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Calcium Intake in Low-Income Women in Indiana

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CALCIUM INTAKE IN LOW-INCOME WOMEN IN INDIANA

by

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Approved by

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Advisor: Amy R. Mobley

Abstract

Background: Calcium has been identified as a nutrient which many individuals are lacking in their diets. Furthermore, the calcium intake of low income individuals tends to be lower than their higher income counterparts. The purpose of this research study was to specifically assess the overall calcium intake level and knowledge, attitudes and behaviors regarding consumption of milk products for low-income female Indiana residents ages 19 and older.

Methods: Women ages 19 and older throughout Indiana and eligible to participate in the Family Nutrition Program (FNP) and/or Expanded Food and Nutrition Education Program (EFNEP) were recruited by FNP and EFNEP paraprofessionals on a voluntary basis. The study was a cross-sectional baseline analysis of calcium intake and knowledge, attitudes and behaviors about milk products among participants. A three-part survey, including: 1) a pre-validated one-page Short Calcium Questionnaire as well as 2) demographic and 3) behavioral questions, was administered to participants, through face-to-face interviews conducted by paraprofessionals, prior to any milk-related nutrition education lessons. Descriptive statistics as well as chi-square, linear and multivariate regression and ANCOVA were conducted using SPSS software after establishing normality of the data.

Results: The sample (n=673) population was primarily ages 19-50 years old, white, had completed high school, was neither pregnant nor breastfeeding and had 1-2 children. Across all subjects mean daily dietary calcium intake was found to be 1,063 mg (SD = 478 mg), mean daily supplemental calcium was 160 mg (SD = 247 mg), mean total daily calcium was 1,233 mg (SD = 531 mg) and mean consumption of milk and milk equivalents per day was 1.8 cups (SD = 1.1 cups). When examined by age, a significant different (P=0.001) was observed in dietary calcium intake between women ages 19-50 (1,100 mg) and women ages 51 and older (951 mg). No

significant differences existed when total calcium intake was compared between age groups. There were no significant differences in calcium intake among women of different races. Significant relationships existed between some, but not all, of the knowledge, attitude and behavior questions and calcium or milk product intake. The more participants liked the taste of milk, the more calcium they consumed in their diet yet, the more concerned they were about their intake or if they had lactose intolerance, the less calcium they consumed in their diet. In addition, participants were less likely to know about the relationship of milk/calcium with blood pressure (68%) and weight management (41%), were unconcerned about their calcium intake (50%), and preferred the taste of reduced fat or whole milk (60%).

Discussion: Based on data collected, women ages 51 and older tend to have lower dietary calcium intakes than younger women, with 70% of older women not meeting the Adequate Intake (AI) compared with 44% younger women not meeting their respective AI for calcium. However, when total calcium intake (dietary and supplemental calcium) was compared among the age groups, a smaller insignificant difference existed between the two groups, indicating that older women may be compensating for a lower dietary intake of calcium by using calcium-containing supplements. Information obtained from knowledge, attitude and behavior questions identified several potential focus areas for educational programming within the representative population.

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ACKNOWLEDGEMENTS

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Introduction

Calcium is generally regarded as an important nutrient for bone health. In addition to being essential in the development of peak bone mass in adolescence, calcium has been shown to play a key role in helping to maintain bone mass in adults (1). National data have indicated that many groups of individuals, including minorities and those of lower socioeconomic classes, are not meeting the current Adequate Intakes (AI) for calcium established by the Institute of Medicine (2). The National Health and Nutrition Examination Survey (NHANES) data from 2005-2006 reveal that women ages 20 and older consumed an average of 858 mg calcium per day, with calcium intake generally decreasing by age group with advancing age. Women ages 20-29 years old consumed 933 mg calcium daily and those 70 years and older consumed only 752 mg calcium daily (3). Current AIs for adult women are set at 1000 mg/day for ages 19-50 years and 1200 mg/day for those aged 51 and older. Individuals below 131% of the established federal poverty income level ages 20 and older consumed 923 mg calcium per day, compared with 979 mg per day in those of the same age group earning more than 185% of the poverty threshold. Similarly, non-Hispanic blacks and Mexican Americans consumed 801 mg and 955 mg calcium daily respectively, compared to 1018 mg for non-Hispanic whites.

While it is possible to meet calcium recommendations by consuming a variety of foods (4), milk products are known as one of the best sources of dietary calcium due to high calcium content, bioavailability of the calcium, and other nutrients which may facilitate absorption (5). Only 17% of women ages 20 years and older consume at least 2 cups/servings of milk and milk products per day (6). Various reasons are often cited for adult women not consuming the recommended number of cups of milk products each day, such as a dislike for the taste of milk, self-perceived lactose intolerance and unconcern for meeting calcium needs (7). When attempting to change dietary intake behaviors, studies have shown that addressing an individual's

attitude and belief systems is equally important to increasing knowledge (8-10). Thus, identifying the attitudes and beliefs of a population may be important when planning and an educational campaign to increase calcium consumption.

While calcium has been identified as a nutrient which many individuals are lacking in their diets, there is no data to our knowledge about the calcium and milk intake patterns of low-income women within the state of Indiana. The purpose of this research study was to assess the overall calcium intake levels and attitudes regarding milk and milk products for low-income female Indiana residents ages 19 and older. Results of the study will be used as formative research in the development of a social marketing campaign aimed at educating low-income women on intake of calcium and milk and milk products.

Specific aims of the project include:

Specific Aim #1: Estimate intake of calcium and milk and milk products of low-income women in Indiana.

- **Hypothesis: The mean calcium and milk and milk product intake for low-income women will be less than the national recommendation (Institute of Medicine Adequate Intake or MyPyramid).**

Specific Aim #2a: Determine if calcium intake differs by age.

- **Hypothesis: Older women (ages 51+ years) will have lower calcium intakes than younger women (ages 19-50 years).**

Specific Aim #2b: Determine if calcium intake differs by race.

- **Hypothesis: Black women will have lower calcium intakes than white and women of "other" races.**

Specific Aim #3: Identify which factors are primary barriers to consuming milk products, related to knowledge, attitudes and behaviors.

- **Hypothesis: There will be an inverse relationship between milk product consumption and the following characteristics/attitudes: self-perceived lactose intolerance, distaste for milk and lack of concern for calcium intake.**

Methods/Methodology

Subjects: Women ages 19 and older throughout Indiana who were FNP/EFNEP eligible were recruited on a voluntary basis. The minimum age was set in congruence with the major established adult adequate intake (AI) values for calcium. A goal of 600 participants was set to achieve 80% power to detect significant statistical differences between groups. Family Nutrition Program (FNP) and Expanded Food and Nutrition Education Program (EFNEP) staff were provided with small insulated lunch bags to offer as incentive for participation.

Design: The research study was a cross-sectional baseline analysis of calcium intake and knowledge, attitudes and behaviors about milk products.

Data Collection: A three-part calcium survey, including a pre-validated short-form calcium intake food frequency questionnaire (Appendix A), demographic questions (Appendix B), and knowledge, attitudes and behaviors questions (Appendix C) were administered through face-to-face interviews conducted with participants by paraprofessional employees, prior to any milk-related lessons. A portion size estimation kit was provided to paraprofessionals to help estimate serving sizes of participant's food. The three part survey was tested prior to administration with the target audience and FNP

staff.

Results

Low-income women (n=673) from 51 Indiana counties (Figure 1) participated in the study. Participants were primarily ages 19-50 years (76%), White (84%), and completed a high school degree or less (67%). Full demographic results are provided in Table 1. Mean total calcium was 1233 mg while mean dietary calcium was 1063 mg and mean supplemental calcium was 160 mg for all participants. Mean consumption of milk and milk products per day was 1.8 cups (Table 2). Only 16% of participants were meeting the 2005 *Dietary Guidelines for Americans* recommendation to consume at least 3 cups of milk and milk products per day.

The proportion of participants not meeting the current age-specific Adequate Intake (AI) for calcium from dietary sources alone was 44% for women 19-50 and 70% for those 51 and older. More than one-third (36%) of women ages 19-50 years and almost half (49%) of women ages 51 years and older did not meet the AI for calcium from combined dietary and supplemental sources (Figure 2).

Women ages 19-50 years consumed significantly more dietary calcium (1100 mg) than women 51 years and older (951 mg), (P = 0.001), but the effect diminished when supplemental calcium was accounted for in total calcium intake (P=0.454), shown in Figure 3. Mean supplemental calcium intake for women ages 51 years and older was 246 mg, while mean supplemental intake in younger women was 133 mg daily. The proportion of women ages 51 years and older taking calcium supplements was 45% compared with 32% of women ages 19-50 years. Total daily calcium intake for women ages 19-50 years was 1,233 mg, and 1,197 mg for women ages 51 years and older (Table 2).

There were no significant differences (P>0.05) in calcium intake between races (Table 3).

However, consumption of milk and milk products differed significantly across racial groups (P=0.043) as shown in Figure 4. Mean daily consumption of milk and milk products by black women was 1.5 servings, compared to white and other non-white participants, who consumed 1.8 cups daily. Milk and milk product intake did not differ significantly across age groups (Table 2). Refer to Appendix D for a list of items and respective servings that represent one cup of milk and milk products.

As related to specific aim #3, results of the knowledge, attitude and behavior questions are presented in Table 4. Significant relationships existed between some, but not all, of the knowledge, attitude and behavior questions and calcium or milk product intake (Table 4). The more participants liked the taste of milk, the more calcium they consumed in their diet yet, the more concerned they were about their intake or if they had lactose intolerance, the less calcium they consumed in their diet.

In addition, participants were less likely to know about the relationship of milk/calcium with blood pressure (68%) and weight management (41%), were unconcerned about their calcium intake (50%), and preferred the taste of reduced fat or whole milk (60%).

Discussion

Women ages 51 years and older tended to have lower dietary calcium intakes than younger women ages 19 to 50 years old, however there were no significant differences in total calcium intake between the two age groups. This may indicate that older women may be compensating for a lower dietary intake of calcium with the use of calcium-containing supplements. In addition to a significantly higher proportion of older women using calcium-containing supplements, analysis of our data indicates that older women received an average of 21% of total calcium through calcium-containing supplements, while younger women were

consuming 13% of total calcium through supplements. Research by Chapman et al also indicated an increased proportion of older women using calcium-containing supplements compared with younger participants, with 73.7% of women ages 51 years and older using the supplements compared to only 52.4% use among those ages 18-50 years old (7). Similarly, Ma et al reported calcium supplementation in 53.7% of moderate-risk participants (ages 51 years and older) and only 43% of men and women ages 19-50 years old (5). The 1994 NIH Consensus Conference report stated that, while consuming calcium-rich foods is the preferred source of calcium, supplementation up to 2000 mg/day is safe for most people and may be helpful in preventing and treating osteoporosis in those individuals who cannot meet their calcium needs through food (10).

Despite some evidence presented in the literature (11,12), there were no significant differences in calcium consumption based on race. This could be an effect of comparatively low numbers of non-white participants. Non-white groups comprised less than 17% of the 673 participants. Despite this, black women in the study were consuming significantly less milk and milk products than white and other non-white participants. Recent research by Fulgoni et al also revealed significantly less consumption of milk products by African Americans (11). This corresponds to research presented by Buchowski et al, which revealed reduced milk consumption in African American lactose maldigesters compared with those with normal lactose digestion (13). Although Buchowski's study determined lactase deficiency through breath hydrogen levels following lactose consumption, in addition to recording subjective symptoms, it could be hypothesized that a similar effect could be seen in those who believe themselves to be maldigestors. However, Buchowski also saw decreased overall calcium intake, not seen in this study, our results may suggest that these women were consuming a broader variety of non-milk

calcium-containing foods.

The current study indicated that self-perceived lactose intolerance was inversely related to calcium consumption, while reportedly liking the taste of milk was positively associated with calcium consumption, as hypothesized. This is similar to data by Chapman et al (7). However, contrary to our hypothesis, and Chapman's research, concern for calcium intake was inversely associated with actual calcium intake. This may be explained by the participant's awareness of not meeting current calcium recommendations and subsequent concern, rather than concern motivating an increased intake.

Other selected knowledge, attitude and behavior questions identified that a large proportion of sample participants were unaware of relationships between the benefits of consuming milk products for certain health conditions identified in recent research studies. Specifically, 68% of participants were unaware of associations between low-fat milk products and blood pressure control. Also, a high proportion of participants (60%) indicated that low-fat milk products did not taste as good as higher-fat versions, indicating a potential barrier to consuming milk products considering the recent push to consume low-fat foods whenever possible.

Limitations

As with any study, several limitations of the study have been identified that should be considered when interpreting the results. The study design is cross-sectional, providing only a snapshot view of participants' dietary habits. The sample itself was a convenience sample accessed by EFNEP and FNP programs throughout the state, which may not be a representative sample of the population. Regarding the assessment, FNP and EFNEP paraprofessional employees administered the tool, over which researchers had no control beyond initial training

sessions. A short form calcium questionnaire was used in assessment which may have led to inaccurate estimation of food and/or supplement intake (14). Finally, participants may have overestimated supplement usage and/or the consumption of various foods on the FFQ due to the "social approval" bias (15), difficulty separating individual from family consumption, body image (16), or socioeconomic status (17).

Future Research

The current research study provides a framework for formative research in the development of a social marketing campaign aimed at low-income women within the state of Indiana, and will aid in efforts to focus on a targeted population for the larger campaign. Additionally, information obtained by knowledge, attitude and behavior questions identified several potential focus areas for educational programming within the representative population. Specifically, educational opportunities in the areas of choosing dietary calcium sources among older women instead of using supplements, increasing milk consumption in black women, promoting positive relationships between milk products and health conditions, and overcoming taste barriers to milk products have been identified.

Conclusion

Based on the findings of this study it would appear that older low-income women in Indiana are consuming less dietary calcium than women ages 19-50 years. This is of concern due to the fact that Adequate Intake (AI) of calcium increases from 1000 mg to 1200 mg after age 50 years for women. Although half of older women in the study met the AI through both dietary and supplemental sources, only 30% met the AI through dietary sources, which indicates a need for education on the importance of meeting nutritional needs through food, particularly in an economically-challenged population.

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Table 1 Demographic characteristics of study participants

Characteristic	N	%
Age (years)		
19-50	510	76
51 and older	162	24
Race		
White	555	84
Black	72	11
Other	36	6
Education		
Less than high school	167	25
High school diploma/GED	282	42
Some college	185	28
College degree or higher	35	5

Table 2 Intake of calcium and milk and milk products by age

Age (years)	Mean dietary calcium in mg (SD)	Mean supplemental calcium in mg (SD)	Mean total calcium in mg (SD)	Mean milk and milk products in cups (SD)
19-50	1100 (483)	133 (214)	1233 (531)	1.8 (1.1)
51 and older	951 (447)	246 (318)	1197 (539)	1.8 (1.0)
19 and older	1064 (478)	160 (247)	1224 (532)	1.8 (1.1)

SD = standard deviation

Table 3 Intake of calcium and milk and milk products by race

Race	Mean Dietary Calcium (SD) in mg	Mean Supplemental Calcium (SD) in mg	Mean Total Calcium (SD) in mg	Milk and milk products (SD) in cups
White	1058 (474)	168 (251)	1228 (524)	1.8 (1.1)
Black	1077 (510)	109 (201)	1188 (604)	1.5 (0.9)
Other	1148 (484)	147 (284)	1295 (519)	1.8 (1.1)

SD = standard deviation

Table 4 Relationship of age, race, and positive response to specified attitudes and behavior questions to calcium intake

Variable	B	SE	Beta	P
Q1: I like the taste of milk	0.217	0.029	0.282	<0.001
Q8: I am concerned about my calcium intake.	-0.156	0.028	-0.209	<0.001
Q15: I don't eat or drink milk products because I have lactose intolerance.	-0.123	0.036	-0.131	0.001
Age	-0.068	0.041	-0.062	0.099
Race	-0.073	0.077	-0.035	0.349

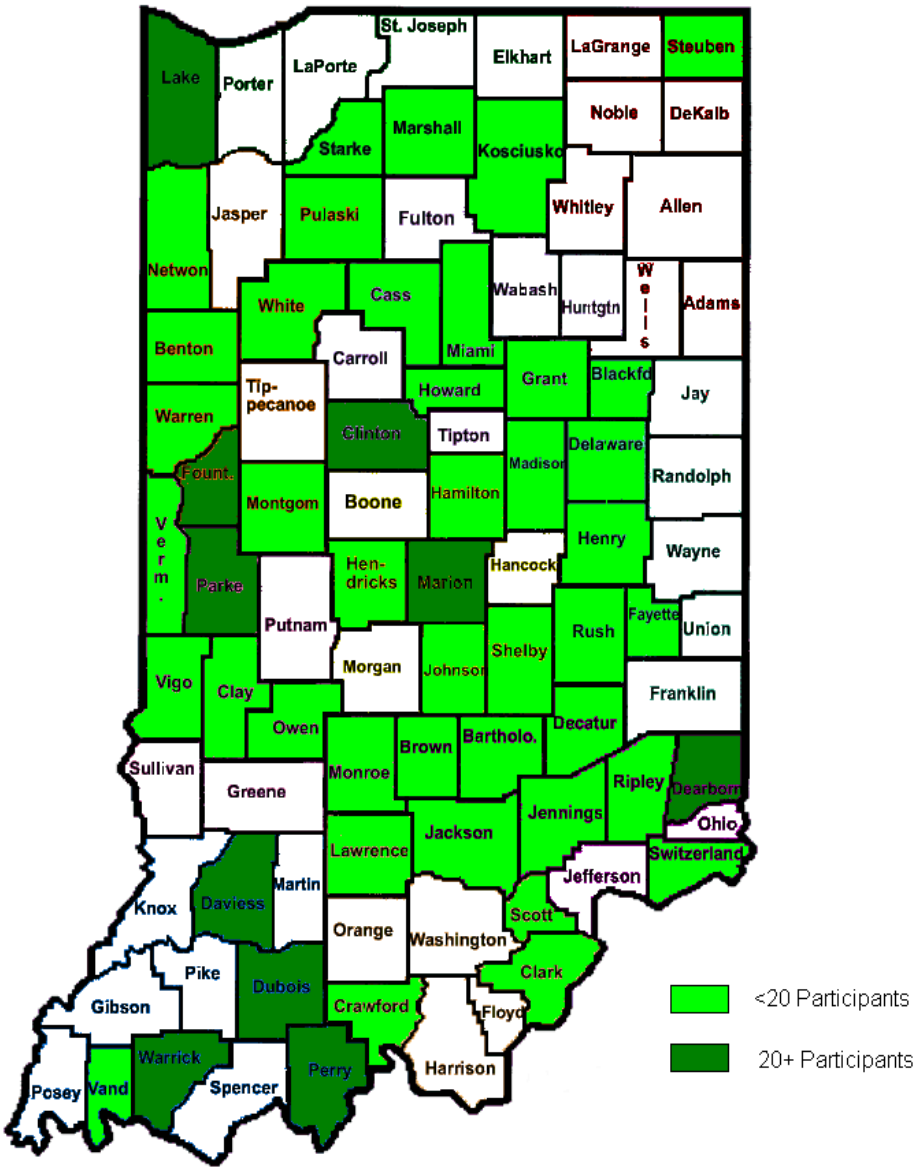


Figure 1 Indiana counties represented in sample

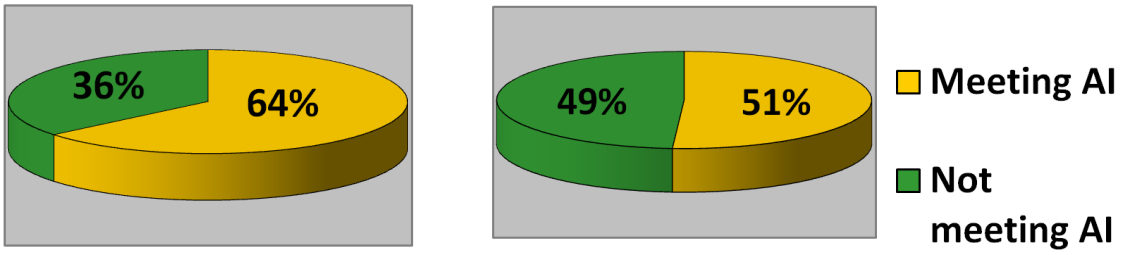
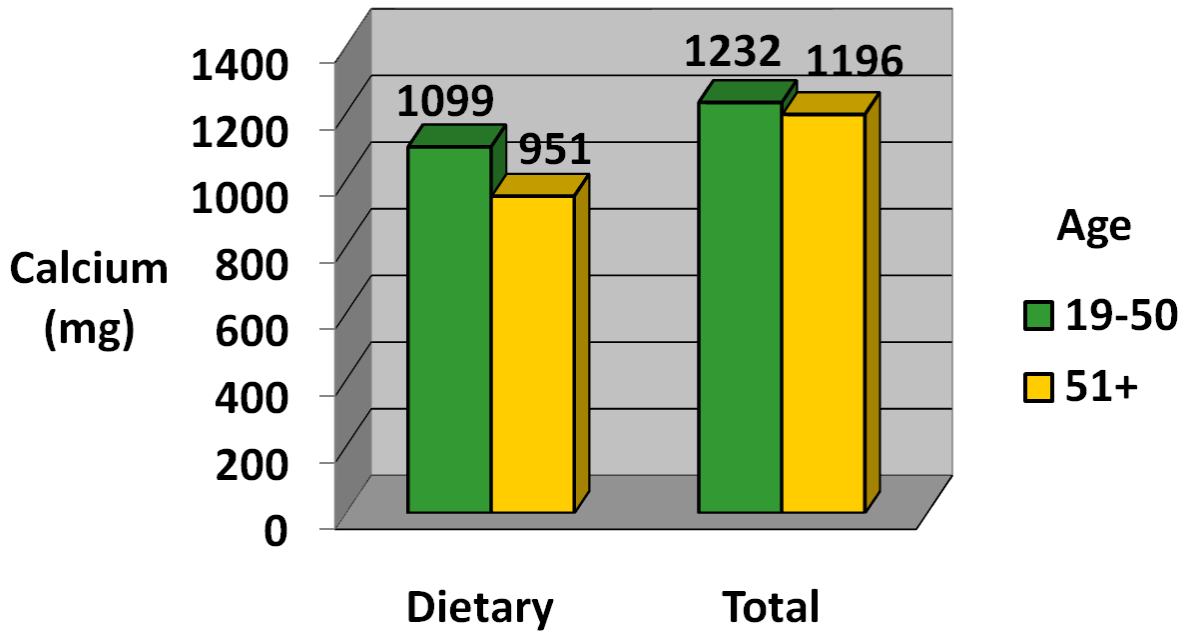


Figure 2 Proportion of women ages 19-50 years old (left) and ages 51 years and older (right) meeting recommended Adequate Intake (AI) for calcium



* $P = .001$

Figure 3 Mean calcium intakes of women by age group

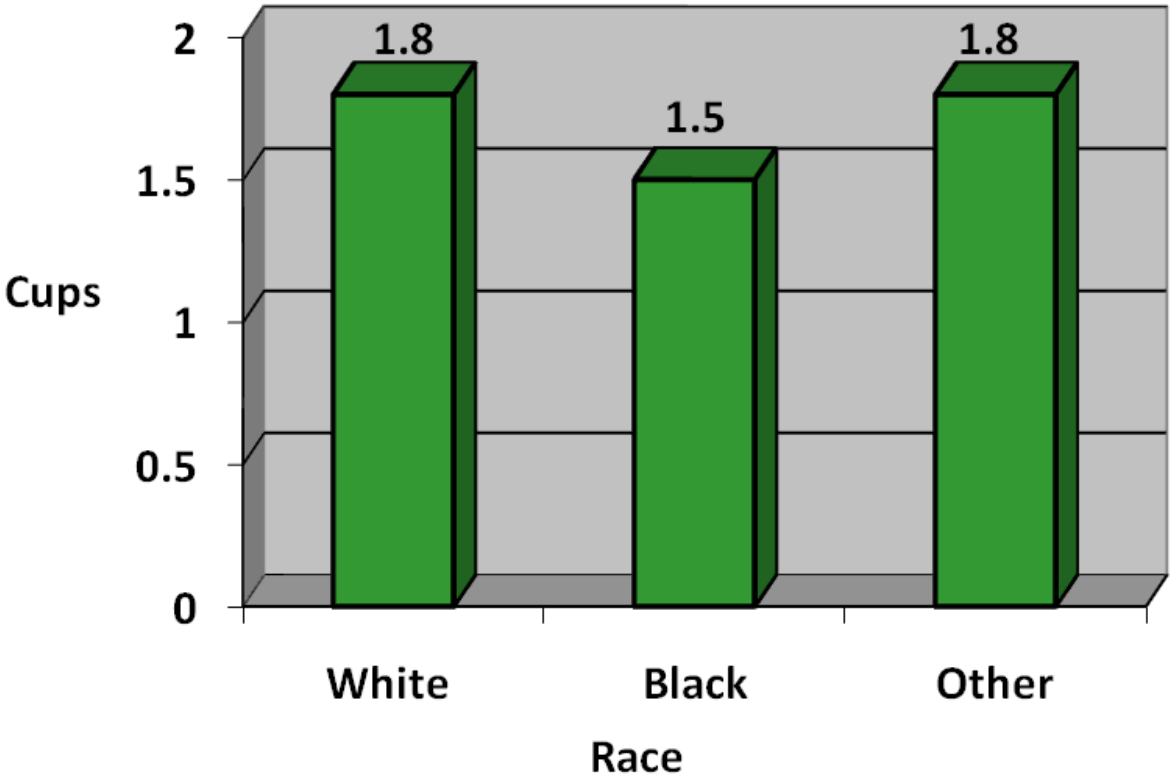


Figure 4 Consumption of milk and milk products by race ($P < 0.05$)

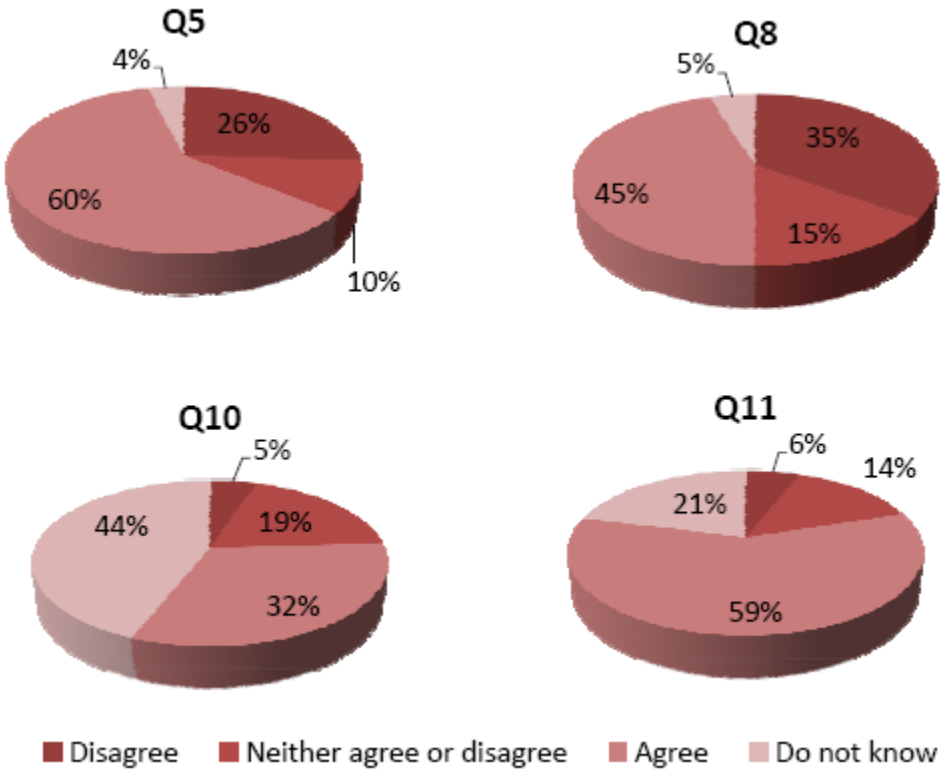


Figure 5 Participant responses to select (Q5, Q8, Q10, Q11) knowledge, attitude and behavior questions
Q5: "Nonfat (skim) or low-fat (1%) milk does not taste as good as 2% or whole milk."
Q8: "I am concerned about my calcium intake."
Q10: "Nonfat (skim) or low-fat (1%) milk products may help lower high blood pressure."
Q11: "Nonfat (skim) or low-fat (1%) milk products may help with weight loss."

Appendix A

Calcium Questionnaire #1

Directions: In the boxes below, please write the number of servings of each of the following foods or beverages **your client** (**not their family**) eats or drinks in a typical week. Please put a zero in the box if your client does not eat or drink the food or beverage item during the week.

Food or beverage	Serving size	Servings/week
1. Milk, any kind, including on cereal, in beverages, etc	1 cup	
2. Yogurt (not frozen)	1 cup	
3. Ice cream, frozen yogurt	½ cup	
4. Pudding, made with milk	½ cup	
5. Latte, cappuccino, frappucino drinks, etc	12 fl. oz	
6. Instant breakfast drinks, shakes, diet shakes, liquid supplements	12 fl. oz	
7. Meal replacement or energy bars	1 medium	
8. Breakfast bars	1 medium	
9. Cheese: Swiss, cheddar, provolone, American, others (including on sandwiches, salads or burgers)	1 oz/1 slice	
10. Cottage cheese	¾ cup	
11. Pizza with cheese	1 slice	
12. Lasagna, ravioli, etc. with cheese	1 cup	
13. Macaroni with cheese	1 cup	
14. Taco, burrito, quesadilla, etc. with cheese	1 each	
15. Soup (homemade or canned) made with milk	1 cup	
16. Sardines or salmon with bones	3 oz	
17. Tofu, firm, processed with calcium sulfate	½ cup	
18. Almonds (alone or in other foods and recipes)	¼ cup	
19. Broccoli, collards, turnip greens, kale, bok choy	½ cup cooked	
20. Beans: kidney, navy, black, baked, etc	1 cup cooked	
21. Pancakes, waffles or French toast	1 each	
22. "Total®" brand cold cereals (not other brands)	1 cup	
23. Other cold cereals (not including Total ®)	1 cup	
24. Calcium fortified orange juice	1 cup	
25. Other calcium-fortified drinks or juices	1 cup	

Please record whether your client has taken any of the following in the past month:

26. Vitamin/mineral supplement (including prenatal) Yes [ ] No [ ]

If Yes, Name of product: _____

A. Calcium (mg) per dose [ ]

B. Average number of doses taken per week [ ]

27. Calcium supplements or pills (including Viactiv® chews) Yes [ ] No [ ]

If Yes, Name of product: _____

A. Calcium (mg) per dose [ ]

B. Average number of doses taken per week [ ]

28. Tums® or Rolaids® or other antacids with calcium Yes [ ] No [ ]

If Yes, Name of product: _____

A. Calcium (mg) per dose [ ]

B. Average number of doses taken per week [ ]

Client's County	Month Day Year	For Office Use Only
	Date: ☐☐ ☐☐ ☐☐	ID# ☐☐☐☐

Short Calcium Questionnaire (version SCQ 2002): Nutrition Department, NIH Clinical Center, National Institutes of Health, Bethesda, MD

Appendix B

Survey Code: _____ 2

Calcium Survey #2

General Information: Last, we would like to collect some information about you. Your information will be kept private.

1. What is your current age?
- ☐ 19-30 years old
- ☐ 31-50 years old
- ☐ 51-70 years old
- ☐ 71 years or older

2. Do you consider yourself to be Hispanic or Latino?
- ☐ Yes
- ☐ No

3. What race do you consider yourself to be? (Check all that apply)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White
- ☐ Other (please describe):_____

4. What is the highest level of education you received?
- ☐ Less than high school diploma or GED
- ☐ High school diploma or GED
- ☐ Some college or technical school
- ☐ Bachelor's degree or more

5. Are you currently pregnant or breastfeeding? (Check all that apply)
- ☐ No
- ☐ Yes, I am pregnant
- ☐ Yes, I am breastfeeding

6. How many children ages <u>18 years old or younger</u> live with you on a regular basis?
- ☐ None
- ☐ 1-2 children
- ☐ 3-4 children
- ☐ More than 4 children

Client's County	Month Day Year	For Office Use Only
	Date: ☐☐ ☐☐ ☐☐	ID# ☐☐☐☐

Appendix C

Survey Code: _____ 3

Calcium Survey #3

Participant Opinions: We would also like to know your opinions about milk products. This information will also be kept private. The term "**milk products**" = any type of milk, yogurt (any type except frozen) or cheese (any type).

Please write an X in the box for one answer for each question.

Opinion	Do Not Know	Disagree A lot	Disagree Somewhat	Neither Agree or Disagree	Agree Somewhat	Agree A lot
	1	2	3	4	5	6
1. I like the taste of milk.						
2. I like the taste of yogurt.						
3. My family likes the taste of milk products.						
4. When it comes to nutrition, I am a good role model for my family when I eat/drink milk products.						
5. Nonfat (skim) or low-fat (1%) milk does not taste as good as 2% or whole (vitamin D).						
6. Milk products are a good source of calcium.						
7. For the most part, I get enough calcium in my diet now.						
8. I am concerned about my calcium intake.						
9. Milk products are important for strong bones.						
10. Nonfat (skim) or low-fat (1%) milk products may help lower high blood pressure.						
11. Nonfat (skim) or low-fat (1%) milk products may help with weight loss.						
12. I don't always buy milk products because they are expensive.						
13. Milk "goes bad" in my refrigerator before I drink it.						
14. I don't drink milk because it upsets my stomach.						
15. I don't eat or drink milk products because I have lactose intolerance.						

Client's County	Month	Day	Year	For Office Use Only
	Date: ☐☐	☐☐	☐☐	ID# ☐☐☐☐

Appendix D

Milk Product Equivalents* (MPEs)

Milk, any variety	1 cup
Evaporated milk	½ cup
Yogurt, any variety	1 cup
Hard cheese (cheddar, mozzarella, parmesan)	1 ½ ounces
Shredded cheese	1/3 cup
American processed cheese	2 ounces
Ricotta cheese	½ cup
Cottage cheese	2 cups
Pudding made with milk	1 cup
Ice cream	1 ½ cups

*Each serving size is equal to 1 cup of milk and milk products according to 2005 MyPyramid