Lactose Intolerance: Comparison of the nutritive value of milk substitutes to milk.

Meena Somanchi, PhD and Pamela Pehrsson, PhD
U.S. Dept. of Agriculture, ARS, Beltsville Human Nutrition Research Center, Beltsville, MD 20705

Beltsville Human Nutrition Research Center
Serving The Nation Since 1906. Improving Health Thru Research.

Abstract #2025 Program #774.7

Abstract

Self-reported LI suggests 12.3% of Americans cannot digest lactose. MS consumption is rising in the US, especially among LI individuals reporting a decrease in gastrointestinal symptoms with diets excluding dairy products. However, without milk and other dairy foods in the diet, meeting calcium and vitamin D recommendations may be challenging. Calcium and vitamin D are important for bone health, and a low intake may increase the risk for osteoporosis. The objective of this abstract is to compare select nutrients of MS to those of milk products. Nutrient profiles for milk (whole, 2%, 1%, fat-free milk and lactose-free skim milk), almond milk, soymilk and rice milk were retrieved from the USDA National Nutrient Database for Standard Reference. Analytical milk values were generated from USDA-contracted labs using official AOAC methods. MS, from major market producers, were unsweetened and fortified with calcium and vitamin D; values were compiled from product labels and calories, cholesterol, lactose, calcium, sodium , saturated fat, and vitamin D were compared to the milks. Results showed that MS do not contain any lactose, saturated fat or cholesterol. All MS are fortified with calcium (118-156mg/100g) and vitamin D (42-49IU/100g), comparable to milk products (112-124mg/100g and 47-51IU/100g, respectively). When compared to all other products, almond milk is lower in sodium (3mg vs. 39-51mg/100g) and calories (12 vs. 33-61cal/100g). MS nutrient profiles are needed for consumers and for researchers working with this population. Milk falls only behind carbonated soft drinks, bottled water and beer in beverage consumption in the US. Since MS do not contain lactose, saturated fat, cholesterol and are a comparable source of calcium and vitamin D, consumption may impact not only those with LI, but may be included in a low-sodium, reduced-calorie diet designed to reduce the risk of CVD and maintain bone health.

Introduction

Lactose intolerance is the inability or insufficient ability to digest lactose, a sugar found in milk and milk products. Self-reported LI suggests 12.3% of Americans cannot digest lactose [1]. Lactose intolerance is caused by a deficiency of the enzyme lactase, which is produced by the cells lining the small intestine. Lactase breaks down lactose into two simpler forms of sugar called glucose and galactose, which are then absorbed into the bloodstream. Not all people with lactase deficiency have digestive symptoms, but those who do may have lactose intolerance. Most people with lactose intolerance can tolerate some amount of lactose in their diet. People sometimes confuse lactose intolerance with cow milk allergy. Milk allergy is a reaction by the body's immune system to one or more milk proteins and can be life threatening when just a small amount of milk or milk product is consumed. Milk allergy most commonly appears in the first year of life, while lactose intolerance occurs more often in adulthood. The cause of lactose intolerance is best explained by describing how a person develops lactase deficiency. Primary lactase deficiency develops over time and begins after about age two when the body begins to produce less lactase. Most children who have lactase deficiency do not experience symptoms of lactose intolerance until late adolescence or adulthood. Researchers have identified a possible genetic link to primary lactase deficiency. Some people inherit a gene from their parents that makes it likely they will develop primary lactase deficiency. This discovery may be useful in developing future genetic tests to identify people at risk for lactose intolerance. Secondary lactase deficiency results from injury to the small intestine that occurs with diarrhea, celiac disease, Crohn's disease, or chemotherapy. This type of lactase deficiency can occur at any age but is more common in infancy. Lactose intolerance can be hard to diagnose based on symptoms alone. People may think they suffer from lactose intolerance because they have digestive symptoms; however, other conditions such as irritable bowel syndrome can cause similar symptoms. Because lactose intolerance is uncommon in infants and children younger than two years, a health professional should take special care in determining the cause of a child's digestive symptoms [1]. The objective of this abstract is to compare select nutrients of milk substitutes (MS) to those of milk products.

Methods

Nutrient profiles for milk (whole, 2%,1%, fat-free and lactose-free skim milk), almond, soy and rice were retrieved from the USDA National Nutrient Database for Standard Reference 25 [2] . Analytical milk values were generated from USDA-contracted labs using official AOAC methods[3] (Total lipid: 922.06, 925.12, 989.05, or 954.02; saturated fat: 989.05 (33.2.26), lactose: 982.14; Ca and Na: 984.27; vitamin D : 982.29 or 992.26). Energy values are based on the Atwater system for determining energy values[4]. Milk types were sampled nationally under the USDA-NIH National Food and Nutrient Analysis Program; samples were collected in 12-24 locations across the US and based on a census-based sampling plan [5]. MS, from major market producers, were unsweetened and fortified with calcium and vitamin D; values were compiled from product labels and cholesterol, lactose, calcium, total fat, and vitamin D were compared to the milks. Nutrient values were retrieved from the nutrition facts panel and converted to 100g basis. The sample size for MS was too small for statistical analyses, so a comparative study was performed.

Results and Discussion

From Table 1 it can be inferred that MS do not contain any lactose, or cholesterol when compared to milk (lactose 5 g/100g and cholesterol 2-10 mg in milk). Whole milk contributes the highest amount of calories (61 Kcal/100g) and sodium (42.5mg/100g), while almond milk contributes the lowest amount of calories (12 Kcal/100g) and sodium (3.4mg/100g).Total fats are low in MS (0.97 -1.65 g/100g) when compared to milk (0.1 – 3.25g/100g) (Figure 1). The selected samples of MS are fortified with calcium (118-156mg/100g) and vitamin D (42-49IU/100g), and therefore comparable to milk products (112-124mg/100g and 47-51IU/100g), respectively (Figure 2). We therefore plan to sample and analyze these food items in the National Food and Nutrient Analysis Program (NFNAP) [5]. Rice milk and soy milk was reported 50 times and 404 times over a 2 day period in the survey What We Eat in America/NHANES 2009-10 respectively[6] .Getting enough calcium and vitamin D is a concern for people with lactose intolerance when the intake of milk and milk products is limited. MS contribute 30% and 25-45% of the %DRI of calcium and vitamin D per serving respectively, without producing the symptoms of LI (Figure 3).The National Medical Association commented : "Lactose intolerance is a complex condition that is complicated by cultural beliefs…and may contribute to inadequate intake of key nutrients that may impact conditions that contribute to health disparities in African Americans" [7]. According to the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) 19.5% of African Americans, 10.05% of Hispanic Americans and 7.72% of European Americans are LI in the US [1]. Introduction of MS to these populations will be beneficial. Vegans are another group that will be benefitted by consuming MS. Because vegans do not eat dairy products, their calcium intakes tend to be low. Studies that have surveyed vegetarians' calcium intakes indicate that vegans consume 500 - 600 mg /day, Lacto-ovo vegetarians consume 800 - 900 mg/day and Non-vegetarians consume 1,000 mg /day [8].

Table 1. Comparison of The Nutritive Value of Select Nutrients in MS to Milk (100g)

Food	Calories	Total Fat	Saturated Fat (g)	Lactose (g)	Cholesterol (mg)	Ca (mg)	Na (mg)	Vit D (IU)
Whole milk	60.60	3.25	1.86	5.05	10.36	112.50	42.52	51.05
2 % milk	50.80	1.97	1.25	5.01	8.15	120.00	46.50	48.55
1 % milk	42.20	0.67	0.63	5.20	4.75	124.00	43.98	47.80
Skim milk	34.30	0.08	0.06	5.09	1.80	122.00	42.00	46.70
Lactose free milk	32.60	0.08	0.05	0.00	0.00	122.40	51.00	40.80
Soymilk	41.00	1.65	0.20	0.00	0.00	123.00	49.00	49.00
Rice milk	47.00	0.97	0.00	0.00	0.00	118.00	39.00	42.00
Almond milk	12.10	0.97	0.00	0.00	0.00	156.20	3.40	41.66

Figure 1. Comparison of The Nutritive Value of Select Nutrients in MS to Milk

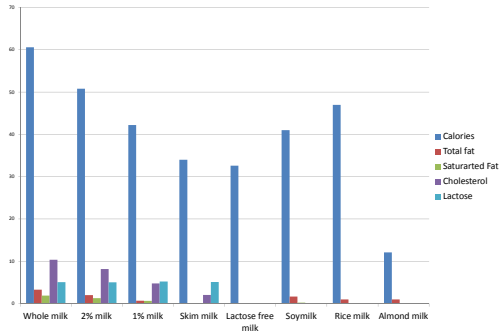


Figure 2. Comparison of The Nutritive Value of Select Nutrients in MS to Milk

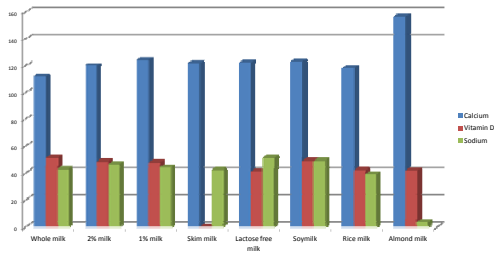
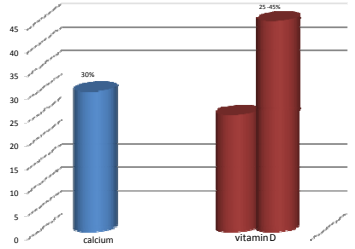


Figure 3. Percent Contribution of Calcium and Vitamin D to %DRI By MS Per Serving



Significance

MS nutrient profiles are needed for consumers and for researchers working with LI population. Milk falls only behind carbonated soft drinks, bottled water and beer in beverage consumption in the US. Dietary guidelines 2010 recommends "Choose foods that provide more potassium, calcium, and vitamin D, which are nutrients of concern in the American diets. These foods include….milk and milk products." MS are a comparable source of calcium and vitamin D to milk. Additional benefits are that they not contain lactose, cholesterol, are low in total fats and consumption may impact not only those with LI, but may be included in a diet designed to reduce the risk of CVD and maintain bone health.

References

1 National Digestive Diseases Information Clearing house. http://digestive.niddk.nih.gov/ddiseases/pubs/lactoseintolerance.
2.Nutrient Data Laboratory, USDA. www.ars.usda.gov/nutrientdata.
3. AOAC International. 2010. Official Methods of Analysis, 18th ed., AOAC International, Gaithersburg, MD. http://www.aoac.org.
4. Merrill, A.L., and B.K. Watt. 1973. Energy Value of Foods: Basis and Derivation, revised. U.S. Department of Agriculture, Agriculture Handbook 74.
5.Pehrsson PR, Haytowitz DB, Holden JM. 2003. The USDA's National Food and Nutrient Analysis Program: Update 2002. J Food Comp Anal 16:331-341.
6. . Anand, J, Goldman, JD, Steinfeldt, LC, Montville, JB, Heendeniya, KY, Omolewa-Tomobi, G, Enns, CW, Ahuja, JK, Martin, CL, LaComb, RP, Moshfegh, AJ. 2012. What We Eat In America, NHANES 2009-2010: Documentation and Data Files. Worldwide Web Site: Food Surveys Research Group. Available: http://www.ars.usda.gov/Services/docs.htm?docid=18349.
7.DeLegge MH, and Duyff R. Fact or Fiction? Learn the Truth About Lactose Intolerance and Discover Real Life Solutions for Maintaining Good Nutrition. http://www.nationaldairycouncil.org/SiteCollectionDocuments/health_wellness/lactose_intolerance/NDC%20LI%20November%202012%20Webinar_11.12.12_FINAL.pdf.
8. Virginia Messina, Reed Mangels and Mark Messina (2004). The Dietitian's Guide to Vegetarian Diets. Appendix G. Jones and Bartlett publishers 2004