



Prevalence of Self-reported Lactose Intolerance in a Multiethnic Sample of Adults

Theresa A. Nicklas, DrPH
Haiyan Qu, PhD
Sheryl O. Hughes, PhD
Sara E. Wagner, MPH
H. Russell Foushee, PhD
Richard M. Shewchuk, PhD

According to the National Institute of Diabetes and Digestive and Kidney Diseases, between 30 and 50 million Americans have the potential for lactose-intolerance symptoms. However, lactose-intolerance prevalence rates in practical life settings may be lower than originally suggested. The goal of this study was to determine the prevalence of self-reported lactose intolerance among a national sample of European American (EA), African American (AA), and Hispanic American (HA) adults. A nationally representative sample of randomly generated telephone numbers was purchased from a commercial sample provider. A nationally representative sample of randomly selected telephone numbers were called from the Survey Research Unit's Computer-Assisted Telephone Interviewing facility at the University of Alabama at Birmingham. Interviews were completed by a total of 1,084 respondents between the ages of 19 and 70 years with 486 EAs, 355 AAs, and 243 HAs. The response rate was 24.2%, and the cooperation rate was 34.2%. The age-adjusted lactose-intolerance prevalence estimates were 7.72%, 19.50%, and 10.05% for EAs, AAs, and HAs, respectively. For all respondents in the sample, the crude and age-adjusted self-reported lactose-intolerance prevalence rates were 13.38% and 12.04%, respectively. These results indicate that the prevalence of perceived lactose intolerance is significantly lower than what has been previously estimated. Health professionals need to be aware of the misrepresentation of currently estimated

lactose-intolerance rates and should continue to encourage individuals with lactose intolerance to consume dairy foods first to help meet key nutrient recommendations with proper guidance and education. *Nutr Today*. 2009;44(5):222-227

The 2005 Dietary Guidelines for Americans (DGA)¹ recommends the consumption of 3 cups of low-fat or fat-free milk or equivalent milk products each day for Americans aged 9 years and older and 2 cups for children aged 2 to 8 years.¹ Together, milk, cheese, and yogurt contain 9 essential nutrients including 4 of the 7 “nutrients of concern” identified by the 2005 DGA to be lacking in adult Americans’ diets: calcium, potassium, magnesium, and vitamin A, and 3 of the 5 “nutrients of concern” lacking in children’s diets: calcium, potassium, and magnesium.^{1,2} Adequate intake of dairy foods may also help decrease the risk of several chronic diseases including osteoporosis, hypertension, obesity, and colon cancer.³⁻⁵ While the dairy foods milk, cheese, and yogurt contribute a unique nutrient package to a healthful diet and may decrease the risk of certain chronic diseases, some individuals may limit or completely avoid consuming dairy foods and their nutrients because of perceived lactose intolerance. Avoiding dairy foods may have long-term deleterious effects on diet quality, bone metabolism, and strength, as well as overall health.^{1,6-8}

Lactose intolerance is defined as gastrointestinal symptoms including abdominal discomfort, cramps, flatulence, and nausea, associated with lactose maldigestion, a condition resulting in the incomplete digestion of lactose, a natural milk sugar.⁶ Lactose

maldigestion occurs when more lactose is consumed than the existing lactase enzyme can hydrolyze at one time.⁶ Based on lactose maldigestion studies, lactose intolerance in Americans has been estimated to occur in approximately 15% of whites, 50% of Mexican Americans, and 80% of African Americans (AAs).^{9–11}

Current lactose maldigestion incidence rates can greatly overestimate the percentage of those who may experience the subsequent lactose-intolerance symptoms after drinking a usual serving of milk (ie, 1 cup). One reason may be that the method used to diagnose lactose maldigestion used a 50-g test dose of lactose dissolved in water after an overnight fast—the amount of lactose in a quart of milk—rather than an amount usually consumed in a cup of milk (12 g).^{9,12} Since individuals with lactose maldigestion (ie, low lactase level) may or may not experience the symptoms of lactose intolerance, lactose-intolerance incidence rates do not necessarily equate with lactose maldigestion incidence rates.⁹ In addition, in many instances, lactose intolerance is either self-diagnosed or diagnosed by a physician using subjective information (ie, description of symptoms or elimination of foods) instead of objective testing methods.^{6,13,14}

According to the National Institute of Diabetes and Digestive and Kidney Diseases, between 30 and 50 million Americans have the potential for lactose-intolerance symptoms.¹⁵ However, because of previous diagnostic conditions used for lactose maldigestion (high lactose load of 50 g in water after an overnight fast), the inaccurate assumption that lactose maldigestion equals lactose intolerance, and poor diagnosis based on subjective information over objective analysis, lactose-intolerance prevalence rates in practical life settings may be lower than originally suggested.^{9,16} The National Medical Association, the largest and oldest national organization representing AA physicians in the United States, issued a consensus report¹⁷ stating that current estimates of lactose maldigestion may overestimate the number of AAs with lactose intolerance. According to this consensus report, only 24% of AAs surveyed actually reported being lactose intolerant.¹⁷ These results are important because they suggest that the official rates on the incidence of lactose intolerance among AAs may be overstated.

Reported prevalence rates of lactose intolerance in AAs are inconsistent, and very little is known about prevalence rates in the white and Hispanic populations. The goal of this study was to determine the prevalence of self-reported lactose intolerance among a national sample of European American (EA), AA, and Hispanic American (HA) adults. This study is one phase of a larger, ongoing project that was designed to examine the effects of self-reported lactose intolerance as it relates

to calcium intake and specific health problems that have been attributed to reduced intake of calcium and foods from the milk group. In addition, the larger study will examine an array of facilitative strategies that reportedly are used by those who perceive themselves as lactose intolerant and how these influence calcium/dairy food intake. This information will be a valuable contribution to public health and is an area of research that has not been well investigated.

Methods

Nominal Group Technique meetings¹⁸ were conducted with groups of individuals with self-reported lactose intolerance to develop content for a questionnaire. The questionnaire consisted of questions to assess lactose intolerance, symptoms, calcium intake, strategies for reducing symptoms, and demographics. The questionnaire was translated to Spanish, and Spanish-speaking interviewers conducted the survey with respondents who preferred answering questions in Spanish. Before implementation, the questionnaire was reviewed by a panel of health professionals with expertise in lactose intolerance.

The survey was conducted using Computer-Assisted Telephone Interviewing techniques. Interviews were completed by interviewers who were trained in proper interviewing procedures, study specific protocols, and human subjects' protection. Interviewers were monitored and supervised for quality control. The study was approved by the institutional review boards for Human Use at the University of Alabama at Birmingham and Baylor College of Medicine.

The sample frame consisted of all households in the contiguous United States with a telephone, including both landlines and cell phones. The sample was stratified by race/ethnicity into 3 mutually exclusive groups: EA, AA, and HA. A nationally representative sample of randomly generated telephone numbers was purchased from a commercial sample provider. A nationally representative sample of randomly selected telephone numbers was called from the Survey Research Unit's Computer-Assisted Telephone Interviewing facility at the University of Alabama at Birmingham. The sample was divided into 3 strata: census tracts with 50% or more AA population, census tracts with 50% or more HA population, and all remaining census tracts. Calls were placed to all numbers to locate households with eligible respondents.

At this time, interviews have been completed by a total of 1,084 respondents between the ages of 19 and 70 years with 486 EAs, 355 AAs, and 243 HAs. The response rate was 24.2%, and the cooperation rate was 34.2%. Respondents were compensated with a \$20

gift card for participating. A total of 351 men (32.4%) and 733 women (68.6%) completed the survey.

A person was classified as having lactose intolerance if he/she said yes to the question: “Do you think that you are lactose intolerant?” after a brief description of the condition was provided. People who responded *no* or *don’t know* were classified as not lactose intolerant.

To allow for comparisons across racial/ethnic groups and gender, age-adjusted self-reported lactose-intolerance prevalence rates were calculated in addition to the crude prevalence. Age-adjusted prevalence calculations for each racial/ethnic–gender combination were based on standard population US Census Bureau data (2005–2007 American Community Survey).

Results

Estimates of self-reported lactose-intolerance prevalence for males and females within each race/ethnicity group are presented in Table 1. Collapsing across gender, the age-adjusted lactose-intolerance prevalence estimates were 7.72%, 19.50%, and 10.05% for EAs, AAs, and HAs, respectively. For all race/ethnic groups, both the crude and the age-adjusted lactose-intolerance prevalence rates were higher for females than for males. For all respondents in the sample, the crude and age-adjusted self-reported lactose-intolerance prevalence rates were 13.38% and 12.04%, respectively.

Discussion

These results indicate that the prevalence of perceived lactose intolerance is significantly lower than what has been previously estimated based on reported lactose maldigestion studies. The age-adjusted prevalence rates of self-reported lactose intolerance was 7.7% for EAs, 19.5% for AAs, and 10.1% for HAs, with an overall prevalence rate of 12.0%. The crude prevalence of self-reported lactose intolerance in AAs (22.8%) is consistent with the National Medical Association Consensus Report.¹⁹

Based on previously reported prevalence rates for lactose intolerance (15% EAs, 80% AAs, 50% HAs) and what was found from this national survey, lactose maldigestion incidence rates do not equate with lactose-intolerance crude prevalence rates, and the prevalence rates for lactose intolerance are grossly overestimated.

A potential reason for this disparity is that the population-wide incidence rates for lactose maldigestion were based on studies using a breath hydrogen test using a challenge dose of 50 g of lactose in water. Although this test may be effective in diagnosing lactose maldigestion, it may overestimate the likelihood that an individual will experience symptoms of lactose intolerance after consuming a typical serving of dairy food (ie, 1 cup of milk, which contains 12 g of lactose) with a meal.²⁰

Table 1. Estimates of Self-reported Lactose Intolerance Prevalence by Race/Ethnicity and Gender (n = 1,084)

REG	Gender Group	Population Estimate	Population Proportion	Sample Size	Number With Self-reported LI	Crude ^a Prevalence	Age-Adjusted Prevalence Rate ^b
EAs	Male	77,426,611	49.80	168	11	6.55	7.39
	Female	78,044,109	50.20	318	31	9.75	7.91
	Total	155,470,720	100.00	486	42	8.64	7.72
AAs	Male	11,610,914	46.97	92	16	17.39	15.42
	Female	13,109,217	53.03	263	65	24.71	20.81
	Total	24,720,131	100.00	355	81	22.82	19.50
HAs	Male	14,704,497	52.38	91	8	8.79	8.42
	Female	13,367,230	47.62	152	14	9.21	10.57
	Total	28,071,727	100.00	243	22	9.05	10.05
Total		208,262,578	100.00	1,084	145	13.38	12.04

Abbreviations: AAs, African Americans; EAs, European Americans; HAs, Hispanic Americans; LI, lactose intolerance; REG, racial/ethnic groups.

^aCrude prevalence = (no. of people with self-reported lactose intolerance / no. of people in survey) × 100%.

^bAge-adjusted prevalence = Σ[(no. of people in an age group / total population) × 100% × (no. of people with self-reported lactose intolerance in an age group / no. of people in survey in an age group) × 100%].

Age-adjusted prevalence was calculated based on data from US Census Bureau, 2005–2007 American Community Survey: <http://www.census.gov/acs/www/index.html>.

A high lactose-intolerance incidence rate, particularly among select ethnic groups, may encourage some healthcare professionals and individuals to assume that experiencing the nonspecific symptoms associated with lactose intolerance after food intake is definitively due to lactose intolerance without objective testing. As a result, dairy food intake may be decreased or completely eliminated. As such, individuals and physicians have relied on subjective assessments for diagnosing lactose intolerance.¹⁴ However, since the symptoms of lactose intolerance are not specific to the condition, it is impossible to determine if lactase maldigestion is the source of the symptoms without objective testing.⁹

Limiting dairy food intake because of perceived lactose or milk intolerance may have adverse effects. For example, it has been shown that half of adolescent girls who considered themselves to be milk intolerant were not lactose “maldigesters” and were avoiding milk unnecessarily.²¹ Those who perceived themselves to be milk intolerant, regardless of whether they were maldigesters, had a significantly lower calcium intake and significantly lower bone mineral content of the spine.²¹ In addition, numerous studies have shown that adequate dairy food intake has been associated with improved bone health, lower blood pressure, lower body weight, lower incidence of colon cancer, and higher diet quality.^{1,3,5}

Individuals who avoid dairy products may find it difficult to meet the adequate intake for nutrients such as calcium and magnesium from other food sources alone.²² Also, dairy avoiders may have lower potassium intake, particularly since milk is the No. 1 source of this nutrient in America’s diet.^{23,24} The avoidance of dairy products because of perceived lactose intolerance at an early age may have detrimental effects that last throughout life.

Dairy foods provide one of the most natural bioavailable sources of calcium, and together, they provide a complete nutrient package that includes 8 additional essential nutrients. As a result, health authorities still recommend choosing dairy foods first for lactose maldigesters who experience the symptoms of lactose intolerance, through select strategies that may help manage symptoms.^{1,17,25} The 2005 DGA recommends consuming 3 servings of low-fat or fat-free dairy foods per day to ensure adequate nutrient intakes; for individuals who may be lactose intolerant, milk products such as yogurt because of its active cultures and increased viscosity, hard cheeses because of their lower lactose levels, or lactose-free milk are recommended, as well as taking lactase enzyme tablets before consuming milk or milk products.¹ Further supporting the 2005 DGA recommendation to choose

food items such as lactose-free cow’s milk from the dairy group first, a recent study assessing the taste preference of whites, AA, and Hispanic adults with self-reported lactose intolerance found that lactose-free cow’s milk was preferred over a substitute, nondairy, soy-based beverage.²⁶ The National Medical Association¹⁷ similarly recommends 3 to 4 servings of low-fat dairy per day for the AA population along with strategies to manage lactose intolerance. Those individuals who have trouble digesting lactose can consider alternatives to milk such as yogurt.^{9,27,28} The American Academy of Pediatrics supports consuming dairy foods to meet the calcium needs for bone health and other health benefits.^{29,30} The American Academy of Pediatrics recommends that lactose-intolerant children try alternatives to regular milk such as yogurt, cheese, or partially digested dairy products (products containing *Lactobacillus acidophilus* and lactase-pretreated milk) or use oral lactase supplementation.²⁵ Finally, several studies have shown that individuals with self-reported lactose intolerance can still consume dairy foods.^{31,32} A recent meta-analysis was conducted to determine the prevalence of lactose-intolerance symptoms in lactose-intolerant individuals consuming lactose-containing milk products as compared with placebo.³¹ Researchers found that individuals were able to consume a usual intake of dairy foods (1 cup) without experiencing lactose-intolerance symptoms.³¹ An earlier study demonstrated that self-reported lactose-intolerant individuals could tolerate 2 cups of milk a day without appreciable symptoms when 1 cup of milk was consumed with breakfast and 1 cup with dinner.³² The authors noted that 2 cups of milk intake daily can help individuals meet calcium recommendations and suggest lactose-intolerant individuals consume other calcium-containing, low-in-lactose foods such as hard cheese to further help meet needs.³² Based on these recommendations and studies, health professionals need to be aware of the misrepresentation of currently estimated lactose-intolerance rates and should continue to encourage individuals with lactose intolerance to consume dairy foods first to help meet key nutrient recommendations with proper guidance and education.

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Theresa A. Nicklas, DrPH, is professor, Department of Pediatrics, US Department of Agriculture/Agricultural Research Service (USDA/ARS) Children’s Nutrition Research Center at Baylor College of Medicine, Houston, Texas.

Haiyan Qu, PhD, is research assistant professor, Survey Research Unit, Ryals School of Public Health, University of Alabama at Birmingham.

Sheryl O. Hughes, PhD, is assistant professor, Department of Pediatrics, USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine, Houston, Texas.

Sara E. Wagner, MPH, is project director, Survey Research Unit, Ryals School of Public Health, University of Alabama at Birmingham.

H. Russell Foushee, PhD, is program director, Survey Research Unit, Ryals School of Public Health, University of Alabama at Birmingham.

Richard M. Shewchuk, PhD, is professor, Department of Health Services Administration, University of Alabama at Birmingham.

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Corresponding author: Theresa A. Nicklas, DrPH, USDA/ARS Children's Nutrition Research Center, Department of Pediatrics, 1100 Bates Ave, Baylor College of Medicine, Houston, TX 77030 (tnicklas@bcm.tmc.edu).

REFERENCES

- Dietary Guidelines for Americans 2005 Advisory Committee Report. US Department of Health and Human Services, US Department of Agriculture. <http://www.health.gov/dietaryguidelines/dga2005/document/html/executivesummary.htm>. Accessed June 15, 2009.
- US Department of Agriculture National Nutrient Database for Standard Reference, Release 21. US Department of Agriculture. <http://www.nal.usda.gov/fnic/foodcomp.search/>. Accessed March 18, 2009.
- Huth PJ, DiRienzo DB, Miller GD. Major scientific advances with dairy foods in nutrition and health. *J Dairy Sci*. 2006;89:1207–1221.
- Huth PJ, Fulgoni VL, DiRienzo DB, Miller GD. Role of dairy foods in the Dietary Guidelines. *Nutr Today*. 2008;43:226–234.
- Huncharek M, Muscat J, Kupelnick B. Colorectal cancer risk and dietary intake of calcium, vitamin D, and dairy products: a meta-analysis of 26,335 cases from 60 observational studies. *Nutr Cancer*. 2009;61:47–69.
- Miller GD, Jarvis JK, McBean LD. *The Handbook of Dairy Foods and Nutrition*. 3rd ed. Boca Raton, FL: CRC Press; 2007.
- Surgeon General's Report*. Washington, DC: US Department of Health & Human Services. http://www.surgeongeneral.gov/topics/obesity/calltoaction/fact_glance.htm. Accessed June 15, 2009.
- Savaiano D. Lactose intolerance: a self-fulfilling prophecy leading to osteoporosis? *Nutr Rev*. 2003;61:221–223.
- Jarvis JK, Miller GD. Overcoming the barrier of lactose intolerance to reduce health disparities. *J Natl Med Assoc*. 2002;94:55–66.
- Sabi T. Hypolactasia and lactase persistence; historical review and terminology. *Scand J Gastroenterol Suppl*. 1994;202:1–6.
- Scrimshaw NS, Murray EB. Prevalence of lactose maldigestion. *Am J Clin Nutr*. 1988;48:1086–1098.
- Saavedra JM, Perman JA. Current concepts in lactose malabsorption and intolerance. *Annu Rev Nutr*. 1989;9:475–502.
- Montes RG, Perman JA. Lactose intolerance. Pinpointing the source of nonspecific gastrointestinal symptoms. *Postgrad Med*. 1991;89:175–178, 181–184.
- Lovelace HY, Barr SI. Diagnosis, symptoms, and calcium intakes of individuals with self-reported lactose intolerance. *J Am Coll Nutr*. 2005;24:51–57.
- National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health. Washington, DC. <http://digestive.niddk.nih.gov/ddiseases/pubs/lactoseintolerance/>. Accessed June 15, 2009.
- McBean LD, Miller GD. Allaying fears and fallacies about lactose intolerance. *J Am Diet Assoc*. 1998;98:671–676.
- Wooten WJ, Price W. Consensus report of the National Medical Association. The role of dairy and dairy nutrients in the diet of African Americans. *J Natl Med Assoc*. 2004;96:5S–31S.
- Delbecq A, Van de Ven A, Gustafson D. *Group Techniques for Program Planning: A Guide to Nominal Group and Delphi Processes*. Glenview, IL: Scott Foresmann; 1975.
- Gerrior S, Bente L, Hiza H. Nutrient content of the U.S. food supply, 1909–2000. US Department of Agriculture, Center for Nutrition Policy and Promotion. Home Economics research report 56. 2004.
- Suarez FL, Savaiano DA, Levitt MD. A comparison of symptoms after the consumption of milk or lactose-hydrolyzed milk by people with self-reported severe lactose intolerance. *N Engl J Med*. 1995;333:1–4.
- Matlik L, Savaiano D, McCabe G, VanLoan M, Blue CL, Boushey CJ. Perceived milk intolerance is related to bone mineral content in 10- to 13-year-old female adolescents. *Pediatrics*. 2007;120:e669–e677.
- Fulgoni VL, Zariqheh S, Huth PJ, DiRienzo DB, Miller GD. Usual intake of vitamin A, calcium, magnesium, phosphorous and potassium from NHANES (2003–2004). *FASEB J*. 2008;22:1081.5.
- McGill CR, Fulgoni VL 3rd, DiRienzo D, Huth PJ, Kurilich AC, Miller GD. Contribution of dairy products to dietary potassium intake in the United States population. *J Am Coll Nutr*. 2008;27:44–50.
- Rafferty K, Heaney RP. Nutrient effects on the calcium economy: emphasizing the potassium controversy. *J Nutr*. 2008;138:1665–1715.
- Heyman MB. Lactose intolerance in infants, children, and adolescents. *Pediatrics*. 2006;118:1279–1286.
- Palacios OM, Badran J, Drake MA, Reisner M, Moskowitz HR. Consumer acceptance of cow's milk versus soy beverages: impact of ethnicity, lactose tolerance, and sensory preference segmentation. *J Sens Sci*. In press.

27. Jackson KA, Savaiano DA. Lactose maldigestion, calcium intake and osteoporosis in African-, Asian-, and Hispanic-Americans. *J Am Coll Nutr.* 2001;20:198S–207S.
28. Byers KG, Savaiano DA. The myth of increased lactose intolerance in African-Americans. *J Am Coll Nutr.* 2005;24:569S–573S.
29. Baker SS, Cochran WJ, Flores CA, et al. American Academy of Pediatrics. Committee on Nutrition. Calcium requirements of infants, children, and adolescents. *Pediatrics.* 1999;104:1152–1157.
30. Greer FR, Krebs NF. Optimizing bone health and calcium intakes of infants, children, and adolescents. *Pediatrics.* 2006;117:578–585.
31. Savaiano DA, Boushey CJ, McCabe GP. Lactose intolerance symptoms assessed by meta-analysis: a grain of truth that leads to exaggeration. *J Nutr.* 2006;136:1107–1113.
32. Suarez FL, Savaiano D, Arbisi P, Levitt MD. Tolerance to the daily ingestion of two cups of milk by individuals claiming lactose intolerance. *Am J Clin Nutr.* 1997;65:1502–1506.

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