eaten in place of more cholesterol-rich foods.

Our data present a very positive picture for the contributions of dairy foods, particularly milk, while indicating caution in the applicability of these findings when cheese alone is considered. Suggestions are made for applications of our results.

J. MAJOR ACCOMPLISHMENTS (OBJECTIVES, METHODS, AND FINDINGS):

The purpose of this project was to examine dairy foods eating patterns and to assess the contributions of dairy foods to nutrient intakes and other health-related characteristics of people in the US. All of our analyses have been of data from USDA's Continuing Survey of Food Intakes by Individuals (CSFII) 1994-96, and most of the analyses have also included the CSFII 1998 Supplemental Children's Survey. The CSFII, commonly called "What We Eat in America," included two 24-hour dietary recalls with detailed information on the location and timing of each eating occasion. In addition, subjects were asked many questions about socioeconomic status, living situation, self-reported health and weight, supplement use, and so on. Documentation of all survey questions and details of methodology for the survey are supplied by USDA (1998).

We looked at data from respondents age 2 and over who had two complete days of dietary data, and excluded pregnant and lactating women. Analyses were done for the total population as well as for age and gender subgroups. Sampling weights were applied to all data so that results presented are nationally representative.

We used SAS Version 8 (SAS Institute, Inc., Cary NC) for data management and descriptive statistics, and SAS-Callable SUDAAN (Research Triangle Institute, Research Triangle Park, NC) for additional statistical analyses. SUDAAN allows computation of standard errors taking into account the complex sample design of CSFII. We used the WR design in SUDAAN which uses the VARSTRAT and VARUNIT variables from the CSFII dataset and the Taylor Linearization method of estimating standard errors. In a limited number of analyses for certain age and gender subgroups, the sample sizes were too small for SUDAAN to calculate statistics using the WR design, so we used WesVar PC, Version 3.1 (1998, Westat, Rockville, MD) which uses the jackknife replication method. For these few analyses, the jackknife replication weights provided by USDA in the CSFII dataset were used.

Here we describe the major approaches and findings from each research objective. Additional detailed data are included in appendices to this summary report, as indicated.

Objective 1. To determine the range and typical intakes of dairy products and specific dairy product categories in the US and among select subgroups of the US population.

Some of our key findings were presented in poster form at Experimental Biology 2001 [Berner, L.A., Rector, M., and Groves, J.E. 2001. Dairy product intakes and patterns of consumption in the US. FASEB J. 15(4): A622 (abstract #496.2)]. Matt Rector, an undergraduate Statistics major at Cal Poly, was responsible for conducting most of the analyses with direction from the principal investigators.

Using the CSFII 1994-96, 98 sample, we generated descriptive data on the mean, 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles of intake of several dairy categories. The sample sizes for the total sample population and the subgroups we examined are shown in Table 1; recall that all other data we provide have sample weights applied so they are nationally representative.

Table 1. Sample Sizes for 1994-96, 98 CSFII Data Used in Our Analyses

Population Group		n
Males and Females		
	2-3	2805
	4-8	3769
	9-13	1149
	14-18	882
	≥2	17959
	≥19	9354
	≥71	1297
Males		
	9-13	569
	14-18	446
	19-30	854
	31-50	1684
	51-70	1606
	≥19	4818
	≥71	674
Females		
	9-13	580
	14-18	436
	19-30	760
	31-50	1614
	51-70	1539
	≥19	4536
	≥71	623

Our descriptive data on intake are for the food categories of total dairy; fluid milk and types of fluid milk; yogurt; cheese; and cheese from mixtures. "Total dairy" is presented in terms of Pyramid servings, and includes all dairy consumed either when recorded as a dairy food such as fluid milk or cheese or when eaten as part of a food mixture such as mashed potatoes or lasagna. Data on fluid milk intake include only milk that was coded as fluid milk; for example, the fluid milk data *do* include intake of a glass of milk or milk poured on cereal or in coffee but do *not* include milk used as an ingredient to make pancakes or mashed potatoes. We provide data in ounces for total fluid milk and fluid milk categories because that has most practical meaning for consumers and nutritionists at this time. Yogurt data are presented in ounces as well.

For cheese, we present data both for total cheese intake and for cheese from mixtures only. Total cheese intake is given as what we call "ounces of natural cheese equivalent." The CSFII dataset directly provides Pyramid servings for cheese, based on USDA's "serving" of cheese defined as the amount providing 302 mg of calcium. We converted the Pyramid servings data to "ounces of natural cheese equivalent," to be more consistent with the other intake data we present, by multiplying by 1.5, since 1.5 ounces of natural cheese typically provides about 302 mg of calcium or a Pyramid serving's worth of calcium. In addition, we developed a strategy to determine cheese intake from mixtures as follows:

1. Used Record type 32 (which gives Pyramid servings of cheese contributed by *each food line item for each person* per day) and Record type 42 (which gives total Pyramid servings of cheese per person per day). The servings include both natural and processed cheeses and, importantly, *include cheese from food mixtures* such as pizza, tacos, etc.

2. Converted each cheese "serving" to "*ounces natural cheese equivalent*" (1 serving = 1.5 ounces NCE). USDA defines a "serving" of cheese as the number of ounces needed to provide 302 mg of calcium. Because we usually think of 1.5 ounces of natural cheese as providing about this much calcium, we converted the "servings" of cheese to "ounces natural cheese equivalent."

3. Identified food codes for food mixtures that could contain cheese (grain-based, meat-based, and vegetable-based foods), and then determined the number of cheese servings (in ounces NCE) eaten as part of food mixtures by summing cheese from these foods per person per day.

4. Compared cheese from mixtures (determined as above) to total cheese intake (available in RT 42, and converted for practical purposes to "ounces natural cheese equivalent") for each person for each day, and determined an average daily proportion from cheese mixtures among people who ate any cheese on one or more survey days. We also looked separately at cheese contributed by meat-based, vegetable-based, and grain-based mixtures.

All of the descriptive data on dairy foods intakes are included in Appendix A. These data themselves may have some use to our project sponsors and nutrition educators. More importantly for us, however, these descriptive data were critical as we moved to Objective 4. For one thing, we found out that it would not be useful to look at how nutrient intakes varied by quartile of yogurt or specific milk (nonfat, lowfat, etc.) intake, because too many in the population did not consume those specific foods during the two-day survey period. For example, the 50^{th} percentile of lowfat milk intake was zero for nearly all age/gender groups, and the 90^{th} percentile of yogurt intake was zero. On the other hand, we confirmed that it *would* be useful to compare nutrient intakes by quartile of total dairy, total milk, and cheese intake.

Based on our analysis of cheese consumption, we found that cheese eaten in food recorded as food mixtures (such as pizza, tacos, fast food cheeseburgers, lasagna, etc.) contributed up to 60% of total cheese intake depending on age group. Figure 1 shows the results by population subgroup. It is of obvious importance to include "ingredient" use of cheese when assessing cheese intake.

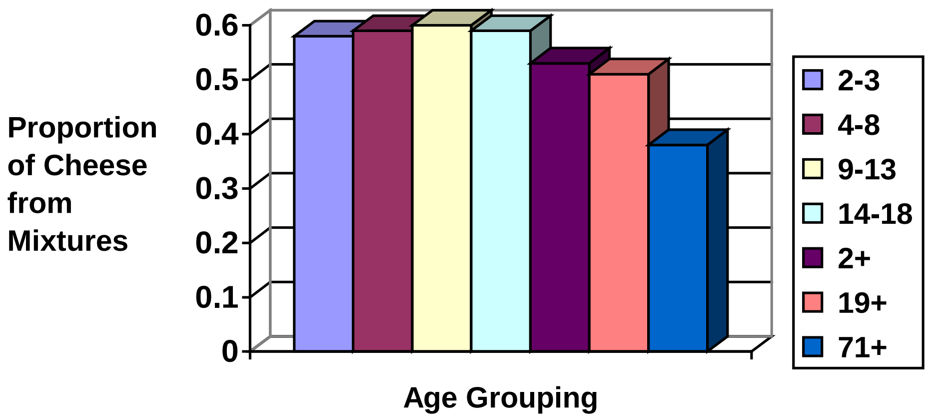

Figure 1. Cheese eaten in foods recorded as food mixtures (such as pizza, tacos, fast food cheeseburgers, etc.), as a proportion of total cheese intake, from CSFII 94-96, 98 for different age groups. Data are weighted. Includes only people who ate cheese on one or more survey days.

We also examined dairy intake data in terms of the proportion of the total population who did not consume any of a particular dairy food on either of the two survey days, as summarized in Appendix Table A12. We were somewhat surprised by the fact that approximately 14% of children 9-13, 28% of boys 14-18, and more than 41% of girls 14-18 consumed no fluid milk during the survey period. Our subsequent data on the many positive nutrient contributions of milk raise a real red flag about the implications of low or no fluid milk intake. Of interest, elderly people 71 and older were more likely to be fluid milk consumers than younger adults; approximately 23-24% reported no fluid milk during the two survey days, compared with 35-47% of younger adults. We don't know if this is because older adults are more health- and diet-conscious, or perhaps because they developed milk-drinking habits as younger individuals.

Still, milk continues to be the prominent dairy food in US diets. For the total population 2 and older who consumed dairy products on at least one of the survey days, milk (both as beverage milk and as an ingredient) accounted for approximately 63% of dairy intake while cheese accounted for 35%.

When we originally planned and began to carry out this research, CSFII data were only available for the 1994-96 survey period. In 1998, a supplemental survey of thousands of children ages 1-9 was conducted by USDA (its purpose was to estimate pesticide exposures for the Environmental Protection Agency), and it was designed to be analyzed along with the 1994-96 data. We were interested in comparing the 94-96 data on milk intakes with the 1998 data to see if we could identify any major changes among children 2-3 and 4-8 who were consumers of milk. While the survey design precludes statistical analysis of the trends, inspection of mean and median intakes (see Table 2) suggests that intakes of total fluid milk either did not change or increased from 94-96 to 1998 among young children who were consumers of milk on at least one of the two survey days.

Table 2. Average daily intake of total fluid milk (in grams) among children who consumed fluid milk on at least one of the two survey days. Data are weighted.

Population and Survey Period	n	Mean (SE)	Median (SE)
1994-96			
Children 2-3	1074	346 (7.8)	301 (5.4)
Children 4-8	1512	335 (9.0)	284 (17.2)
1998			
Children 2-3	1528	380 (9.4)	327 (11.9)
Children 4-8	1994	340 (13.6)	301 (19.0)

One of the ongoing concerns with national nutrition monitoring surveys (as well as other dietary assessment surveys) is that two days of dietary survey data don't give an accurate picture of *usual* intake of foods and nutrients. Specifically, a two-day survey result will overestimate the high end as well as the low end of consumption because during the two survey days some respondents would just have happened to eat more or less of specific foods than they typically eat. Researchers at Iowa State University have developed software (called CSIDE) that can be used with CSFII and similar surveys to get a better idea of *usual* ranges of intake of nutrients in populations. They have tried to adapt the software for use with foods, but that is a more complicated task because foods are often eaten sporadically (and sometimes not at all on a given day or days, as Table A12 emphasizes) whereas nutrients are consumed virtually every day. We purchased the software to see if we could get a better picture of *usual* intakes of total dairy foods, milk, and cheese in the US population. The program could not be applied successfully for fluid milk, because the program could not normalize the data (a requirement for the program to work). We confirmed with Dr. Alicia Carriquiry at Iowa State that the program is often not successful for looking at usual intakes of <u>foods</u> unless there are at least three days of intake data available. On the other hand, we did apply the software to estimate "usual" intakes of total dairy and total cheese (both in terms of Pyramid servings), and the analyses were successful for most although not all age/gender subgroups. Tables B1 and B2 in Appendix B show a comparison of data based on two-day average intakes vs. the estimates of usual intakes. We confirmed as expected that estimated ranges of *usual* daily intakes of dairy foods are more narrow than average daily intakes based on two survey days. The mean intakes are virtually identical, and median "usual" intakes are slightly higher than median 2-day averages.

We have shown that it is possible to apply the Iowa State software to estimate usual intakes of total dairy and cheese for most but not all population subgroups from CSFII 94-96, 98, but that the approach is not successful for looking at usual intakes of fluid milk. Clearly the application of the software is limited. Moreover, the analyses are very cumbersome because at the present time the software does not work in a typical PC format. (We were able to use a UNIX computer lab on campus.)

For this research project, our primary focus was on how dairy intakes relate to nutrient intakes, and not on the descriptive data on how much dairy foods are consumed. Nevertheless, we need to be clear that all of our subsequent analyses are based on 2 survey days of data. At the present time, there is no easy way or consensus on how to get better estimates of usual intake of foods and the nutrients associated with them, particularly at extremes of intakes.

Objective 2. To determine the patterns of daily intake (breakfast, lunch, dinner, snack, and away from home meals) of fluid milk and cheese/cheese mixtures in the US.

As for Objective 1, some of our key findings were presented in poster form at Experimental Biology 2001 [Berner, L.A., Rector, M., and Groves, J.E. 2001. Dairy product intakes and patterns of consumption in the US. FASEB J. 15(4): A622 (abstract #496.2)]. Again, Matt Rector, an undergraduate Statistics major at Cal Poly, was responsible for conducting most of the analyses with direction from the principal investigators.

First, we examined how different dairy foods were consumed by meal occasion. The meal occasion names represent the names given by the survey respondents except that we combined “breakfast” and “brunch” occasions into one “breakfast” category. We report “dinner” and “supper” separately because the use of the terms varies and is not always synonymous. We considered the idea of reporting “occasions” by time of day since the time of the meal is a variable available in the CSFII dataset. But we decided that arbitrarily assigning a time frame to “breakfast,” “lunch,” etc. would cause more confusion than the self-reported occasion designations.

Appendix C includes data tables detailing the proportion of different dairy foods by eating occasion and for different age/gender subgroups in the population. Table C1 shows results for total dairy (including dairy foods used as ingredients in mixed foods); Table C2 shows results for fluid milk (i.e., milk recorded as such in the survey which would include a glass of milk or milk added to cereal or coffee but would not include “ingredient” milk such as in mashed potatoes); Table C3 shows data for total cheese; and Table C4 summarizes results for cheese from food mixtures only. Table 3 below includes data from Appendix C but for the total population only.

Table 3. Proportion of dairy intake by eating occasion, total population age ≥2, CSFII 94-96, 98.

Dairy Category	Breakfast Mean	Lunch Mean	Dinner Mean	Supper Mean	Snack Mean
Total Dairy	.30	.23	.18	.12	.17
Fluid Milk	.58	.11	.09	.06	.15
Total Cheese	.07	.38	.28	.17	.10
Cheese from Mixtures	.06	.33	.32	.19	.10

A key finding was the large proportion of intake of fluid milk at the breakfast meal (~50% for children 2-8 and ~60% for children and adults over age 9), even among school-age children who presumably are offered milk as part of school lunch programs. As expected, little cheese was consumed at the breakfast meal; in addition, only 10% of cheese consumption was from snacks.

In addition to looking at dairy product intake according to eating occasion, we also examined dairy intakes at home compared with away-from-home. We initially did some analyses defining "at home" and "away from home" meals in complicated ways (for example, by considering packed meals taken to work or elsewhere separately from "away from home" restaurant or vending machine meals). Eventually, however, we decided it was just as informative and more clear to simply use the CSFII designation of whether a food was eaten at home or not. Table 4 shows the proportion of dairy food intakes that were reported as eaten at home.

Table 4. Proportion of dairy intakes eaten at home, from CSFII 94-96, 98. Data are weighted.

Population		Fluid Milk Mean (SE)	Total Dairy Mean (SE)	Yogurt Mean (SE)	Cheese from Mixtures Mean (SE)	Total Cheese Mean (SE)
Children	2-3	.87 (.01)	.83 (.01)	.89 (.02)	.61 (.02)	.69 (.01)
Children	4-8	.78 (.01)	.7 (.01)	.84 (.03)	.48 (.02)	.54 (.01)
Males	9-13	.79 (.01)	.64 (.02)	.87 (.06)	.38 (.02)	.42 (.03)
	14-18	.83 (.02)	.64 (.02)	.78 (.07)	.33 (.04)	.43 (.03)
	19-30	.87 (.02)	.56 (.02)	.64 (.09)	.33 (.02)	.36 (.02)
	31-50	.87 (.02)	.65 (.01)	.75 (.06)	.42 (.02)	.45 (.02)
	51-70	.93 (.01)	.76 (.01)	.8 (.04)	.45 (.02)	.54 (.02)
	≥ 19	.89 (.01)	.67 (.01)	.75 (.04)	.41 (.01)	.46 (.01)
	≥ 71	.96 (.00)	.89 (.01)	.92 (.06)	.55 (.03)	.69 (.02)
Females	9-13	.77 (.02)	.65 (.02)	.79 (.08)	.38 (.03)	.45 (.02)
	14-18	.85 (.02)	.63 (.03)	.56 (.13)	.41 (.03)	.47 (.03)
	19-30	.9 (.01)	.64 (.02)	.71 (.07)	.38 (.03)	.44 (.02)
	31-50	.9 (.01)	.68 (.01)	.59 (.04)	.4 (.02)	.47 (.02)
	51-70	.93 (.01)	.77 (.01)	.79 (.04)	.45 (.02)	.56 (.02)
	≥ 19	.92 (.01)	.72 (.01)	.69 (.02)	.42 (.02)	.5 (.01)
	≥ 71	.97 (.01)	.88 (.02)	.89 (.04)	.6 (.04)	.68 (.03)
Total	9-13	.78 (.01)	.64 (.01)	.82 (.05)	.38 (.02)	.43 (.02)
	14-18	.84 (.01)	.63 (.02)	.67 (.08)	.37 (.03)	.45 (.02)
	≥2	.87 (.00)	.69 (.01)	.74 (.02)	.42 (.01)	.49 (.01)
	≥19	.9 (.01)	.7 (.01)	.71 (.02)	.41 (.01)	.48 (.01)
	≥71	.97 (.01)	.88 (.01)	.9 (.04)	.58 (.03)	.69 (.02)

It is not surprising that fluid milk consumption was greater in the home than away from home, and that cheese consumption was more evenly distributed between home and away meals. However, the proportion of fluid milk consumed away from home is disappointingly small considering that Lin et al. (1999) reported that approximately one third of food energy was consumed away from home by the CSFII population. Our data show that 77-97% of fluid milk was consumed at home with just 3-23% consumed away, depending on age and gender group. The continued trend toward away-from-home meals – combined with low milk in away-from home meals – is an important challenge to address, particularly when we consider the critical nutrient contributions of fluid milk as detailed later in this report.

Objective 3. To determine the relationship of dairy foods consumption to other health and nutrition-related parameters.

Cari Ahlem was responsible for analyses related to this objective as part of her Master's thesis. A copy of her thesis, "Dairy Product Consumption and Other Diet and Health Related Parameters," is available on request. We sent a copy previously to our other sponsors. Much of Cari's work was summarized in a poster presented at Experimental Biology 2001 [Ahlem, C.C., Groves, J.E. and Berner, L.A. 2001. Dairy product consumption and dietary diversity. FASEB J. 15(4): A622 (abstract #496.1)].

The main approaches and findings will be summarized here, with a focus on data from the total population. Appendix tables in Cari's thesis include detailed information for all age and gender subgroups. Because USDA had not yet released data from the 1998 Supplemental Children's Survey when Cari carried out most of her analyses, all of the data for objective 3 were derived using the 1994-96 CSFII only. Again, we looked at data for people age 2 and over who had two complete days of dietary data, and excluded pregnant and lactating women. The final sample included 14,150 people. In addition to data from Cari's thesis, Matt Rector used her SAS computer code to apply her strategies to some additional nutrients we thought might be important to include in research publications.

Within Objective 3, there were three main focus areas: 1) how dairy product intake relates to other dietary choices, and how dietary diversity relates to nutrient intakes; 2) the relationship between dairy product intake and weight status; and 3) the relationship between dairy product intake and vitamin/mineral supplement use as well as perceived health. Methods and results are summarized for each focus area.

Focus 1. Dairy product intake and dietary diversity.

We used Pyramid servings data to assess intake of the various food groups. We defined some groups differently than USDA did for its CSFII data. First, we subtracted cooked dry beans and peas from the vegetable group and added them to the meat group. (The FGP states that they can be counted towards either group.) We also converted fat to a percentage of calories from fat rather than using "discretionary fat" as a method for determining if a person meets current recommendations for fat intake, and defined meeting the recommendation for fat intake as consuming less than or equal to 30% of calories from fat. Similarly, we converted added sugar to a percent of calories from added sugar and defined meeting this recommendation as consuming less than or equal to 10% of calories from added sugar.

Our original intent was to look at whether people meeting the dairy recommendations for the Pyramid were more likely to meet other food recommendations as well, reasoning that milk and other dairy foods might be generally associated with healthful diet choices. We expected to define a diverse diet as one that adhered to Pyramid serving guidelines. However, we quickly determined that virtually no one in the population met all Pyramid recommendations; in fact, only 21 people out of more than 14,000 had average intakes of *at least* the minimum number of recommended Pyramid servings plus a diet with 30 en% or less from fat and 10 en% or less from added sugar. Zero people ate within the Pyramid recommended ranges.

Of the 14,150 non-pregnant, non-lactating people 2 years old and older surveyed in the 1994-96 CSFII who provided 2 days of dietary intake, most did not consume the recommended number of servings from the dairy group. As shown in Table 4.1.2 on page 59 of Cari's thesis, 73% of all people over age 2 consumed less than the recommended minimum of 2 servings of dairy products daily. On average, more males than females met Food Guide Pyramid (FGP) recommendations for the dairy group, although only 33% of males and 20% of females age ≥2 consumed at least 2 servings of dairy foods daily. Females ≥19 consumed the fewest servings of dairy products, with over 83% of this population consuming less than the recommended minimum of 2 servings daily. USDA has summarized CSFII 1994-96 data on dairy product consumption (USDA 1999), although our data provide additional information on the percentage of the population that exceeded the dairy recommendation range and on specific age/gender subgroups.

We relaxed our definition of dietary diversity to be more realistic. Currently there is no consensus on a definition of a 'diverse' or 'varied' diet. For this research, we defined 'diversity' in terms of the different food groups consumed or omitted; we did not examine 'variety' as sometimes used to define the number of different foods *within* a food group a person consumes. We defined a "consumer" of a food group as someone who included an average of ≥1 servings per day of a given food group over the 2 days of dietary intake data. A diverse dietary pattern and several non-diverse dietary patterns were defined by the foods that were consumed or omitted, as shown in Table 5.

Table 5. Dietary pattern definitions, where 1 defines a consumer (eating an average of ≥1 serving per day from the food group) and 0 defines a non-consumer (eating an average of <1 serving per day from the designated food group)

Pattern	Grain	Vegetable	Fruit	Meat	Dairy
Diverse	1	1	1	1	1
Non-Diverse:					
Excluding Dairy	1	1	1	1	0
Excluding Meat	1	1	1	0	1
Excluding Fruit	1	1	0	1	1
Excluding Veg.	1	0	1	1	1
Excluding Grain	0	1	1	1	1
Other not including dairy	Any pattern with 0 in dairy and a 0 for one or more other groups				0
Other including dairy	Any pattern with 1 in dairy and zeros for two or more other groups				1

Figure 2 shows the percentage of the population consuming the different patterns defined in Table 5. The four commonly consumed dietary patterns were the diverse dietary pattern (including ≥1 servings/day from each food group) and dietary patterns that "excluded" (i.e., had <1 serving/day) of fruit only, of dairy only, or of dairy plus one or more other food groups. The most rare patterns were dietary patterns that excluded vegetables only, meat only, and or grains only (with the latter omitted from the figure because only 0.04% of the population followed that pattern).

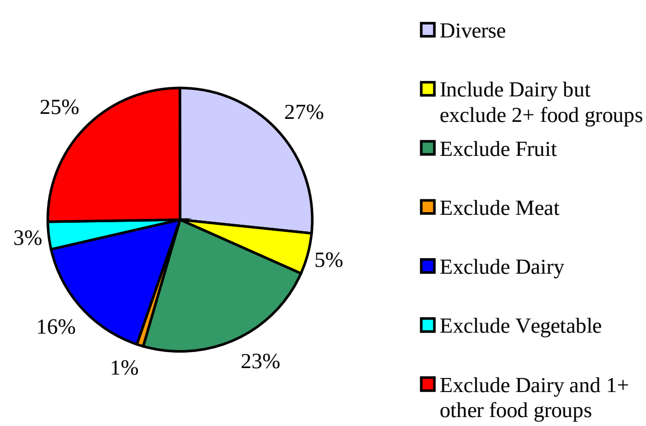

Figure 2. Percentage of the population consuming different dietary patterns, from CSFII 1994-96.

Two questions we asked were whether people who consumed ≥1 serving per day of dairy foods were more likely than people who ate <1 serving of dairy per day to 1) consume ≥1 serving per day from other food groups and 2) meet fat and added sugar recommendations. We used a t-test to compare the proportion of dairy consumers who were consumers of another food group to the proportion of dairy non-consumers who were also consumers of the other food group, as shown in Table 6. We found that dairy consumers were more likely to be fruit consumers and grain consumers than were dairy non-consumers. On the other hand, dairy consumers were less likely to meet fat and added sugar recommendations. Even when we controlled for energy intake in our statistical model, the results were the same. In other words, the conclusion that dairy consumers were more likely to be fruit consumers cannot be simply attributed to them eating more food overall. Because nearly everyone consumed grains, the statistically significant results for grains likely have no practical meaning.

Table 6. Weighted percentage of the population age ≥2 who were consumers or non-consumers of dairy and also consumed other food groups, 2 day average[1,2]

	Grain Consumer	Vegetable Consumer	Fruit Consumer	Meat Consumer	Meet Fat	Meet Sugar
			Proportion of Population			
Dairy Consumer[3]	99.80	86.97	53.55	95.86	32.86	26.73
Dairy Non-consumer[4]	98.69	87.02	45.88	96.02	37.29	32.38
p-value	0.0000	0.9375	0.0000	0.6943	0.0007	0.0000
Standard Error	0.1998	0.6630	1.0735	0.4012	1.2189	1.0822

[1]Data based on CSFII 94-96, USDA sampling weights have been applied
[2]P-values and standard errors are for comparisons of the proportions between dairy consumers and dairy non-consumers who also consume another food group
[3]Consumed an average of ≥1 servings of dairy foods over 2-day survey period
[4]Consumed an average of <1 servings of dairy foods over 2-day survey period

Next, using our dietary pattern definitions, we used a multiple regression model to compare nutrient intakes in the various non-diverse dietary patterns to the diverse dietary pattern. All statistical models included total energy as a covariable to ensure that differences in nutrient intakes were not simply due to consumers of one dietary pattern eating more or less food than consumers of another dietary pattern. Table 7 shows results for the four most commonly consumed non-diverse dietary patterns. Data are the mean differences in nutrient intake between people consuming the indicated non-diverse pattern and the diverse pattern. All of the non-diverse dietary patterns that we looked at provided significantly less of many essential nutrients than the diverse dietary pattern, while patterns excluding dairy or fruit provided more cholesterol.

Table 7. Mean difference in nutrient contribution of selected nutrients in the most commonly-consumed non-diverse dietary patterns as compared to a diverse dietary pattern, population age ≥2, adjusted for calorie intake[1,2,3]

	Excludes Fruit Only	Excludes Dairy Only	Excludes Dairy Plus 1 or More Other Food Groups	Excludes 2+ Food Groups but Includes Dairy
En% fat	+3.7 [a]	-0.66 [a]	+1.8 [a]	+0.71
Total fat (g)	+8.2 [a]	+0.41	+6.1 [a]	+3.5 [a]
Saturated fat (g)	+3.5 [a]	-3.0 [a]	-0.13	+3.0 [a]
Cholesterol (mg)	+26 [a]	+23 [a]	+40 [a]	+10
Protein (g)	+0.4	-2.6 [a]	-3.0 [a]	-6.5 [a]
Calcium (mg)	-49 [a]	-437 [a]	-446 [a]	+15
Iron (mg)	-2.1 [a]	-1.6 [a]	-3.0 [a]	-1.6 [a]
Phosphorus (mg)	-34 [a]	-253 [a]	-272 [a]	-58 [a]
Magnesium (mg)	-35 [a]	-20 [a]	-59 [a]	-50 [a]
Potassium (mg)	-502 [a]	-192 [a]	-698 [a]	-858 [a]
Vitamin C (mg)	-77 [a]	+3	-67 [a]	-73 [a]
Vitamin A (RE)	-292 [a]	-217 [a]	-509 [a]	-404 [a]
Folate (mcg)	-71 [a]	-37 [a]	-103 [a]	-70 [a]
Riboflavin (mg)	-0.19 [a]	-0.57 [a]	-0.68 [a]	-0.06
Vitamin B6 (mg)	-0.39 [a]	-0.13 [a]	-0.50 [a]	-0.49 [a]
Vitamin E (mg)	-0.82 [a]	+0.06	-1.02 [a]	-1.74 [a]
Zinc (mg)	+0.05	-1.06 [a]	-0.89 [a]	-0.34

[1]Data based on CSFII 94-96, USDA sampling weights have been applied
[2]A non-diverse dietary pattern is one that provides <1 serving of at least one food group. Excluded food groups are those consumed in amounts less than 1 serving.
[3]Excludes pregnant and lactating women and persons without 2 complete days of dietary intake data
[a] = p<.01

When dairy foods were excluded, either alone or in combination with another exclusion (the second and third patterns shown in Table 7), there was a particularly notable effect on calcium, phosphorus, riboflavin, and zinc not noted in the other two common patterns shown in the table. For example, people following a pattern with <1 serving of dairy ate, on average, 437 mg less calcium than people eating a diverse diet. The impact of excluding dairy was to decrease intake of phosphorus by 253 mg, of riboflavin by more than half a mg, and of zinc by more than 1 mg per day. Also, people eating the common non-diverse pattern of excluding fruit ate just as much protein as those consuming the diverse diet, but people excluding dairy ate significantly less protein than people eating diverse diets.

The inclusion or exclusion of dairy products from the dietary pattern also affected the percent of calories from fat supplied by the dietary pattern. The non-diverse dietary pattern that excluded dairy products provided significantly less fat (-0.66en%) than the diverse diet that included dairy products. However, the non-diverse dietary pattern that excluded dairy products and one or more other food groups provided significantly more fat (+1.82en%) than the diverse diet that included dairy products. Therefore, it cannot be concluded that a person will consume less fat by simply excluding dairy products from the diet. In fact, data on total fat intake indicate no significant difference in total fat intake between the diverse diet and the diet excluding dairy. Excluding dairy did lead to lower saturated fat intake, yet at the same time higher cholesterol intake. This suggests that when dairy foods are excluded, foods (such as meats) higher in cholesterol but lower in saturated fat are substituted.

It is of interest that the non-diverse dietary patterns excluding dairy provided less iron and folate than the diverse diet, since dairy foods are not good sources of these nutrients. Obviously we are looking at the impact of overall diet choices, and we could imagine that iron- and folate-rich grain foods (such as breakfast cereals) might be important parts of dairy-rich diets. As we have indicated, the diverse dietary pattern consistently provided more of most essential nutrients that we looked at, when compared to the non-diverse dietary patterns, confirming the wisdom behind the time-honored dietary diversity message.

Focus 2. Dairy product intake and weight status.

Many consumers perceive dairy foods as high in fat (Chapman et al., 1995) and, therefore, as fattening foods (Horwath et al., 1995; Sobal and Cassidy, 1990). Some women have reported limiting consumption of dairy foods as a weight management strategy (Gulliver and Horwath, 2001). In recent years, however, there has been growing interest in the apparent inverse relationship between calcium intake and body fatness. We wanted to see if the cross-sectional CSFII data revealed any significant associations between dairy product intake and body mass index (BMI).

We used CSFII Pyramid servings data for total dairy and cheese consumption and BMI calculated from self-reported heights and weights. Sample persons without BMI recorded (n=772), persons without 2 days of dietary intake data, and all children under the age of 12 were excluded. The final sample size for this research question was 10,367, made up of 1,081 adolescents age 12-17, and 9,286 adults age 18 and over (4,446 females and 4,840 males). Children under age 12 were excluded because some of the BMI values provided for young children (based on parent reports of child height and weight) were highly improbable. We decided to limit our research to sample persons age 12 and over because beginning at age 12, the sample person was completely responsible for reporting his or her own data. In addition, the BMI data from CSFII for adolescents were reasonable. Specifically, the percent of adolescents classified as obese using the CSFII BMI data was similar to the percent classified as obese in other nationally representative studies that used measured heights and weights (FASEB 1995). It has also been found that among adolescents, BMI calculated from self-reported heights and weights is highly correlated with BMI calculated from measured heights and weights, and can be used to accurately classify adolescents as obese by using the 95th percentile cutoff for obesity (Goodman et al., 2000). Moreover, BMI from self-reported weight and height in adults is highly correlated with BMI from measured weight and height for most adults (Kuczmarski et al., 2001).

Adolescents age 12-17 were classified as obese or non-obese based on the 95th percentile of the most recent growth curves available from the CDC (Ogden et al., 1997). We found that 11.6% of adolescent males and 8.4% of adolescent females were categorized as obese. These data are fairly similar to data from the 1988-1994 and 1999 NHANES, which uses measured heights and weights to calculate BMI. Using the 95th percentile for age and sex as a cutoff for obesity, 11% of teens age 12-19 were obese in 1988-1994, and 14% were obese in 1999 (USDHHS 2001).

For adults ≥18, overweight was defined as a BMI of ≥25 and obesity as BMI ≥30 (NHLBI, 1998). Our analyses of CSFII data showed that about 59% of adult males and 46% of adult females were overweight or obese based on self-reported heights and weights. These findings are similar to the percentage of adults classified as overweight or obese in the NHANES datasets, which use measured heights and weights. In NHANES III (1988-1994), 56% of adults age 20-74 were classified as obese or overweight, and in NHANES 1999, 61% of this age group were classified as obese or overweight. However, more adults were classified as obese in the NHANES data sets than the CSFII data set; 23-27% of adults were classified as obese in NHANES III and NHANES 1999 (USDHHS 2000), but only about 17-19% of CSFII adults were similarly classified.

To examine the relationship between dairy intake and obesity in adolescents, we did a logistic regression where BMI category (obese or non-obese) was regressed against total dairy servings or total cheese servings consumed. (We couldn't use BMI as a continuous variable in teens because the BMI values associated with "obesity" are moving targets in children and teens.) Total energy consumed and race/ethnicity were included as covariables. Table 8 shows the results, which indicate that there was no significant relationship between total dairy or total cheese intake and obesity in adolescents.

Table 8. Odds ratio for obesity based on total dairy product intake and cheese intake in adolescents age 12-17, from CSFII 1994-96[1,2,3]

	Total Dairy Servings		Total Cheese servings	
	Odds Ratio	P-value	Odds Ratio	P-value
Males				
Age 12-17	1.01	0.97	1.25	0.84
Females				
Age 12-17	0.76	0.34	1.03	0.97

[1]Data based on CSFII 94-96, USDA sampling weights have been applied
[2]Age, energy, and ethnicity were included in regression models as covariates.
[3]Excludes pregnant and lactating teens and people without 2 days of dietary intake data

Among adults, the relationship between total dairy product intake and BMI, and between total cheese intake and BMI, was investigated using a multiple regression model where age, energy, and ethnicity were added to the model as covariables. Here we used BMI as a continuous variable.

Contrary to what many people believe, we found that there was no significant relationship between cheese consumption and BMI in adult males or females and there was no significant relationship between total dairy intake and BMI in adult males. However, BMI was inversely associated with total dairy intake among adult women. Our statistical model showed that each additional dairy serving an adult woman consumed (at a given level of age, energy intake, and ethnicity) was associated with a 0.44 reduction in BMI. These results are shown in Table 9.

Table 9. Effect of total dairy product intake and cheese intake on BMI in adults age ≥18, from CSFII 1994-96[1,2,3]

	Males	Females
Effect of one dairy serving on BMI	+0.07	-0.44
(p-value)	(0.30)	(<0.01)
Effect of one cheese serving on BMI	+0.19	-0.19
(p-value)	(0.13)	(0.26)

[1]Data based on CSFII 94-96, USDA sampling weights have been applied
[2]Age, energy, ethnicity were included in regression models as covariates.
[3]Excludes pregnant and lactating women, people without 2 days of dietary intake data

This inverse relationship found between dairy product intake and weight status in women may be due to the high calcium content of these foods, as suggested by Zemel, et al. (2000). Based on results from their study in transgenic mice, they proposed that dietary calcium increases metabolism and, thereby, reduces obesity risk. They further support this conclusion with analyses based on data from NHANES III that found an inverse relationship between dietary calcium intake and body fatness in women (Zemel, et al., 2000). However, this inverse relationship may also be due to other dietary and lifestyle factors, such as other food choices and activity level, because overweight is a multifactorial disorder.

<u>Focus 3. The relationship between dairy product intake and other health-related characteristics: vitamin/mineral supplement use and perceived health.</u>

CSFII does not include direct measures of health, but does include some "surrogate" measures. We were interested in finding out whether dietary behaviors were associated with vitamin and mineral supplement use (associated in many studies with a whole range of more healthful behaviors and outcomes) and perceived health.

Specifically, we examined three different dietary behaviors and three different vitamin/mineral supplement use categories. The dietary patterns we were interested in were 1) meeting the Pyramid recommendation for dairy products (an average of ≥2 servings per day); 2) consuming an average of ≥1 serving of dairy per day; and 3) consuming a diverse diet as we defined earlier. The vitamin/mineral supplement use categories we examined were 1) frequent users of any vitamin/mineral supplement; 2) users of any multivitamin supplement; and 3) users of a calcium supplement.

Similarly, among adults, we looked at the relationship between the above dietary patterns and whether the person perceived his health favorably ("excellent," "very good," or "good") compared with unfavorably ("fair" or "poor"). We used logistic regression to examine the relationships between the health-related measures and the dietary patterns, using age and energy intake as covariables in the models.

Findings are detailed on pages 79-85 of Cari's thesis. In children, supplement use was not a significant predictor of dietary pattern. In adolescents, vitamin/mineral and multivitamin supplement use was a good predictor of consuming a diverse dietary pattern, but only multivitamin use predicted whether the teen would eat ≥1 serving of dairy. Adults who were frequent users of vitamin/mineral supplements or users of a multivitamin had a higher probability of being dairy consumers, meeting the Pyramid recommendation for dairy, and being a consumer of a diverse dietary pattern than being a non-consumer of these dietary patterns. Calcium supplement use predicted consumption of a diverse diet in adults; in adult males, it predicted consuming ≥1 dairy serving per day while in adult females, calcium supplement use predicted meeting the Pyramid recommendation for dairy. These findings add to the literature which shows that supplement use is associated with positive dietary practices.

Having a favorable perception of health was significantly associated with consuming a diverse diet, but not with dairy product consumption. Adults who perceived their health favorably had an increased likelihood of being a consumer rather than a non-consumer of a diverse dietary pattern.

Objective 4. To determine the average daily contribution of dairy foods (total dairy; fluid milk; cheese; mixed foods containing cheese; and yogurt) to intakes of calcium, protein, vitamin A, zinc, fat, saturated fat, and sodium in the US and in subgroups of the population.

As part of Objective 3, we looked at nutrient intakes associated with diverse dietary patterns vs patterns we considered non-diverse (i.e. with less than one daily serving of dairy or other food group) and showed the strong nutritional profile of diverse diets. We looked in a fairly qualitatively way at dietary patterns (i.e. diets with vs without one or more daily servings of dairy) and did not quantify the impact of increasing amounts of dairy foods on nutrient intakes. Objective 4 was intended to better quantify the nutrient contributions of dairy.

Work for this objective was part of Linda (Veenstra) Weinberg's thesis, a copy of which is available on request; a copy was sent to our other sponsors. Some results were summarized in a poster at Experimental Biology 2002 [Veenstra, L.G., Berner, L.A., and Groves, J.E. 2002. Contributions of dairy foods to nutrient intakes. FASEB J. 16(4): A657-8 (abstract #494.9)].

We used data from the entire 4-year survey (CSFII 94-96, 98) to address this objective. Again, we only looked at people ≥2 who had two complete days of dietary data, and deleted pregnant and lactating women as well as children who were breastfeeding or receiving breast milk. The final dataset contained 17,959 individuals.

Within Objective 4, there were three main focus areas: 1) nutrient intakes by quartile of total dairy intake, fluid milk intake, or cheese intake; 2) dairy intake among individuals who met dietary recommendations vs. those who did not meet recommendations; and 3) proportion of nutrients derived from dairy products and ingredients, examined by intake of total dairy. Methods and results are summarized for each focus area. As for Objective 3, this summary report will focus on select results for the total population and also for a few select age/gender subgroups. The text as well as the Appendix tables in Linda's thesis has detailed data on additional nutrients and additional age/gender subgroups.

Focus 1. Nutrient intakes by quartile of dairy product intakes.
For this research focus, the micronutrients we examined were calcium, zinc, vitamin A, potassium, magnesium, riboflavin, folate, iron, and vitamin C. We also examined total fat, saturated fat, cholesterol, and protein.

Total dairy intake, total cheese intake, and total milk intake were examined in terms of food guide pyramid servings. Food guide pyramid servings data included all dairy products consumed as the foods by themselves as well as ingredients in food mixtures. Fluid milk was examined in terms of grams. Grams of fluid milk only included milk that was consumed as fluid milk, such a consuming a glass of milk or milk poured over cereal, and excluded milk used as an ingredient. Cheese from mixtures was expressed as pyramid servings. Code to generate cheese from mixtures came from previous work done by Matt Rector (see Objective 1).

The total population and the different age/gender subgroups were placed into quartile of intake of the dairy foods mentioned above; all data were weighted. Individuals in the lowest quartile of dairy product intake represented those who consumed the least amount of the dairy food category. Likewise, individuals in the highest (fourth) quartile of intake represented those who consumed the most dairy products. The mean nutrient intakes of the second, third, and fourth quartile of dairy intake were compared with the mean nutrient intake of the first quartile of dairy intake. Comparisons were made using an analysis of covariance with energy as a covariable. P-values were based on the Wald F-test and were considered statistically significant if $p < 0.05$.

For this summary report, we will highlight results for several age/gender groups and for total dairy intake (including ingredient use of dairy), shown in Table 11; fluid milk intake (excluding ingredient use of milk), shown in Table 12; and total cheese intake (including ingredient use of cheese), shown in Table 13. Table 10 shows the mean dairy intakes in each of the quartiles for the total population, confirming that intakes were very different from one quartile to the next.

Table 10. Mean dairy intakes by quartile, total population ≥2, CSFII 94-96, 98.

Dairy Category	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Total Dairy (servings)	0.30	0.90	1.62	3.20
Fluid Milk (grams)	0.00	74.22	200.60	505.16
Total Cheese (servings)	0.00	0.17	0.47	1.28

Table 11. Mean difference in nutrient intakes among people in quartile 2, 3, or 4 of total dairy intake compared with nutrient intakes of people in quartile 1 of total dairy intake. Total population ≥2 (excluding pregnant and lactating women) and other select age/gender subgroups. From CSFII 1994-96, 98.

NUTRIENT	Quartile 2 vs. quartile 1	Quartile 3 vs. quartile 1	Quartile 4 vs. quartile 1
Calcium (mg)			
MF ≥2	159[a]	347[a]	766[a]
M ≥2	187[a]	401[a]	878[a]
F ≥2	151[a]	322[a]	672[a]
MF <19	224 [a]	429[a]	835[a]
MF ≥19	139 [a]	309[a]	709[a]
Zinc (mg)			
MF ≥2	0.30[a]	0.79[a]	1.49[a]
M ≥2	0.01	0.45	1.47[a]
F ≥2	0.55[a]	1.04[a]	1.82[a]
MF <19	0.97[a]	1.34[a]	2.58[a]
MF ≥19	0.47[a]	0.72[a]	1.77[a]
Iron (mg)			
MF ≥2	0.69[a]	1.32 [a]	2.01 [a]
M ≥2	0.55 [b]	1.52 [a]	2.25 [a]
F ≥2	0.74 [a]	1.37 [a]	1.93 [a]
MF < 19	0.97 [a]	1.27 [a]	2.54 [a]
MF ≥ 19	0.77 [a]	1.46 [a]	2.39 [a]
Vitamin A (RE)			
MF ≥2	63[a]	145[a]	373[a]
M ≥2	133[a]	211[a]	430[a]
F ≥2	12	99[a]	292[a]
MF < 19	212[a]	299[a]	534[a]
MF ≥ 19	63	165[a]	410[a]
Riboflavin (mg)			
MF ≥2	0.20[a]	0.46[a]	0.98[a]
M ≥2	0.23[a]	0.53[a]	1.12[a]
F ≥2	0.19[a]	0.43[a]	0.86[a]
MF <19	0.36[a]	0.62[a]	1.17[a]
MF ≥19	0.18[a]	0.40[a]	0.90[a]
Folate (micrograms)			
MF ≥2	18.35 [a]	39.66 [a]	72.25 [a]
M ≥2	17.70 [a]	49.59 [a]	82.26 [a]
F ≥2	19.04 [a]	36.10 [a]	62.52 [a]
MF <19	33.33 [a]	53.59 [a]	92.05 [a]
MF ≥19	16.05 [a]	36.09 [a]	68.67 [a]

Protein (g)			
MF ≥2	-1.79[a]	-0.06	3.05[a]
M ≥2	-3.38[a]	-2.22[b]	1.97
F ≥2	-0.28	1.36	5.96[a]
MF <19	2.58	4.61[a]	10.78[a]
MF ≥19	-0.65	0.22	6.15[a]
Fat (g)			
MF ≥2	1.24[b]	-0.05	-0.20
M ≥2	2.54[a]	1.23	1.14
F ≥2	0.16	-0.95	-2.04[a]
MF <19	-0.42	0.01	0.36
MF ≥19	1.66[b]	0.73	0.18
Saturated fat (g)			
MF ≥2	1.71[a]	2.79[a]	5.39[a]
M ≥2	2.54[a]	3.59[a]	6.82[a]
F ≥2	1.31[a]	2.42[a]	4.22[a]
MF <19	1.87[a]	3.29[a]	6.07[a]
MF ≥19	1.44[a]	2.45[a]	4.59[a]
Cholesterol (mg)			
MF ≥2	-19.93[a]	-27.47[a]	-41.10[a]
M ≥2	-26.06[a]	-37.84[a]	-47.61[a]
F ≥2	-16.55[a]	-19.40[a]	-31.68[a]
MF <19	-5.51	-4.70	-10.62
MF ≥19	-15.32[a]	-21.41[a]	-32.97[a]

[a]=p<0.01
[b]=p<0.05

Table 12. Mean difference in nutrient intakes among people in quartile 2, 3, or 4 of fluid milk intake compared with nutrient intakes of people in quartile 1 of fluid milk intake. Total population ≥2 (excluding pregnant and lactating women) and other select age/gender subgroups. From CSFII 1994-96, 98.

NUTRIENT	Quartile 2 vs. quartile 1	Quartile 3 vs. quartile 1	Quartile 4 vs. quartile 1
Calcium (mg)			
MF ≥2	98 [a]	245 [a]	559[a]
M ≥2	104 [a]	262 [a]	634 [a]
F ≥2	81 [a]	193 [a]	486 [a]
MF <19	160 [a]	340 [a]	660 [a]
MF ≥19	69 [a]	177 [a]	474 [a]
Zinc (mg)			
MF ≥2	0.53 [a]	1.29 [a]	1.63[a]
M ≥2	0.45	1.16 [a]	1.71 [a]
F ≥2	0.49 [a]	1.38 [a]	1.72 [a]
MF <19	1.17 [a]	1.58 [a]	2.29 [a]
MF ≥19	0.33	1.13 [a]	1.73 [a]
Iron (mg)			
MF ≥2	2.30 [a]	3.45 [a]	3.53 [a]
M ≥2	2.71 [a]	3.87 [a]	3.96 [a]
F ≥2	1.90 [a]	2.76 [a]	3.16 [a]
MF < 19	1.78 [a]	2.43 [a]	3.23 [a]
MF ≥ 19	1.77 [a]	3.62 [a]	3.86 [a]
Vitamin A (RE)			
MF ≥2	220 [a]	271 [a]	456 [a]
M ≥2	242 [a]	296 [a]	517 [a]
F ≥2	204 [a]	221 [a]	396 [a]
MF < 19	221 [a]	320 [a]	553 [a]
MF ≥ 19	209 [a]	218 [a]	343 [a]
Riboflavin (mg)			
MF ≥2	0.30 [a]	0.54 [a]	0.98 [a]
M ≥2	0.34 [a]	0.59 [a]	1.11 [a]
F ≥2	0.24 [a]	0.46 [a]	0.84 [a]
MF <19	0.40 [a]	0.66 [a]	1.15 [a]
MF ≥19	0.21 [a]	0.46 [a]	0.87 [a]
Folate (micrograms)			
MF ≥2	48.50 [a]	76.68 [a]	105.73 [a]
M ≥2	55.51 [a]	83.01 [a]	121.84 [a]
F ≥2	41.50 [a]	65.78 [a]	85.64 [a]
MF <19	56.62 [a]	79.63 [a]	117.24 [a]
MF ≥19	35.28 [a]	70.32 [a]	99.15 [a]

Protein (g)			
MF ≥2	0.78	1.12	3.93 [a]
M ≥2	0.58	-0.11	3.38 [a]
F ≥2	1.39	2.14 [b]	5.59 [a]
MF <19	1.09 [b]	2.61 [a]	9.43 [a]
MF ≥19	1.53	1.72 [b]	6.28 [a]
Fat (g)			
MF ≥2	-1.49 [a]	-3.51 [a]	-4.48 [a]
M ≥2	-1.20	-2.56 [a]	-4.04 [a]
F ≥2	-1.80 [a]	-3.30 [a]	-5.45 [a]
MF <19	-0.12	-1.46	-1.57
MF ≥19	-1.44 [b]	-2.76 [a]	-4.69 [a]
Saturated fat (g)			
MF ≥2	0.20	0.31	1.30 [a]
M ≥2	0.50	0.93	1.90 [a]
F ≥2	-0.29	0.01	0.71 [a]
MF <19	1.12 [a]	1.42 [a]	2.82 [a]
MF ≥19	-0.01	0.08	0.22
Cholesterol (mg)			
MF ≥2	-5.98	-20.12 [a]	-25.07 [a]
M ≥2	-10.80	-25.96 [a]	-30.24 [a]
F ≥2	-0.98	-9.73	-16.87 [a]
MF <19	2.45	-5.26	1.20
MF ≥19	-1.03	-15.38 [a]	-15.41 [a]

[a]=p<0.01
[b]=p<0.05

Table 13. Mean difference in nutrient intakes among people in quartile 2, 3, or 4 of total cheese intake compared with nutrient intakes of people in quartile 1 of total cheese intake. Total population ≥2 (excluding pregnant and lactating women) and other select age/gender subgroups. From CSFII 1994-96, 98.

NUTRIENT	Quartile 2 vs. quartile 1	Quartile 3 vs. quartile 1	Quartile 4 vs. quartile 1
Calcium (mg)			
MF ≥2	59 [a]	125 [a]	321 [a]
M ≥2	78 [a]	142 [a]	383 [a]
F ≥2	49 [a]	111 [a]	258 [a]
MF <19	74 [a]	131 [a]	283 [a]
MF ≥19	30 [a]	91 [a]	304 [a]
Zinc (mg)			
MF ≥2	-0.29	-0.48 [b]	-0.20
M ≥2	-0.34	-0.78 [b]	-0.39
F ≥2	0.15	-0.07	0.26
MF <19	-0.05	-0.07	-0.38
MF ≥19	-0.24	-0.44	-0.31
Iron (mg)			
MF ≥2	-0.42 [b]	-0.72 [a]	-1.07 [a]
M ≥2	-0.35	-0.85 [a]	-1.26 [a]
F ≥2	-0.09	-0.57 [a]	-0.71 [a]
MF < 19	-0.26	-0.37	-0.97 [a]
MF ≥ 19	-0.24	-0.75 [a]	-0.94 [a]
Vitamin A (RE)			
MF ≥2	-64 [b]	-98 [a]	-110 [a]
M ≥2	-60	-71 [b]	-122 [a]
F ≥2	-35	-132 [a]	-119 [a]
MF < 19	-52	-80 [b]	-74
MF ≥ 19	-42	-96 [b]	-103 [a]
Riboflavin (mg)			
MF ≥2	0.03	0.04 [a]	0.08 [a]
M ≥2	0.03	0.04	0.09 [a]
F ≥2	0.05	0.03	0.06 [b]
MF <19	0.04	0.03	0.02
MF ≥19	0.00	0.00	0.07 [a]
Folate (micrograms)			
MF ≥2	-1.58	-15.05 [b]	-22.77 [a]
M ≥2	-2.70	-15.73 [a]	-26.11 [a]
F ≥2	3.16	-16.16 [a]	-19.96 [a]
MF <19	-2.50	-12.25	-28.53 [a]
MF ≥19	-0.00	-18.76 [a]	-21.77 [a]

Protein (g)			
MF ≥2	-2.78 [a]	-2.87 [a]	-0.72
M ≥2	-1.87	-2.62 [a]	-1.32
F ≥2	-2.29 [a]	-1.40 [a]	0.24
MF <19	-0.65	0.62	3.46 [a]
MF ≥19	-2.14 [a]	-2.55 [a]	-0.98
Fat (g)			
MF ≥2	1.03	3.45 [a]	5.44 [a]
M ≥2	1.94	5.11 [a]	7.13 [a]
F ≥2	0.21	1.71 [b]	5.31 [a]
MF <19	0.82	2.50 [a]	4.98 [a]
MF ≥19	1.30	3.94 [a]	7.12 [a]
Saturated fat (g)			
MF ≥2	1.09 [a]	2.85 [a]	6.24 [a]
M ≥2	1.42 [a]	3.40 [a]	6.77 [a]
F ≥2	0.84 [a]	2.29 [a]	5.65 [a]
MF <19	1.08 [a]	2.38 [a]	5.33 [a]
MF ≥19	0.63 [b]	2.57 [a]	6.18 [a]
Cholesterol (mg)			
MF ≥2	-21.47 [a]	-17.40 [a]	-28.78 [a]
M ≥2	-18.29 [b]	-19.94 [a]	-39.26 [a]
F ≥2	-16.79 [a]	-14.73 [b]	-18.65 [a]
MF <19	-12.73	-10.39	-10.80 [b]
MF ≥19	-19.28 [a]	-13.08 [b]	-30.05 [a]

[a]=p<0.01
[b]=p<0.05

As clearly shown in Tables 11 and 12, increasing intake of total dairy or of fluid milk was associated with statistically significant and major increases in the intake of essential nutrients including calcium, zinc, iron, vitamin A, riboflavin, and folate. Also, not shown in these summary tables but detailed in Linda's thesis, intakes of potassium and magnesium also were consistently higher in quartiles 2, 3, and 4 of total dairy or fluid milk intake compared with the first quartile. As expected, the results for calcium were most dramatic, although frankly of even greater magnitude than we would have predicted. Clearly people with low total dairy or fluid milk intakes were not compensating with other calcium-rich and other essential-nutrient-rich foods. Results were very similar when we looked at total milk (i.e., including ingredient use of milk in mixed foods), as detailed in Linda's thesis. These results reinforce not only the importance of dairy foods and milk as key calcium sources but as foods associated with a "package" of nutrients. Moreover, because dairy foods are not good sources of iron and folate, yet intakes were higher as more total dairy and milk were eaten, our data suggest people who choose more of these foods also make other more nutrient-rich food choices.

On the other hand, as shown in Table 13, increasing cheese consumption was not associated with greater micronutrient intakes, except for calcium. In fact, in numerous cases (such as with iron, folate, and vitamin A), intakes of essential nutrients were lower among people in the third and fourth quartiles of cheese intake compared with the first quartile. This finding was disappointing and a little surprising because although the nutritional profile of cheese is not equivalent to milk, it is often a part of nutrient-rich food mixtures. It might be appropriate to try to improve the overall nutritional profile of cheese itself to be more similar to the fluid milk from which it is made, or to encourage pairing of cheese with micronutrient-dense foods.

When we examined macronutrients, we found several interesting and consistent patterns. First, as expected, saturated fat intake increased in the second, third, and fourth quartiles of dairy intake compared with the first for total dairy and cheese. For example, for the total population, saturated fat was a little more than 5 grams higher in the fourth compared with the first quartile of total dairy intake. For fluid milk, saturated fat was only significantly increased in the fourth quartile, with only 1.3 grams more, on average, among people in the fourth compared with the first quartile of fluid milk intake.

On the other hand, total fat intake did not increase significantly with increased intake of total dairy or fluid milk. In fact, among females, fat intake was significantly less in the fourth compared with the first quartile of total dairy intake. And fat intake was ***consistently lower*** in the second, third, and fourth quartiles of fluid milk intake (compared with the first quartile) in the total population and in adults. These results reinforce the strong nutritional profile of diets rich in total dairy and milk. Fat intake was higher among people in the third and fourth quartiles of cheese intake compared with the first quartile.

Also contrary to popular notion, cholesterol intake was consistently and significantly ***less*** among people with higher intakes of total dairy, milk, and cheese. The perception that dairy foods are cholesterol-rich was not validated. Instead, it appears that people substitute dairy foods for other more cholesterol-rich foods.

<u>Focus 2. Dairy product intake among individuals who met vs. did not meet dietary recommendations.</u>

Another way to examine the nutritional contributions of dairy foods is to compare intakes between people who met vs. did not meet dietary recommendations during the two-day survey period. While we showed, for example, that saturated fat intakes were statistically significantly higher as dairy intake increased, we don't know for sure whether this actually impacted the likelihood of meeting the dietary recommendation for saturated fat.

For this research focus, we looked at calcium, fat, saturated fat, and cholesterol. First, individuals were placed into categories of either meeting dietary recommendations or not meeting the dietary recommendations based on their 2-day average intakes. Calcium recommendations were the Adequate Intakes from the Institute of Medicine's Dietary Reference Intakes report on calcium and related nutrients. For fat, saturated fat, and cholesterol, recommendations were based upon the 2000 Dietary Guidelines. The definitions we used were as follows:

Calcium: "meet"= Age 2-3: 500 mg or above
Age 4-8: 800 mg or above
Age 9-18: 1300 mg or above

Age 19-50: 1000 mg or above
Age 51+: 1200 mg or above
Fat: "meet" = 30 en% or less
Saturated fat: "meet" = 10 en% or less
Cholesterol "meet" = 300 mg or less

Once individuals were placed into a category of meeting or not meeting the recommendation, the average intake of total dairy, total milk, and total cheese was determined. Analysis of variance was used, with energy as a covariable, to determine if the difference in dairy products intake was statistically different between those who met the dietary recommendation for calcium, fat, saturated fat, and cholesterol vs. those who did not. As with the previous research objective, p-values were based upon the Ward F-test and were considered significant if p<0.05. Results for the total population and a few age/gender subgroups are shown in Table 14.

Table 14. Difference in average daily Pyramid servings of dairy foods in people who met various dietary recommendations compared with people who did not meet the recommendations. From CSFII 1994-96, 98.

Nutrient	Total dairy (servings/day)	Total milk (servings/day)	Total cheese (servings/day)
Calcium			
MF ≥2	1.77 [a]	1.36 [a]	0.35 [a]
M ≥2	1.82 [a]	1.38 [a]	0.40 [a]
F ≥2	1.70 [a]	1.34 [a]	1.70 [a]
MF < 19	1.74 [a]	1.36 [a]	0.32 [a]
MF ≥ 19	1.88 [a]	1.29 [a]	0.52 [a]
Fat			
MF ≥2	-0.03	0.05	-0.11 [a]
M ≥2	-0.07	0.03	-0.14 [a]
F ≥2	-0.0	0.07 [a]	-0.09 [a]
MF < 19	-0.11 [b]	-0.01	-0.13 [a]
MF ≥ 19	-0.00	0.07 [a]	-0.10 [a]
Saturated fat			
MF ≥2	-0.46 [a]	-0.25 [a]	-0.24 [a]
M ≥2	-0.59 [a]	-0.31 [a]	-0.30 [a]
F ≥2	-0.35 [a]	-0.19 [a]	-0.20 [a]
MF < 19	-0.65 [a]	-0.43 [a]	-0.24 [a]
MF ≥ 19	-0.33 [a]	-0.11 [a]	-0.24 [a]
Cholesterol			
MF ≥2	0.16 [a]	0.10 [a]	0.04 [a]
M ≥2	0.15 [a]	0.04 [b]	0.04 [b]
F ≥2	0.17 [a]	0.13 [a]	0.03
MF < 19	0.08	0.08	-0.01
MF ≥ 19	0.09 [a]	0.02	0.05 [a]

[a]=p<0.01
[b]=p<0.05

As we would predict and consistent with our earlier findings, people who met dietary recommendations for calcium consumed more total dairy, total milk, and total cheese than those individuals who did not meet dietary recommendations for calcium. When the total population was examined, people who met dietary recommendations for calcium consumed on average 1.77 servings more total dairy, 1.36 servings more total milk, and 0.35 servings more total cheese than those who did not meet dietary recommendations. This large difference in dairy product intake reinforces the important role dairy products play in dietary calcium intake.

Again consistent with our earlier findings, there was no relationship between the intake of total dairy and total milk and the ability to meet dietary recommendations for total fat. People who met dietary recommendations for fat consumed less total cheese than those individuals who did not meet dietary recommendations; among the total population ≥2, those who met dietary recommendations for fat ate an average of 0.11 servings less total cheese. While this difference is statistically significant, it is small – not even a quarter serving of cheese.

People who met the dietary recommendations for saturated fat ate less dairy: 0.46 fewer servings of total dairy, 0.25 fewer servings of total milk, and 0.25 fewer servings of total cheese for the total population ≥2. It would seem likely that small decreases in the typical saturated fat content of dairy foods or small shifts in dairy foods choices would help people adhere to diets low in saturated fat while still gaining the overwhelming nutritional benefits of dairy.

Compared with people who did not meet cholesterol guidelines, people ≥2 who met dietary recommendations for cholesterol ate an average of 0.16 more servings of total dairy, 0.10 servings more of total milk, and 0.04 servings more of cheese. These statistically significant differences are very small in terms of serving sizes. Their practical importance is to reconfirm that dairy foods should not be regarded as foods to avoid because of high cholesterol content.

<u>Focus 3. Proportion of nutrient intakes derived from dairy products and ingredients, examined by intake of total dairy.</u>

The approach described in Focus 1 of Objective 4 associates nutrients with levels of dairy intake, and it is likely that the data reflect at least in part the effects of dairy per se. However, the quartile analyses do not DIRECTLY tie the nutrients to dairy foods or ingredients. For example, people who eat a lot of dairy foods may also choose other healthful foods such as cereals and fruits that positively impact nutrient intakes. So, we took a more complicated approach to Objective 4 which involved dealing with the recipe databases provided as technical support files with CSFII data. We readily know from CSFII data that a food item such as a specific lasagna provides x amount of calcium, fat, vitamin A, and so forth. But we do *not* know directly from the CSFII data how much of those nutrients come from cheese vs pasta vs meat vs sauce. To determine that, we needed to develop strategies to use the recipe and ingredient technical databases that accompany the main files of CSFII. Investigator Groves successfully developed SAS code to allow us to answer the following: What proportion of calcium, fat, saturated fat, and cholesterol intake actually comes from all dairy foods <u>and</u> ingredients? As people get a higher proportion of calcium from dairy, does total calcium go up or do they compensate by eating other calcium-rich foods? As people get a higher proportion of "undesirable" fat, saturated fat, and cholesterol from dairy foods and ingredients, does the total intake of the nutrient go up, or do consumers compensate by eating less from other sources?

The first step was to determine the quantity of nutrients that came from dairy products. To do this, we used the recipe database provided in the Technical Support Files of the CSFII. The recipe database includes recipes for *all* food codes listed in the CSFII. Some foods consisted of just a single ingredient (such as whole milk) while other foods (like lasagna) were made up of many individual ingredients. We identified which ingredients were dairy ingredients by inspecting the list of thousands of ingredient names. We included butter as a dairy ingredient. Most of the time, we could easily label an ingredient as "dairy." However, in limited cases, certain food items were listed as single-ingredient foods even though they contained other non-dairy ingredients. Examples include fast-food milkshakes and some puddings. We chose to designate these as "dairy ingredients" even though they contained other non-dairy components that could contribute calcium, fat, saturated fat, or cholesterol. On the other hand, some so-called "ingredients," such as a commercial bread or cake for which only a single "ingredient" was listed, may contain dairy products but were not considered dairy ingredients for our purposes. The over- and under-estimation of dairy ingredients was probably small and to some extent should balance each other out. (We did confirm this summer, during a visit to USDA's Beltsville Human Nutrition Research Center and the Food Surveys Research Group, that our approach to linking dairy ingredients and nutrients directly was appropriate.) We would be happy to supply our list of ingredient codes that we called "dairy ingredients" if they are of interest, though they wouldn't make much sense unless you have the CSFII technical databases handy.

After we determined the total amount of calcium, fat, saturated fat, and cholesterol from dairy foods over the 2-day survey, we compared those values to the total intakes of those nutrients from all sources over the two days. This gave us a proportion of the nutrient obtained directly from dairy foods and ingredients. Table 15 summarizes, for the total population and a few age/gender subgroups, the mean proportion of the nutrient intake that was from dairy. Dairy foods and ingredients provided about half of all dietary calcium intake, about 20% of total fat, about a third of saturated fat, and less than a quarter of dietary cholesterol.

Table 15. Mean proportion of nutrients from dairy foods and ingredients, CSFII 1994-96, 98.

Population	Mean proportion of calcium from dairy	Mean proportion of fat from dairy	Mean proportion of saturated fat from dairy	Mean proportion of cholesterol from dairy
MF ≥2	0.51	0.19	0.32	0.22
M ≥2	0.52	0.19	0.32	0.22
F ≥2	0.51	0.19	0.33	0.23
MF < 19	0.62	0.24	0.39	0.31
MF ≥ 19	0.48	0.17	0.30	0.19

To determine if there was a relationship between the proportion of nutrients from dairy products and the total intake of the nutrient, analysis of covariance was performed. We looked at absolute intakes of calcium and cholesterol in mg/day and at total fat and saturated fat intakes as average daily percent of energy from fat or saturated fat. Energy was a covariable in the model. Since the proportion of nutrients from dairy products and total nutrient intakes may both relate to race and age, we also included these as covariables. P-values were based upon the Wald F-test and were considered significant when $p<0.05$. Table 16 summarizes results for the total population and a few age/gender subgroups.

Table 16. Mean change in intake of nutrient per 1% increase in the proportion of nutrients from dairy products. CSFII 1994-96-1998.

Population	Mean change in calcium (mg)	Mean change in %en from fat	Mean change in %en from saturated fat	Mean change in cholesterol (mg)
MF ≥2	10.05 [a]	0.005%	0.062% [a]	-2.97 [a]
M ≥2	11.89 [a]	0.011%	0.065% [a]	-3.58 [a]
F ≥2	8.35 [a]	0.001%	0.060% [a]	-2.43 [a]
MF < 19	11.56 [a]	-0.003%	0.060% [a]	-2.39 [a]
MF ≥ 19	9.37 [a]	0.006%	0.061% [a]	-3.37 [a]

[a]=$p<0.01$

There was no significant change in the daily percent of energy from fat when the proportion of fat from dairy foods increased. In other words, when people ate a higher proportion of fat from dairy foods, there was no significant impact on fat intake. As more of a day's fat was consumed from dairy, people must have compensated by eating less fat elsewhere in the diet. This lack of a relationship between dairy intake and fat intake is consistent with our earlier findings that fat intake did not increase as quartile of total dairy intake increased.

Intakes of calcium, saturated fat, and cholesterol did change as the proportion of those nutrients from dairy increased. Specifically, there was a rather dramatic increase in total daily calcium intake as the proportion of calcium from dairy increased. For the total population ≥2, as the proportion of calcium from dairy products increased 1%, the total intake of calcium increased about 10 mg. That means, for instance, that we would estimate that going from 45% of calcium from dairy to 55% of calcium from dairy would result in an additional 100 mg of calcium. Consuming a higher proportion of saturated fat from dairy also led to an increase in saturated fat (expressed as a percent of energy). Specifically, for the total population ≥2, as the proportion of saturated fat from dairy products increased 1%, en% from saturated fat increased 0.06%. We could estimate that a shift from consuming 25% of saturated fat from dairy products to consuming to 35% of saturated fat from dairy would be associated with an increase in en% saturated fat of 0.6%. This appears to be a relatively small change.

Finally, cholesterol intake goes down as the proportion of cholesterol from dairy goes up. For the total population ≥2, daily cholesterol intake went down about 3 mg per 1% increase in proportion of cholesterol from dairy. We could estimate that an increase in proportion of cholesterol from dairy products from 15% to 25% would be associated with a 30 mg decrease in total cholesterol. As our earlier data suggested, this confirms that people make higher-cholesterol substitutes for dairy foods (or vice versa).

Objective 5. To determine the contribution of dairy foods to nutrient intakes from snacks in children and adolescents.

Linda (Veenstra) Weinberg carried out the analyses for Objective 5 as part of her Master's thesis, where details of methods and additional data beyond what we present in this summary are available.

Reports have shown that children consume a quarter of their daily calories from snacks. Choosing snacks with low nutrient density vs. those with higher nutrient density, such as yogurt and milk, may have a profound effect on the total nutrient intake of children and adolescents. We wanted to understand what role dairy based snacks had in the nutrient intake of subjects under the age of 18.

To answer this question, first we removed all subjects over the age of 18 and under the age of 2 from the CSFII 94-96, 98 sample. Any subjects who were pregnant/lactating or breastfeeding were additionally removed from the data set. As with the previous research questions, any individuals without two complete days of data were also removed from the dataset. The final dataset contained 8,605 children and adolescents.

We identified snacks as meals designated in the CSFII dataset as a "food or beverage break." Total dairy, total cheese, and total milk Pyramid servings were summed for each snack occasion for the day, and then a two-day average was calculated. Mean intakes of dairy snacks, cheese snacks, and milk snacks for the total population age 2-18 and for a few subgroups are shown in Table 17.

Table 17. Mean intake of dairy from snacks in children and adolescents, in average Pyramid servings per day, from CSFII 94-96, 98.

Population	Total Dairy from Snacks (servings/day)	Total Milk from Snacks (servings/day)	Total Cheese from Snacks (servings/day)
MF 2-18	0.46	0.30	0.11
M 2-18	0.51	0.34	0.14
F 2-18	0.40	0.27	0.08
MF 2-8	0.47	0.33	0.09
MF 9-18	0.45	0.29	0.13

To determine if there was a relationship between the intake of select nutrients (total fat, saturated fat, calcium, zinc, and vitamin A) and the intake of dairy snacks among children and adolescents, an analysis of covariance was performed. Energy was a covariable in the model. Changes in nutrient intake as intake of servings of dairy from snacks increased were considered significant if $p < 0.05$. P values were based upon the Wald F-test. Table 18 summarizes the results.

Table 18. Difference in intake of nutrients per day for every one Pyramid serving increase in intake of dairy from snacks among children and adolescents age 2-18. From CSFII 94-96, 98.

Dairy Category	Difference in total fat (g)	Difference in saturated fat (g)	Difference in calcium (mg)	Difference in zinc (mg)	Difference in Vitamin A (RE)
Total Dairy in Snacks	-0.59	1.68[a]	220[a]	0.30	122[a]
Total Milk in Snacks	-1.53[b]	1.33[a]	219[a]	0.20	112[a]
Total Cheese in Snacks	1.73[a]	2.37[a]	132[a]	0.71	-11

[a]=p<0.01
[b]=p<0.05

Dairy snacks were significantly associated with increased total dietary calcium and saturated fat (for all dairy categories) and vitamin A (for total dairy and milk from snacks only). As an example, the data show that for every one serving increase in total dairy from snacks, there was an associated 220 mg increase in total calcium intake and 1.68 g more saturated fat. Total fat was significantly lower as milk from snacks increased, and significantly higher as cheese from snacks increased. There were no significant effects on zinc intake, but the trends were in the direction of increasing zinc. These results confirm the important role of dairy snacks as they impact calcium intakes.

AREAS FOR POSSIBLE FUTURE STUDY:

We successfully completed our original research objectives and, in some cases, conducted analyses beyond what we had originally intended. It would be of interest for someone to examine or pursue several areas, however. For example, we did not explore the effects of education, socioeconomic status, region, and other respondent characteristics on the intake of dairy products or on dietary patterns. These factors may have a large impact on overall dietary practices such as compensating for additional saturated fat contributed by dairy products. Also, we did not examine how the proportion of nutrients attributed directly to different types of dairy products, such as cheese and milk, impacts total nutrient intake. (Rather, we looked at the contribution of all dairy foods/ingredients.) As we have observed, milk and cheese affect nutrient intakes differently when we look at quartiles of intake of those dairy foods. But that analysis precludes us from concluding with certainty that the differences among quartiles were due to the dairy foods per se; rather, it is possible that overall dietary choices accompanying milk and cheese intake are very different.

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APPENDIX A
DESCRIPTIVE DATA ON DAIRY FOODS INTAKES

Table A1. Average daily intake of total dairy, in Pyramid servings, from CSFII 94-96, 98. Data are weighted. Total dairy includes all dairy foods from both single and mixed foods.

Population		Mean (SE)	Percentiles 10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)
Children	2-3	1.92 (.03)	.61 (.03)	1.1 (.03)	1.75 (.03)	2.52 (.04)	3.4 (.06)
Children	4-8	2.03 (.03)	.77 (.04)	1.27 (.03)	1.89 (.04)	2.65 (.05)	3.43 (.06)
Males	9-13	2.31 (.07)	.77 (.07)	1.35 (.07)	2.11 (.09)	3.15 (.1)	3.91 (.16)
	14-18	2.47 (.1)	.6 (.07)	1.2 (.12)	2.05 (.12)	3.2 (.12)	4.96 (.32)
	19-30	1.69 (.06)	.25 (.05)	.68 (.06)	1.35 (.07)	2.28 (.1)	3.48 (.14)
	31-50	1.64 (.07)	.2 (.03)	.63 (.04)	1.26 (.06)	2.17 (.08)	3.44 (.23)
	51-70	1.31 (.04)	.16 (.02)	.5 (.02)	1.04 (.04)	1.86 (.05)	2.71 (.09)
	≥19	1.55 (.04)	.2 (.02)	.6 (.02)	1.22 (.04)	2.1 (.04)	3.25 (.1)
	≥71	1.31 (.05)	.25 (.04)	.52 (.03)	1.09 (.05)	1.88 (.09)	2.67 (.11)
Females	9-13	1.85 (.07)	.59 (.05)	1.07 (.07)	1.72 (.07)	2.44 (.11)	3.39 (.14)
	14-18	1.37 (.06)	.25 (.04)	.53 (.04)	1.1 (.07)	1.91 (.09)	2.92 (.14)
	19-30	1.2 (.06)	.18 (.04)	.49 (.05)	1.01 (.07)	1.64 (.06)	2.31 (.14)
	31-50	1.12 (.03)	.16 (.02)	.43 (.02)	.89 (.03)	1.57 (.07)	2.41 (.08)
	51-70	1.02 (.03)	.12 (.02)	.42 (.03)	.81 (.03)	1.46 (.05)	2.17 (.06)
	≥19	1.11 (.02)	.15 (.01)	.44 (.02)	.89 (.02)	1.56 (.04)	2.29 (.05)
	≥71	1.09 (.05)	.15 (.04)	.44 (.03)	.85 (.05)	1.56 (.07)	2.31 (.15)
Total	9-13	2.07 (.06)	.65 (.04)	1.19 (.05)	1.85 (.05)	2.79 (.09)	3.63 (.09)
	14-18	1.94 (.05)	.33 (.03)	.75 (.04)	1.6 (.08)	2.67 (.07)	4.11 (.2)
	≥2	1.5 (.02)	.23 (.01)	.6 (.02)	1.22 (.02)	2.07 (.03)	3.09 (.04)
	≥19	1.32 (.02)	.18 (.01)	.5 (.01)	1.03 (.02)	1.81 (.03)	2.76 (.05)
	≥71	1.18 (.04)	.21 (.03)	.47 (.02)	.96 (.04)	1.67 (.05)	2.47 (.1)

Table A2. Average daily intake of total fluid milk, in ounces, from CSFII 94-96, 98. Data are weighted. Figures do not include fluid milk that was an ingredient in a food mixture (such as pancakes or soup) and coded as the food mixture for the survey.

Population		Mean (SE)	10th (SE)	25th (SE)	Percentiles 50th (SE)	75th (SE)	90th (SE)
Children	2-3	13.97 (.21)	3.56 (.34)	7.48 (.19)	12.81 (.25)	18.86 (.36)	25.96 (.52)
Children	4-8	14.36 (.26)	4.28 (.13)	8.37 (.24)	13.16 (.24)	19.41 (.41)	25.96 (.49)
Males	9-13	15.6 (.48)	3.53 (.71)	8.53 (.45)	13.65 (.55)	21.96 (.87)	28.24 (.97)
	14-18	14.61 (.76)	0.38	5.17 (.52)	11.75 (.98)	21.5 (1.07)	31.86 (2.92)
	19-30	8.06 (.35)	0	.91 (.16)	4.68 (.28)	11.6 (.76)	20.96 (1.05)
	31-50	9.02 (.56)	0	1.29 (.22)	5.87 (.37)	13.02 (.61)	21.03 (1.87)
	51-70	7.99 (.22)	0	1.62 (.2)	6.07 (.27)	11.65 (.42)	18.24 (.56)
	≥19	8.56 (.28)	0	1.4 (.11)	5.57 (.25)	12.43 (.32)	20.22 (.67)
	≥71	9.12 (.36)	0.54	3.16 (.3)	7.06 (.49)	13.13 (.53)	20.55 (.87)
Females	9-13	12.46 (.53)	2.22	6.08 (.61)	11.38 (.61)	17.06 (.8)	24.96 (.98)
	14-18	7.92 (.48)	0	1.29 (.37)	5.18 (.45)	11.21 (.97)	18.41 (1.7)
	19-30	6.47 (.43)	0	1.09 (.28)	4.35 (.31)	9.49 (.52)	15.36 (1.26)
	31-50	6.32 (.21)	0	1 (.15)	4.39 (.15)	9.33 (.37)	16.05 (.46)
	51-70	6.64 (.2)	0	1.41 (.18)	4.72 (.18)	9.71 (.31)	15.1 (.58)
	≥19	6.59 (.17)	0	1.26 (.13)	4.6 (.11)	9.65 (.29)	15.83 (.4)
	≥71	7.57 (.44)	0.34	2.26 (.19)	5.78 (.39)	11.05 (.74)	17.06 (1.04)
Total	9-13	14.02 (.45)	2.82 (.58)	7.03 (.47)	12.86 (.43)	19.25 (.76)	26.92 (.73)
	14-18	11.42 (.45)	0	2.18 (.45)	8.59 (.33)	16.23 (.73)	25.96 (1.51)
	≥2	9.08 (.16)	0.04	2.14 (.08)	6.56 (.18)	13.34 (.17)	21.09 (.34)
	≥19	7.55 (.18)	0	1.34 (.11)	5.01 (.16)	10.88 (.25)	17.99 (.35)
	≥71	8.2 (.32)	0.36 (.17)	2.53 (.16)	6.19 (.33)	11.96 (.49)	18.47 (.88)

Table A3. Average daily intake of total fluid milk, in ounces, including only those who consumed fluid milk on one or both of the survey days, from CSFII 94-96, 98.

Population	Mean (SE)	Median (SE)
Children 2-3	12.71 (.22)	10.7 (.23)
Children 4-8	11.97 (.29)	10.54 (.28)
Males 9-13	13.65 (.41)	11.6 (.6)
14-18	14.74 (.88)	12.48 (1.27)
19-30	10.99 (.47)	7.96 (.35)
31-50	9.6 (.28)	6.47 (.5)
51-70	8.34 (.25)	6.4 (.32)
≥19	9.45 (.2)	6.47 (.31)
≥71	8.26 (.38)	6.22 (.7)
Females 9-13	10.45 (.41)	8.4 (.26)
14-18	9.37 (.51)	6.44 (.71)
19-30	7.35 (.41)	6.03 (.51)
31-50	6.77 (.22)	4.82 (.28)
51-70	6.41 (.21)	4.31 (.26)
≥19	6.82 (.16)	4.71 (.21)
≥71	7 (.5)	4.31 (.39)
Total 9-13	12.04 (.32)	10.2 (.25)
14-18	12.44 (.55)	8.53 (.39)
≥2	9.4 (.13)	7.49 (.1)
≥19	8.09 (.15)	6.36 (.14)
≥71	7.52 (.37)	4.9 (.55)

Table A4. Average daily intake of whole fluid milk, in ounces, from CSFII 94-96, 98. Data are weighted. Figures do not include fluid milk that was an ingredient in a food mixture (such as pancakes or soup) and coded as the food mixture for the survey.

Population		Mean (SE)	10th (SE)	25th (SE)	Percentiles 50th (SE)	75th (SE)	90th (SE)
Children	2-3	5.83 (.21)	0	0	1.35	9.23 (.47)	17.08 (.45)
Children	4-8	4.31 (.21)	0	0	0	6.44 (.5)	13.62 (.59)
Males	9-13	3.7 (.39)	0	0	0	4.58 (.92)	12.5 (1.77)
	14-18	3.42 (.48)	0	0	0	3.57	13.57 (1.7)
	19-30	1.99 (.17)	0	0	0	0	7.53 (.72)
	31-50	1.74 (.2)	0	0	0	0	6.29 (.91)
	51-70	1.31 (.14)	0	0	0	0	4.22 (.5)
	≥19	1.7 (.14)	0	0	0	0	6.29 (.9)
	≥71	1.64 (.26)	0	0	0	0	6.01 (1.31)
Females	9-13	3.02 (.31)	0	0	0	4.3	10.27 (1.1)
	14-18	1.93 (.28)	0	0	0	0	6.26 (1.09)
	19-30	1.49 (.19)	0	0	0	0	5.39 (1)
	31-50	1 (.11)	0	0	0	0	3.7 (.48)
	51-70	0.81 (.09)	0	0	0	0	2.09
	≥19	1.07 (.07)	0	0	0	0	4.15 (.22)
	≥71	1.11 (.13)	0	0	0	0	4.18 (.37)
Total	9-13	3.36 (.28)	0	0	0	4.27 (.64)	11.85 (.71)
	14-18	2.71 (.31)	0	0	0	0	10.03 (1.37)
	≥2	2 (.1)	0	0	0	0.07	8.57 (.32)
	≥19	1.38 (.09)	0	0	0	0	4.29 (.49)
	≥71	1.33 (.15)	0	0	0	0	4.25 (.56)

Table A5. Average daily intake of lowfat fluid milk, in ounces, from CSFII 94-96, 98. Data are weighted. Figures do not include fluid milk that was an ingredient in a food mixture (such as pancakes or soup) and coded as the food mixture for the survey.

					Percentiles		
Population		Mean (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)
Children	2-3	5.04 (.25)	0	0	0	8.48 (.47)	16.08 (.58)
Children	4-8	5.52 (.25)	0	0	1.95	8.53 (.46)	15.98 (.49)
Males	9-13	6.18 (.5)	0	0	1.35	10.45 (.86)	17.82 (1.08)
	14-18	5.86 (.6)	0	0	0	8.24 (1.67)	20.28 (1.34)
	19-30	2.65 (.25)	0	0	0	0.33	8.5 (.87)
	31-50	2.97 (.2)	0	0	0	3.12 (.77)	10.41 (.83)
	51-70	2.62 (.15)	0	0	0	3.95 (.49)	8.83 (.49)
	≥19	2.84 (.13)	0	0	0	3.15 (.49)	9.61 (.47)
	≥71	3.34 (.24)	0	0	0	4.26 (.35)	10.5 (.99)
Females	9-13	4.23 (.36)	0	0	0	5.9 (.74)	12.63 (1.39)
	14-18	2.55 (.26)	0	0	0	2.55 (.98)	8.3 (1.34)
	19-30	1.53 (.15)	0	0	0	0	5.63 (.78)
	31-50	1.95 (.2)	0	0	0	2.06 (.49)	6.73 (.88)
	51-70	1.81 (.11)	0	0	0	2.09 (.31)	6.43 (.78)
	≥19	1.89 (.11)	0	0	0	2.07 (.23)	6.61 (.54)
	≥71	2.5 (.29)	0	0	0	3.02 (.42)	8.34 (.61)
Total	9-13	5.2 (.38)	0	0	0	8.22 (.71)	16.72 (.91)
	14-18	4.28 (.36)	0	0	0	4.23 (.69)	16.25 (1.35)
	≥2	3.06 (.13)	0	0	0	4.29 (.19)	10.7 (.36)
	≥19	2.35 (.1)	0	0	0	2.12 (.27)	8.46 (.06)
	≥71	2.84 (.23)	0	0	0	4.13 (.23)	8.74 (.6)

Table A6. Average daily intake of nonfat fluid milk, in ounces, from CSFII 94-96, 98. Data are weighted. Figures do not include fluid milk that was an ingredient in a food mixture (such as pancakes or soup) and coded as the food mixture for the survey.

Population		Mean (SE)	Percentiles 10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)
Children	2-3	0.68 (.08)	0	0	0	0	0
Children	4-8	0.91 (.1)	0	0	0	0	0
Males	9-13	1.51 (.33)	0	0	0	0	3.4
	14-18	1.27 (.22)	0	0	0	0	0.35
	19-30	1.07 (.15)	0	0	0	0	0
	31-50	1.22 (.15)	0	0	0	0	3.1 (.94)
	51-70	1.49 (.13)	0	0	0	0	5.39 (.66)
	≥19	1.25 (.1)	0	0	0	0	4.3 (.59)
	≥71	1.32 (.19)	0	0	0	0	4.31 (.66)
Females	9-13	1.45 (.26)	0	0	0	0	4.31
	14-18	1.02 (.15)	0	0	0	0	3.03
	19-30	1.22 (.18)	0	0	0	0	4.31 (1.27)
	31-50	1.1 (.1)	0	0	0	0	4.31 (.25)
	51-70	1.47 (.11)	0	0	0	0	6.47 (.66)
	≥19	1.3 (.08)	0	0	0	0	4.31 (.46)
	≥71	1.73 (.27)	0	0	0	0	6.47 (1.03)
Total	9-13	1.48 (.24)	0	0	0	0	4.31 (1.73)
	14-18	1.15 (.13)	0	0	0	0	2.69
	≥2	1.23 (.07)	0	0	0	0	4.31 (.17)
	≥19	1.27 (.08)	0	0	0	0	4.31 (.04)
	≥71	1.56 (.18)	0	0	0	0	5.39 (.81)

Table A7. Average daily intake of yogurt, in ounces, from CSFII 94-96, 98. Data are weighted.

Population		Mean (SE)	Percentiles 10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)
Children	2-3	0.35 (.03)	0	0	0	0	1.48 (.39)
Children	4-8	0.24 (.02)	0	0	0	0	0
Males	9-13	0.14 (.04)	0	0	0	0	0
	14-18	0.15 (.04)	0	0	0	0	0
	19-30	0.16 (.02)	0	0	0	0	0
	31-50	0.26 (.05)	0	0	0	0	0
	51-70	0.18 (.03)	0	0	0	0	0
	≥19	0.2 (.03)	0	0	0	0	0
	≥71	0.13 (.03)	0	0	0	0	0
Females	9-13	0.18 (.04)	0	0	0	0	0
	14-18	0.14 (.04)	0	0	0	0	0
	19-30	0.24 (.05)	0	0	0	0	0
	31-50	0.37 (.05)	0	0	0	0	0
	51-70	0.43 (.05)	0	0	0	0	0
	≥19	0.34 (.03)	0	0	0	0	0
	≥71	0.23 (.05)	0	0	0	0	0
Total	9-13	0.16 (.03)	0	0	0	0	0
	14-18	0.14 (.03)	0	0	0	0	0
	≥2	0.26 (.02)	0	0	0	0	0
	≥19	0.27 (.03)	0	0	0	0	0
	≥71	0.19 (.04)	0	0	0	0	0

Table A8. Average daily intake of total cheese (including cheese from food mixtures), in ounces natural cheese equivalent, from CSFII 94-96, 98. Data are weighted.

Population		Mean (SE)	10th (SE)	25th (SE)	Percentiles 50th (SE)	75th (SE)	90th (SE)
Children	2-3	.47 (.02)	0	.05 (.01)	.29 (.02)	.68 (.03)	1.13 (.04)
Children	4-8	.6 (.02)	0	.14 (.01)	.44 (.02)	.84 (.03)	1.36 (.04)
Males	9-13	.81 (.05)	0	.2 (.02)	.6 (.05)	1.09 (.06)	1.8 (.09)
	14-18	1.18 (.08)	0	.37 (.06)	.88 (.07)	1.59 (.12)	2.61 (.18)
	19-30	1.18 (.04)	0	.34 (.04)	.85 (.04)	1.68 (.07)	2.57 (.13)
	31-50	.93 (.05)	0	.08 (.03)	.6 (.03)	1.27 (.06)	2.3 (.14)
	51-70	.59 (.03)	0	0	.34 (.03)	.82 (.04)	1.55 (.08)
	≥19	.87 (.03)	0	0.01	.55 (.02)	1.22 (.03)	2.16 (.07)
	≥71	.37 (.03)	0	0	.1 (.05)	.55 (.04)	.99 (.1)
Females	9-13	.67 (.04)	0	.17 (.03)	.48 (.04)	.96 (.07)	1.69 (.13)
	14-18	.72 (.04)	0	.15 (.04)	.56 (.05)	1.03 (.05)	1.69 (.15)
	19-30	.72 (.05)	0	.1 (.05)	.5 (.04)	1.04 (.05)	1.73 (.11)
	31-50	.61 (.02)	0	0.03	.4 (.02)	.84 (.04)	1.54 (.05)
	51-70	.41 (.01)	0	0	.19 (.02)	.59 (.03)	1.1 (.05)
	≥19	.55 (.02)	0	0	.34 (.02)	.77 (.02)	1.43 (.04)
	≥71	.3 (.02)	0	0	.09 (.03)	.45 (.03)	.85 (.08)
Total	9-13	.74 (.03)	0	.19 (.02)	.55 (.03)	1.03 (.03)	1.76 (.07)
	14-18	.96 (.05)	0	.23 (.03)	.7 (.04)	1.28 (.06)	2.2 (.13)
	≥2	.71 (.02)	0	.03 (.01)	.44 (.01)	.99 (.02)	1.77 (.04)
	≥19	.71 (.02)	0	0	.42 (.01)	.99 (.03)	1.80 (.05)
	≥71	.33 (.02)	0	0	.09 (.03)	.49 (.03)	.93 (.07)

Table A9. Average daily intake of cheese from grain, meat/egg, and vegetable mixtures, in ounces natural cheese equivalent, from CSFII 94-96, 98. Data are weighted.

Population		Mean (SE)	10th (SE)	25th (SE)	Percentiles 50th (SE)	75th (SE)	90th (SE)
Children	2-3	.18 (.01)	0	0	.08 (.01)	.26 (.01)	.53 (.02)
Children	4-8	.27 (.01)	0	0	.15 (.01)	.4 (.02)	.75 (.03)
Males	9-13	.41 (.02)	0	0	.21 (.03)	.63 (.05)	1.12 (.08)
	14-18	.64 (.04)	0	0	.41 (.04)	.98 (.08)	1.6 (.13)
	19-30	.64 (.04)	0	0	.38 (.02)	.91 (.07)	1.81 (.1)
	31-50	.39 (.01)	0	0	.09 (.03)	.61 (.02)	1.14 (.05)
	51-70	.23 (.01)	0	0	0	.33 (.03)	.72 (.05)
	≥19	.39 (.01)	0	0	.05 (.02)	.57 (.02)	1.18 (.04)
	≥71	.11 (.01)	0	0	0	.02 (.02)	.41 (.05)
Females	9-13	.33 (.03)	0	0	.17 (.02)	.42 (.04)	.84 (.11)
	14-18	.39 (.03)	0	0	.18 (.04)	.61 (.06)	1.15 (.09)
	19-30	.32 (.02)	0	0	.14 (.03)	.52 (.05)	.93 (.05)
	31-50	.27 (.01)	0	0	.06 (.02)	.42 (.02)	.76 (.03)
	51-70	.14 (.01)	0	0	0	.18 (.02)	.5 (.03)
	≥19	.23 (.01)	0	0	0	.35 (.01)	.73 (.02)
	≥71	.1 (.01)	0	0	0	.05 (.02)	.37 (.06)
Total	9-13	.37 (.02)	0	0	.19 (.02)	.53 (.03)	1.01 (.07)
	14-18	.52 (.03)	0	0	.3 (.03)	.77 (.05)	1.39 (.07)
	≥2	.32 (.01)	0	0	.06 (.01)	.46 (.01)	.93 (.02)
	≥19	.31 (.01)	0	0	.01 (.01)	.44 (.01)	.91 (.02)
	≥71	.1 (.01)	0	0	0	.04 (.02)	.39 (.04)

Table A10. Average daily intake of cheese from grain-based mixtures, in ounces natural cheese equivalent, from CSFII 94-96, 98. Data are weighted.

Population		Mean (SE)	10th (SE)	25th (SE)	Percentiles 50th (SE)	75th (SE)	90th (SE)
Children	2-3	.15 (.01)	0	0	.03 (.00)	.2 (.01)	.48 (.02)
Children	4-8	.23 (.01)	0	0	.09 (.01)	.33 (.02)	.67 (.03)
Males	9-13	.35 (.02)	0	0	.14 (.04)	.52 (.04)	1.02 (.06)
	14-18	.52 (.04)	0	0	.24 (.04)	.82 (.08)	1.43 (.12)
	19-30	.48 (.03)	0	0	.04 (.04)	.69 (.07)	1.52 (.11)
	31-50	.28 (.01)	0	0	0	.4 (.04)	.94 (.06)
	51-70	.16 (.01)	0	0	0	.07 (.03)	.58 (.05)
	≥19	.29 (.01)	0	0	0	.36 (.03)	.98 (.04)
	≥71	.08 (.01)	0	0	0	0	.26 (.06)
Females	9-13	.27 (.02)	0	0	.09 (.03)	.35 (.03)	.73 (.07)
	14-18	.32 (.03)	0	0	.12 (.04)	.51 (.05)	1.01 (.11)
	19-30	.24 (.02)	0	0	0	.35 (.04)	.79 (.06)
	31-50	.2 (.01)	0	0	0	.27 (.03)	.68 (.04)
	51-70	.1 (.01)	0	0	0	.02 (.01)	.36 (.04)
	≥19	.17 (.01)	0	0	0	.2 (.02)	.6 (.02)
	≥71	.07 (.01)	0	0	0	0	.27 (.06)
Total	9-13	.31 (.01)	0	0	.12 (.02)	.42 (.03)	.93 (.06)
	14-18	.43 (.02)	0	0	.16 (.02)	.64 (.05)	1.19 (.08)
	≥2	.25 (.01)	0	0	0	.31 (.02)	.79 (.02)
	≥19	.23 (.01)	0	0	0	.26 (.02)	.77 (.02)
	≥71	.08 (.01)	0	0	0	0	.26 (.04)

Table A11. Average daily intake of cheese from meat and egg-based mixtures, in ounces natural cheese equivalent, from CSFII 94-96, 98. Data are weighted.

Population		Mean (SE)	Percentiles 10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)
Children	2-3	.02 (.00)	0	0	0	0	.09 (.01)
Children	4-8	.03 (.00)	0	0	0	0	.14 (.02)
Males	9-13	.05 (.01)	0	0	0	0	.18 (.05)
	14-18	.1 (.01)	0	0	0	0	.44 (.04)
	19-30	.15 (.01)	0	0	0	.27 (.07)	.5 (.04)
	31-50	.08 (.01)	0	0	0	0	.34 (.01)
	51-70	.04 (.00)	0	0	0	0	0.17
	≥19	.08 (.00)	0	0	0	0	.35 (.01)
	≥71	.02 (.00)	0	0	0	0	0
Females	9-13	.05 (.01)	0	0	0	0	.16 (.05)
	14-18	.05 (.01)	0	0	0	0	.26 (.05)
	19-30	.06 (.01)	0	0	0	0	.3 (.04)
	31-50	.04 (.00)	0	0	0	0	.16 (.05)
	51-70	.03 (.00)	0	0	0	0	0
	≥19	.04 (.00)	0	0	0	0	.15 (.04)
	≥71	.01 (.00)	0	0	0	0	0
Total	9-13	.05 (.01)	0	0	0	0	.17 (.04)
	14-18	.08 (.01)	0	0	0	0	.35 (.02)
	≥2	.06 (.00)	0	0	0	0	.27 (.02)
	≥19	.06 (.00)	0	0	0	0	.3 (.01)
	≥71	.01 (.00)	0	0	0	0	0

Note: cheese intake from vegetable-based mixtures only was negligible (mean of approximately 0.01 ounces per day, with intake = 0 for all percentiles), so no data table is included.

Table A12. Percent of the population with zero intake of various dairy foods during the two-day survey period, from CSFII 94-96, 98. Data are weighted.

Population	Total Milk and Milk Products	Total Fluid Milk	Whole Milk	Lowfat Milk	Skim Milk	Yogurt	Cheese
Children 2-3	2.1%	7.5%	48.3%	54.8%	92.9%	88.2%	46.4%
Children 4-8	1.6%	7.0%	51.6%	49.2%	91.1%	90.8%	46.3%
Males 9-13	3.3%	14.6%	62.0%	49.6%	89.3%	97.0%	47.3%
14-18	8.5%	27.8%	70.6%	61.7%	89.9%	97.1%	43.5%
19-30	15.2%	46.8%	78.2%	74.4%	90.6%	95.9%	45.3%
31-50	13.4%	39.5%	77.2%	70.0%	88.3%	95.5%	48.9%
51-70	12.1%	35.0%	79.6%	67.4%	84.5%	96.4%	56.5%
≥19	12.7%	37.0%	78.0%	68.2%	86.6%	96.1%	52.3%
≥71	8.9%	23.1%	76.3%	57.7%	82.3%	96.7%	59.5%
Females 9-13	3.3%	14.0%	62.1%	53.3%	87.6%	94.3%	48.3%
14-18	13.8%	41.5%	80.3%	70.2%	88.1%	96.3%	49.5%
19-30	14.2%	44.1%	77.0%	77.2%	86.3%	94.1%	46.8%
31-50	12.5%	40.6%	79.5%	71.4%	84.3%	91.9%	48.9%
51-70	11.2%	35.6%	83.0%	69.1%	79.5%	90.8%	55.8%
≥19	11.7%	37.2%	80.2%	70.2%	82.1%	92.3%	52.3%
≥71	7.7%	24.1%	79.1%	61.0%	77.5%	94.7%	59.2%
Total 9-13	3.3%	14.3%	62.1%	51.4%	88.4%	95.6%	47.8%
14-18	11.1%	34.6%	75.4%	65.9%	89.0%	96.7%	46.5%
≥2	7.8%	24.6%	67.3%	61.4%	87.6%	92.8%	49.5%
≥19	12.2%	37.1%	79.1%	69.2%	84.4%	94.2%	52.3%
≥71	8.3%	23.6%	77.6%	59.3%	80.0%	95.8%	59.4%

APPENDIX B

ESTIMATES OF USUAL INTAKES OF TOTAL DAIRY AND CHEESE

Table B1. 2-day average intakes compared with estimated usual intakes of total dairy, from CSFII 94-96, 98. Data are Pyramid servings.

Population		Mean		Percentiles 10th		25th		50th		75th		90th	
		2-Day	Usual	2-Day	Usual	2-Day	Usual	2-Day	Usual	2-Day	Usual	2-Day	Usual
Males	9-13	2.31	2.33	.77	1.28	1.35	1.71	2.11	2.25	3.15	2.86	3.91	3.48
	14-18	2.47	2.51	.60	1.07	1.20	1.58	2.05	2.30	3.20	3.20	4.96	4.20
	19-30	1.69	1.70	.25	.75	.68	1.08	1.35	1.54	2.28	2.16	3.48	2.86
	31-50	1.64	1.57	.20	.61	.63	.95	1.26	1.42	2.17	2.02	3.44	2.71
	51-70	1.31	1.29	.16	.42	.50	.71	1.04	1.13	1.86	1.69	2.71	2.34
	≥71	1.31	1.29	.25	.40	.52	.71	1.09	1.17	1.88	1.74	2.67	2.35
Females	9-13	1.85	1.92	.59	1.07	1.07	1.41	1.72	1.84	2.44	2.35	3.39	2.86
	14-18	1.37	1.34	.25	.57	.53	.84	1.10	1.22	1.91	1.72	2.92	2.27
	19-30	1.2	1.21	.18	.57	.49	.83	1.01	1.15	1.64	1.53	2.31	1.94
	31-50	1.12	1.12	.16	.42	.43	.65	.89	1.01	1.57	1.46	2.41	1.96
	≥71	1.09	1.05	.15	.31	.44	.56	.85	.92	1.56	1.41	2.31	1.96
Total	9-13	2.07	2.12	.65	1.16	1.19	1.54	1.85	2.03	2.79	2.61	3.63	3.21
	14-18	1.94	1.94	.33	.75	.75	1.15	1.60	1.73	2.67	2.49	4.11	3.38

Table B2. 2-day average intakes compared with estimated usual intakes of total cheese, from CSFII 94-96, 98. Data are Pyramid servings.

Population		Mean		Percentiles 10th		25th		50th		75th		90th	
		2-Day	Usual	2-Day	Usual	2-Day	Usual	2-Day	Usual	2-Day	Usual	2-Day	Usual
Males	9-13	.54	.54	0	.29	.13	.38	.40	.50	.73	.66	1.20	.83
	14-18	.79	.76	0	.38	.25	.57	.59	.77	1.06	.96	1.74	1.14
	19-30	.79	.83	0	.38	.23	.54	.57	.76	1.12	1.05	1.71	1.38
	31-50	.62	.60	0	.22	.05	.34	.40	.52	.85	.77	1.53	1.07
	51-70	.40	.39	0	.13	0	.22	.22	.34	.55	.51	1.03	.71
	≥71	.25	.25	0	.03	0	.08	.06	.18	.37	.35	.66	.56
Females	9-13	.45	.47	0	.23	.11	.32	.32	.44	.64	.59	1.12	.75
	14-18	.48	.44	0	.19	.10	.28	.37	.41	.69	.56	1.12	.73
	19-30	.48	.48	0	.21	.07	.31	.33	.45	.69	.61	1.15	.80
	31-50	.41	.39	0	.19	.02	.27	.27	.27	.56	.49	1.03	.63
	51-70	.27	.27	0	.10	0	.16	.13	.25	.39	.35	.73	.46
	≥71	.20	.20	0	.06	0	.10	.06	.18	.30	.27	.57	.37
Total	9-13	.50	.50	0	.25	.13	.34	.36	.47	.68	.62	1.17	.79
	14-18	.64	.61	0	.27	.15	.41	.47	.57	.85	.77	1.47	1.00
	≥71	.22	.22	0	.04	0	.09	.06	.18	.32	.30	.62	.46

APPENDIX C
DAIRY FOODS INTAKES BY EATING OCCASION

Table C1. Proportion of total dairy intake by eating occasion, from CSFII 94-96, 98. Data are weighted.

Population		Breakfast Mean (SE)	Lunch Mean (SE)	Dinner Mean (SE)	Supper Mean (SE)	Snack Mean (SE)
Children 2-3		.36 (.01)	.19 (.01)	.14 (.01)	.08 (.01)	.23 (.01)
Children 4-8		.35 (.01)	.27 (.01)	.14 (.01)	.08 (.01)	.16 (.01)
Males	9-13	.33 (.01)	.27 (.01)	.15 (.01)	.09 (.01)	.16 (.01)
	14-18	.27 (.01)	.25 (.02)	.19 (.02)	.1 (.01)	.19 (.01)
	19-30	.26 (.01)	.24 (.01)	.21 (.01)	.13 (.02)	.15 (.01)
	31-50	.26 (.01)	.23 (.01)	.2 (.01)	.14 (.01)	.17 (.01)
	51-70	.31 (.01)	.2 (.01)	.17 (.01)	.15 (.01)	.17 (.01)
	≥19	.28 (.01)	.22 (.00)	.19 (.01)	.14 (.01)	.16 (.00)
	≥71	.36 (.02)	.21 (.01)	.16 (.01)	.12 (.01)	.14 (.01)
Females	9-13	.33 (.01)	.25 (.01)	.16 (.01)	.1 (.01)	.17 (.01)
	14-18	.26 (.02)	.25 (.02)	.22 (.02)	.09 (.01)	.19 (.01)
	19-30	.3 (.02)	.23 (.01)	.2 (.01)	.11 (.01)	.17 (.01)
	31-50	.28 (.01)	.24 (.01)	.19 (.01)	.12 (.01)	.17 (.01)
	51-70	.32 (.01)	.21 (.01)	.17 (.01)	.13 (.01)	.17 (.01)
	≥19	.3 (.01)	.23 (.01)	.18 (.01)	.12 (.01)	.17 (.01)
	≥71	.33 (.01)	.21 (.01)	.17 (.02)	.14 (.02)	.16 (.01)
Total	9-13	.33 (.01)	.26 (.01)	.15 (.01)	.1 (.01)	.16 (.01)
	14-18	.26 (.01)	.25 (.01)	.2 (.02)	.1 (.01)	.19 (.01)
	≥2	.3 (.00)	.23 (.00)	.18 (.01)	.12 (.01)	.17 (.00)
	≥19	.29 (.00)	.23 (.00)	.19 (.01)	.13 (.01)	.16 (.00)
	≥71	.34 (.01)	.21 (.01)	.16 (.01)	.13 (.01)	.15 (.01)

Table C2. Proportion of fluid milk intake by eating occasion, from CSFII 94-96, 98. Data are weighted.

Population		Breakfast Mean (SE)	Lunch Mean (SE)	Dinner Mean (SE)	Supper Mean (SE)	Snack Mean (SE)
Children 2-3		.49 (.01)	.14 (.00)	.11 (.01)	.06 (.01)	.2 (.01)
Children 4-8		.53 (.01)	.18 (.01)	.1 (.01)	.06 (.01)	.13 (.01)
Males	9-13	.56 (.02)	.16 (.01)	.09 (.01)	.07 (.01)	.13 (.01)
	14-18	.54 (.02)	.12 (.01)	.12 (.01)	.06 (.01)	.17 (.02)
	19-30	.64 (.02)	.08 (.01)	.09 (.01)	.04 (.01)	.15 (.02)
	31-50	.57 (.02)	.07 (.01)	.1 (.01)	.07 (.01)	.19 (.02)
	51-70	.6 (.02)	.09 (.01)	.09 (.01)	.08 (.01)	.14 (.01)
	≥19	.6 (.01)	.08 (.00)	.09 (.01)	.07 (.01)	.16 (.01)
	≥71	.62 (.02)	.13 (.01)	.06 (.01)	.07 (.01)	.12 (.01)
Females	9-13	.57 (.02)	.14 (.01)	.09 (.01)	.05 (.01)	.14 (.02)
	14-18	.6 (.03)	.1 (.02)	.1 (.02)	.04 (.01)	.15 (.02)
	19-30	.66 (.03)	.09 (.01)	.09 (.02)	.03 (.01)	.15 (.02)
	31-50	.57 (.01)	.09 (.01)	.1 (.01)	.06 (.01)	.18 (.01)
	51-70	.62 (.02)	.09 (.01)	.08 (.01)	.07 (.01)	.14 (.01)
	≥19	.6 (.01)	.09 (.01)	.09 (.01)	.06 (.01)	.15 (.01)
	≥71	.59 (.02)	.12 (.01)	.08 (.01)	.1 (.02)	.11 (.01)
Total	9-13	.57 (.01)	.15 (.01)	.09 (.01)	.06 (.01)	.13 (.01)
	14-18	.56 (.02)	.11 (.01)	.11 (.01)	.05 (.01)	.16 (.01)
	≥2	.58 (.01)	.11 (.00)	.09 (.00)	.06 (.01)	.15 (.00)
	≥19	.6 (.01)	.09 (.00)	.09 (.01)	.06 (.01)	.16 (.01)
	≥71	.6 (.02)	.12 (.01)	.07 (.01)	.08 (.01)	.12 (.01)

Table C3. Proportion of total cheese intake by eating occasion, from CSFII 94-96, 98. Data are weighted.

Population		Breakfast Mean (SE)	Lunch Mean (SE)	Dinner Mean (SE)	Supper Mean (SE)	Snack Mean (SE)
Children 2-3		.06 (.01)	.39 (.01)	.25 (.01)	.14 (.01)	.16 (.01)
Children 4-8		.05 (.00)	.43 (.01)	.26 (.01)	.15 (.01)	.11 (.01)
Males	9-13	.04 (.01)	.41 (.02)	.26 (.02)	.16 (.02)	.13 (.02)
	14-18	.05 (.01)	.39 (.02)	.28 (.03)	.15 (.02)	.13 (.02)
	19-30	.08 (.01)	.39 (.01)	.28 (.02)	.15 (.02)	.1 (.01)
	31-50	.09 (.01)	.37 (.02)	.28 (.02)	.19 (.02)	.07 (.01)
	51-70	.09 (.01)	.35 (.02)	.26 (.02)	.2 (.02)	.11 (.01)
	≥19	.08 (.01)	.37 (.01)	.28 (.01)	.18 (.02)	.09 (.01)
	≥71	.06 (.01)	.38 (.03)	.28 (.03)	.19 (.02)	.09 (.01)
Females	9-13	.05 (.01)	.39 (.02)	.28 (.02)	.19 (.02)	.1 (.01)
	14-18	.07 (.01)	.35 (.02)	.29 (.03)	.14 (.02)	.16 (.02)
	19-30	.08 (.01)	.36 (.02)	.3 (.02)	.17 (.03)	.08 (.01)
	31-50	.08 (.01)	.38 (.01)	.29 (.02)	.18 (.02)	.07 (.01)
	51-70	.08 (.01)	.37 (.02)	.27 (.02)	.2 (.02)	.07 (.01)
	≥19	.08 (.00)	.38 (.01)	.29 (.02)	.18 (.02)	.08 (.00)
	≥71	.06 (.01)	.41 (.03)	.26 (.02)	.18 (.03)	.09 (.01)
Total	9-13	.04 (.01)	.4 (.02)	.27 (.02)	.17 (.02)	.11 (.01)
	14-18	.06 (.01)	.37 (.02)	.28 (.02)	.14 (.02)	.14 (.01)
	≥2	.07 (.00)	.38 (.01)	.28 (.01)	.17 (.01)	.1 (.00)
	≥19	.08 (.00)	.38 (.01)	.28 (.01)	.18 (.02)	.08 (.00)
	≥71	.06 (.01)	.4 (.02)	.27 (.02)	.18 (.02)	.09 (.01)

Table C4. Proportion of cheese intake from food mixtures by eating occasion, from CSFII 94-96, 98. Data are weighted.

Population		Breakfast Mean (SE)	Lunch Mean (SE)	Dinner Mean (SE)	Supper Mean (SE)	Snack Mean (SE)
Children 2-3		.06 (.01)	.35 (.01)	.32 (.02)	.16 (.01)	.11 (.01)
Children 4-8		.04 (.00)	.37 (.01)	.3 (.02)	.17 (.01)	.11 (.01)
Males	9-13	.03 (.01)	.41 (.03)	.28 (.02)	.19 (.02)	.1 (.02)
	14-18	.04 (.01)	.34 (.03)	.31 (.03)	.18 (.02)	.12 (.02)
	19-30	.07 (.01)	.37 (.02)	.3 (.02)	.17 (.02)	.09 (.01)
	31-50	.08 (.01)	.32 (.02)	.31 (.02)	.2 (.02)	.08 (.01)
	51-70	.08 (.01)	.26 (.02)	.32 (.03)	.23 (.02)	.11 (.01)
	≥19	.07 (.01)	.33 (.01)	.32 (.02)	.2 (.02)	.09 (.01)
	≥71	.02 (.01)	.29 (.03)	.4 (.03)	.22 (.04)	.07 (.02)
Females	9-13	.04 (.01)	.37 (.03)	.3 (.02)	.19 (.02)	.1 (.02)
	14-18	.06 (.01)	.3 (.03)	.33 (.04)	.16 (.03)	.15 (.02)
	19-30	.08 (.01)	.31 (.02)	.35 (.02)	.17 (.02)	.09 (.01)
	31-50	.08 (.01)	.32 (.01)	.33 (.02)	.19 (.02)	.08 (.01)
	51-70	.07 (.01)	.3 (.02)	.32 (.03)	.22 (.02)	.08 (.01)
	≥19	.07 (.00)	.32 (.01)	.33 (.02)	.19 (.02)	.08 (.01)
	≥71	.05 (.02)	.32 (.05)	.35 (.04)	.2 (.04)	.09 (.02)
Total	9-13	.03 (.01)	.39 (.02)	.29 (.02)	.19 (.02)	.1 (.01)
	14-18	.05 (.01)	.32 (.03)	.32 (.03)	.17 (.02)	.13 (.01)
	≥2	.06 (.00)	.33 (.01)	.32 (.02)	.19 (.01)	.1 (.00)
	≥19	.07 (.00)	.32 (.01)	.32 (.02)	.2 (.02)	.09 (.00)
	≥71	.03 (.01)	.31 (.03)	.37 (.03)	.21 (.04)	.08 (.02)

K-1. "IMPACT STATEMENTS"/ SCIENTIFIC AND PRACTICAL APPLICATIONS:

There are several clear areas where our sponsors and others can apply our results. Some suggestions follow:

1. Use data on micronutrient intakes associated with dairy foods to provide strong support for dairy and particularly milk consumption. The positive picture is not limited to calcium, though calcium intake is most dramatically influenced by dairy (and based on our analyses people do not compensate with other dietary calcium when dairy calcium is low).

2. In conjunction with data on very high proportion of fluid milk consumed at breakfast, work to increase intakes at other meals or maintain/improve intakes at breakfast. (The latter is particularly critical given reports that breakfast cereals are no longer "convenience foods"!)

3. Consider encouragement of food pairings to optimize nutrient intakes and adherence to Food Guide Pyramid type of recommendations. For example, the fruit and dairy groups are the least met groups, with 73% of the population consuming less than recommended amounts for each of those groups. Strikingly, only about a quarter of the population even consumes a diverse diet as we defined it. At the same time, dairy consumers were statistically more likely to be grain consumers and fruit consumers. It may be possible to use our data to provide even more encouragement for both dairy and fruit consumption.

4. The inverse relationship between BMI and total dairy product consumption in adult women is of interest, given the fact that women age 19 and over are the demographic group most likely to under-consume dairy products. While our data are cross-sectional and do not show cause and effect, they do call into the question the perception that dairy foods are "fattening" and may be used to set the record straight. Also, perhaps evidence that dairy products are not associated with obesity will encourage some adolescents to include more dairy foods in their diets.

5. It might be advantageous to dairy industry groups and to consumers if consideration is given to trying to modify the nutritional profile of cheese or if efforts are made to optimize food pairings with cheese for optimal nutrition. The positive dairy nutrition messages supported by our research are not as applicable to cheese alone (except for calcium). There is some potential threat to the image of dairy as nutrient-rich foods if the shift away from milk and toward cheese continues without any changes in nutritional profile of cheese or in overall dietary choices accompanying cheese.

6. Our analyses, conducted from numerous different angles, show that it is not correct to associate dairy foods with high fat and high cholesterol diets. This can be used as an educational message for consumers, and might lead some to examine the real contributors of fat and cholesterol in their diets. The consistent though modest contributions of dairy to saturated fat intakes supports continued efforts to reduce the saturated fat content of dairy foods.

K-2. "IMPACT STATEMENTS": ESTABLISHING EXPERTISE, COLLABORATIONS, ETC.

In addition to the scientific impacts or messages listed above, this project benefited the researchers and university in other ways by:

1. Establishment of excellent working relationship/collaboration between Statistics and FSN faculty.
2. Training of two M.S. students, each now working for large food companies (General Mills and Masterfoods).
3. Training of undergraduate statistics majors, helping them secure excellent jobs after graduation.
4. Strengthening of working relationship of P.I. with Dairy Council of CA and Kraft.
5. Development of expertise for P.I., leading to exciting sabbatical projects during 2002-2003 academic year and likely other future opportunities.

L. DISSEMINATION, PUBLICATIONS AND PRESENTATIONS OF RESEARCH:

MS THESES:

Ahlem, C.C. June 2001. Dairy Product Consumption and Other Diet and Health Related Parameters. Master's Thesis. California Polytechnic State University, San Luis Obispo. (128 pages; available on request from PI if you really want a copy, or go to library)

Weinberg, L.G. July 2002. Nutrient Contributions of Dairy Products in the US Diet. Master's Thesis. California Polytechnic State University, San Luis Obispo. (210 pages; available on request from PI if you really want a copy, or go to library)

PRESENTATIONS AT REGIONAL OR NATIONAL MEETINGS:

1. Berner, L.A. Intake and nutritional contributions of dairy foods in the US. Third Symposium on Advances in Dairy Products Technology: Concentrated and Dried Dairy Ingredients. February 27, 2001, Shell Beach, CA.

2. Ahlem, C.C., Groves, J.E. and Berner, L.A. 2001. Dairy product consumption and dietary diversity. FASEB J. 15(4): A622 (abstract #496.1). POSTER PRESENTATION AT EXPERIMENTAL BIOLOGY ANNUAL MEETING, MARCH 2001, ORLANDO, FL.

3. Berner, L.A., Rector, M., and Groves, J.E. 2001. Dairy product intakes and patterns of consumption in the US. FASEB J. 15(4): A622 (abstract #496.2). POSTER PRESENTATION AT EXPERIMENTAL BIOLOGY ANNUAL MEETING, MARCH 2001, ORLANDO, FL.

4. Ahlem, C.C. 2001. Dairy product consumption and dietary diversity. California State University Research Competition, San Jose State University, April 28

5. Berner, L.A. and Ahlem, C.C. Dairy food intake patterns and associated nutrients. Dairy Council of California Research Committee Meeting. May 25, 2001, Farm Bureau, Sacramento, CA.

6. Ahlem, C.C. 2001. Dairy product consumption and dietary diversity. DSCI 581 Graduate Seminar in Dairy Science, May 29.

7. Veenstra, L.G., Berner, L.A., and Groves, J.E. 2002. Contributions of dairy foods to nutrient intakes. FASEB J. 16(4): A657-8 (abstract #494.9). POSTER PRESENTATION AT EXPERIMENTAL BIOLOGY ANNUAL MEETING, APRIL 2002, NEW ORLEANS, LA.

8. Veenstra, L.G. 2002. Nutrient contributions of dairy products in US diets. DSCI 581 Graduate Seminar in Dairy Science, May 21.

MANUSCRIPTS:

Weinberg LG, Berner LA, Groves JE. Nutrient contributions of dairy foods in the US, CSFII 1994-96, 98. J. Am. Diet. Assoc. STATUS: Accepted contingent on acceptable revisions, by J. Am. Dietetic Association; revised manuscript sent May 30, 2003: (COPY ATTACHED)

Ahlem CC, Berner LA, Groves JE. Dairy product consumption and diverse dietary patterns are positively associated with nutrient intakes and other health-related parameters. STATUS: Manuscript being formatted for Journal of the American College of Nutrition, with some revision needed. (COPY OF DRAFT MANUSCRIPT ATTACHED)