

# Lactose Intolerance: Considerations for the Clinician



Stacey McCray

**An estimated 30% of Americans and approximately 65%–75% of people worldwide have decreased intestinal lactase levels, which may lead to lactose intolerance and difficulty digesting dairy products. The primary goals for treatment of lactose intolerance include symptom relief and ensuring adequate nutritional status. Many patients who wish to continue to consume dairy products (lactose) can do so by adjusting the type, amount and timing of intake. Patients with lactose intolerance are at risk for inadequate intake of calcium and vitamin D, which ultimately leads to an increased risk of osteoporosis. The intent of this article is to provide practical guidelines for working with patients who are lactose intolerant and to answer some common questions that may arise.**

## INTRODUCTION

**L**actose malabsorption occurs when lactose, the primary sugar in dairy products, is not completely digested and absorbed in the small bowel. Lactase, the enzyme required to hydrolyze lactose for intestinal absorption, is found primarily in tips of the villi in the jejunum (1). If lactase activity is decreased as a result of primary deficiency, altered anatomy, or an underlying disease process, malabsorption of lactose may occur. When unabsorbed lactose reaches the colon, colonic bacteria use this substrate for fermentation, producing gas and short chain fatty acids. The

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unabsorbed lactose also affects osmolality, causing water to be drawn into the bowel and accelerating the intestinal transit time (1). The symptoms of lactose intolerance may include bloating, diarrhea, flatulence, abdominal pain, distention and cramping.

The most common cause of lactose malabsorption and lactose intolerance is a natural decrease in intestinal lactase levels, known as primary adult hypolactasia (2) or lactase non-persistence (1). This decrease usually begins during childhood or adolescence and is very common among adults (1,3). It is estimated that 30% of Americans (4) and 65%–75% (1,4) of people worldwide have low lactase levels. Human congenital lactase deficiency is an extremely rare condition where there is a complete lack of lactase activity (1).

Lactose malabsorption may also be a secondary problem due to small bowel disease or other disorders which cause inflammation or flattening of the villi (5). Malabsorption in such cases is thought to be primarily due to decreased lactase production, although other factors may also play a role in tolerance (6). Secondary lactase deficiency may be transient and often resolves once the underlying condition improves (7).

A complete review of the epidemiology, pathophysiology and other details of lactose malabsorption and lactose intolerance are available elsewhere (1,2). The intent of this article is to provide practical information for dealing with the clinical aspects of lactose intolerance.

### DIAGNOSING LACTOSE INTOLERANCE— THE HYDROGEN BREATH TEST

Currently, the most common test used to diagnose lactose malabsorption is the lactose hydrogen breath test. During the test, a patient is given a large dose of lactose, after which hydrogen levels in the breath are measured at regular intervals. A rise in hydrogen breath levels (>20 ppm over baseline) theoretically indicates increased gas production due to malabsorbed lactose reaching the large intestine. In addition to the physician interpretation fee, the cost of the test is in the range of \$180.

There are several things to remember about the hydrogen breath test. First, it diagnoses lactose malabsorption. This may or may not translate into lactose intolerance. Numerous studies have shown a disconnect between results of the hydrogen breath test and clinical symptoms (8–13). The test uses a large amount of lactose, usually 50 grams (equivalent to 4 glasses of milk), and is given in a form which is often the most difficult for patients to tolerate (lactose in water) (1). Many adult patients will have trouble digesting this amount of lactose regardless of how they tolerate smaller amounts in a normal, regular diet. Keep in mind also, that this dose of lactose will likely cause significant discomfort to a patient with lactose intolerance. Such patients may not agree the test is simple or easy.

False negative results may be caused by an absence of hydrogen producing bacteria, recent use of antibiotics, or recent high colonic enema (2). Certain factors

may increase hydrogen production regardless of lactase status; these include sleep, exercise, use of aspirin, or smoking (2). Bacterial overgrowth of the small bowel may also make interpretation of this test more difficult. An earlier rise in hydrogen production would be expected in this setting (small bowel versus colonic production). Unfortunately, many conditions that are associated with bacterial overgrowth may also affect intestinal motility, further clouding the issue. (Look for more on bacterial overgrowth in an upcoming issue.)

Given the above factors, as well as the expense of diagnostic testing, a two-week empiric trial of a low lactose (<8–10 grams) (14) or a lactose free diet may be useful. If such a trial proves successful, a patient may choose to continue to limit lactose or gradually increase lactose intake based on the following suggestions.

### SOURCES OF LACTOSE

At first, it may seem obvious what foods contain lactose—dairy products, of course (see Table 1), however, some sources of lactose may be hidden and not so obvious.

Soy milk and rice milk do not contain lactose and may be good alternatives for lactose intolerant patients. However, it is important to note that some brands of soy and rice milk do not contain calcium or vitamin D. Patients hoping to use rice or soy milk as an alternate calcium and vitamin D source should look for brands which specifically state that they contain these nutrients.

Liquid nutritional supplements may or may not contain lactose. Nearly all formulas recommended for enteral feeding are lactose free. Table 2 shows the lactose content of some commonly used nutritional supplements and meal replacement products.

Some patients who are extremely lactose intolerant may also have to look for hidden sources of lactose in baked goods, salad dressings, powdered mixes and other products. Some ingredients to watch out for on labels in addition to milk and lactose are: nonfat dry milk powder, dry milk solids, whey, curds, caseinate, milk sugar or milk by-products.

Finally, lactose is an inactive ingredient in numerous medications. For example, some over the counter

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**Table 1**  
**Lactose Content of Common Dairy Products**

Product	Serving Size	Lactose Content (g)
Milk (whole, lowfat, or nonfat)	1 cup	11
Buttermilk	1 cup	10
Acidophilous milk	1 cup	11
Yogurt, whole milk	1 cup	10–12
Yogurt, low fat	1 cup	5–19
Cheese (such as cheddar, American, Swiss, parmesan)	1 oz	0.4–3
Cottage cheese	1/2 cup	3–4
Ice Cream	1/2 cup	5–6
Sherbet, orange	1/2 cup	2
Whipped cream	1/2 cup	3
Sour cream	1/2 cup	4
Cream cheese	1 oz	1
Half & Half/cream	2 tbsps	1
Butter/margarine	1 tbsps	Trace

pain relievers, anti-diarrheal agents and multi-vitamin/mineral supplements contain lactose. Many prescription drugs also contain lactose. This may be an issue for patients who are extremely intolerant and it may be something to look for in patients who do not completely respond to a lactose free diet alone.

**DIETARY MANAGEMENT**

Lactose intolerance appears to be dose dependent. By adjusting the type and amount ingested, many patients with lactose intolerance can include dairy products in their diet. Suarez, et al. (4) showed that patients with lactose maldigestion could tolerate a diet containing 1300 mg of calcium from dairy products each day. Many patients can tolerate small amounts of dairy products throughout the day, such as 1/2–1 cup of milk at a time for a total of up to two cups per day (3,4).

Some dairy foods are better tolerated than others by patients with lactose intolerance. Hard cheeses have a relatively low lactose content and are often tolerated. Cultured yogurt is generally very well tolerated, even by lactose malabsorbers (1,15). This is likely, at least in part, due to the bacteria contained in cultured yogurt, which continue to digest lactose both in storage and after ingestion in the small bowel. Acidophilous milk, however, is generally no better tolerated than regular milk (1,15,16). The lactobacillus bacteria do not hydrolyze lactose like the bacteria in yogurt. Buttermilk has also been found to be no better tolerated than regular milk (15,16).

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**Table 2**  
**Lactose Content of Common Liquid Nutritional Supplements**

Product	Serving Size	Grams of Lactose (grams)
Ensure® drink	1 can	0
Ensure® powder	1/2 cup powder with 3/4 cup water	0
Boost® drink	1 can	0
Ensure® bars	1 bar	2–3
Ensure® pudding	4 oz serving	5
Boost® pudding	4 oz serving	0
Carnation® Instant Breakfast™ Powder (vanilla)	1 packet of powder	8
Carnation® Instant Breakfast™ Ready to Drink varieties	1 packet mixed with 8 oz milk	19
Slim-fast® powder	1 can	9–13
Slim-fast® Ready to Drink varieties	1 scoop mixed with 8 oz milk	15–16
Slimfast® water-mixable powder with soy protein	1 can	10–12
Slim-fast® Fruit Juice Powder	2 scoops mixed with 8 oz water	0
Slim-fast® Ready-to-Drink Fruit Juice Shakes with soy protein	1 scoop mixed with 8 oz juice	0
	1 can	0

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**Table 3**  
**Lactase Enzyme Replacement Supplements**

Type / Strength	Recommended Dose	Lactaid® (cost per dose)	Store Brand (cost per dose)	Cost per year (based on 2 doses/day)
Regular (3000 lactase units)	3 caplets	\$0.30	\$0.23	
Extra (4500 lactase units)	2 caplets	\$0.31	\$0.24	\$102.00–\$227.00
Ultra (9000 lactase units)	1 caplet	\$0.25	\$0.14	

Other factors may also affect tolerance of lactose-containing foods. Ingesting dairy products with a meal seems to improve tolerance (1). This is thought to be due to the effect of gastric emptying and slower delivery of the lactose to the small bowel. Consuming foods with a higher fat content (such as ice cream) may also produce a similar effect, although this has not been proven (1).

**COLONIC ADAPTATION**

It has been shown that some patients may have improved tolerance of lactose over time if lactose-containing foods are provided slowly and consistently (17). This does not mean the small bowel adapts to produce more lactase; the human small bowel does not produce more lactase in response to increased consumption (11). This "adaptation" most likely occurs in the colon. Over time, the colonic flora may adapt to the lactose load, resulting in less gas production. This, along with adaptations in motility and pH, may decrease or eliminate the symptoms of lactose intolerance. (5,11).

**SUPPLEMENTAL LACTASE ENZYMES AND OTHER PRODUCTS**

Supplemental lactase enzymes are available for patients who do not tolerate lactose but wish to continue to consume dairy products (see Table 3 for information on common types and brands). These are most readily available in caplet or chewable tablet forms. Patients may wish to try the suggestions discussed above before adding the expense of lactase enzyme supplements. Some dairy products that are more easily tolerated (hard cheese, yogurt) may not require sup-

plemental enzymes. In addition, most lactase supplements recommend a dose of 9000 lactase units be taken with dairy products. This dose of enzyme may not be necessary for all patients; patients may wish to start with a lower dose initially and titrate up based on symptoms.

Liquid enzyme drops that can be added to milk no longer appear to be readily available. They may, however, still be available in specialty stores and online. Instead, most grocery stores carry ready to drink 100% lactose reduced milk in the dairy section. It is generally available in fat free, 1%, 2%, and whole milk varieties. The cost of lactase treated milk is approximately \$0.39 per cup versus \$0.17–0.29 per cup of regular milk. Vitamite® 100, also found in many grocery stores, is a non-dairy, lactose free milk alternative. Vitamite® 100 contains calcium and vitamin D in levels similar to milk; however, the protein content is lower (3 grams versus 9 grams per 8 oz serving). The cost is similar to that of lactose reduced milk.

**CALCIUM INTAKE**

Several studies have shown that patients with lactose intolerance have significantly less calcium intake than those who tolerate lactose (8,9,18). In two of these studies, patients who were lactose intolerant had average calcium intake of only 300 mg (9) to 388 mg/day (18). This is only 20%–40% of the recommended calcium intake depending on gender, age and other factors. Table 4 shows the National Institutes of Health recommendations for optimal calcium intake (19); Table 5 shows the Adequate Intake (AI) level for calcium as set in the Dietary Reference Intakes (DRIs)

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**Table 4**  
National Institutes of Health Recommendations for Optimal Calcium Intake (19)

Age and other considerations	Recommended calcium intake (mg/day)
Adolescents and young adults (11–24 yrs)	1200–1500
Women (25–50 yrs)	1000
Pregnant or lactating women	1200–1500
Postmenopausal women (25–65 yrs) on estrogen therapy	1000
Postmenopausal women (25–66 yrs) not on estrogen therapy	1500
Men (25–65 yrs)	1000
Men and women over 65 yrs	1500

**Table 5**  
Adequate Intake (AI) Levels for Calcium Based on 1997 Dietary Reference Intakes (DRIs) (20)

Age (Both men and women)	AI for calcium (mg/day)
19–50 years	1000
> 50 years	1200

(20). The DRIs were published by the Food and Nutrition Board (FNB) and replace the Recommended Dietary Allowances (RDA). Adequate intake (AI) levels, such as those for calcium and vitamin D (see

Tables 5 and 8), are based on the average nutrient intake of *healthy* groups of people.

Decreased calcium intake translates into decreased bone mass and higher risk for osteoporosis. Studies have shown that patients with lactose intolerance had significantly lower bone mineral density (BMD) than those who tolerate lactose (6,8). Therefore, the calcium intake of all patients with lactose intolerance should be evaluated (see Table 6). Patients with lactose intolerance absorb calcium under normal mechanisms, including calcium from dairy products (20).

**Table 6**  
Approximate Calcium Content of Foods and Other Products

Food	Serving Size	Approximate Calcium Content (mg)*
Milk	1 cup	285–300
Cheese	1 oz	175–275
Yogurt	1 cup	275–450
Ice cream	1/2 cup	90–135
Almonds	1 oz	75
Broccoli	1 cup	90–180
Greens (turnip, collard)/kale	1/2 cup	90–180
Salmon, canned, with bones	3 oz	165–285
Sardines, canned, with bones	3 oz	370
Tofu, firm	1/2 cup	155–260
Calcium fortified orange juice	1 cup	290
Fortified cereals	1 serving	varies widely by brand
Vitamite® 100	1 cup	300
Multivitamin with minerals	1 dose	0–210

\*Calcium content of foods may vary based on brand, ingredients, etc. Patients should read labels to determine the actual calcium content of a certain food.

### CALCIUM AND CALCIUM SUPPLEMENTS

Patients who are unable to consume adequate calcium through the diet may require calcium supplementation. The first step is to assess how much calcium a patient is actually receiving in the diet, then make recommendations for supplemental calcium based on requirements (see Tables 4, 5, 6).

Numerous brands of calcium supplements are currently available (see Table 7 for common brands). Calcium carbonate and calcium citrate are the most common forms. Some studies have shown that calcium citrate is better absorbed than calcium carbonate (20–22), however, a recent study showed equal absorption when vitamin D was also supplemented (23). For patients with achlorhydria, calcium

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Brand	Elemental Calcium (mg) per tablet	Approximate cost per tablet	Comments
<b>Calcium Carbonate: 40% elemental calcium (25)</b>			
Tums®	200	\$.02	
Extra Strength Tums®	300	\$.04	
Oscal® 500	500	\$.10	<ul style="list-style-type: none"> <li>• Also available with 200 IU vitamin D</li> <li>• Also available in 250 mg dose</li> </ul>
Caltrate® 600 Plus™	600	\$.11	<ul style="list-style-type: none"> <li>• Contains 200 IU vitamin D plus additional minerals</li> </ul>
Viactiv®,	500	\$.10	<ul style="list-style-type: none"> <li>• Contains 100 IU vitamin D and 40 mcg vitamin K</li> <li>• Contains &lt;0.5 g lactose per dose</li> <li>• 20 calories per piece</li> </ul>
<b>Calcium Citrate: 21% elemental calcium (25)</b>			
Citrical®	200	\$.07	
Citrical® + D	315	\$.11	<ul style="list-style-type: none"> <li>• Contains 200 IU vitamin D</li> </ul>

Age (Men and Women)	AI for Vitamin D (IU)
19–50 years	200
51–70 years	400
> 70 years	600

source of vitamin D in the diet. Although some vitamin D is derived from sunlight, some vitamin D in the diet is also important in maintaining adequate levels (20). Ultraviolet radiation in northern areas may not allow for adequate vitamin D synthesis (3). Moreover, the elderly (>65 yrs) may lose some of their capacity to synthesize vitamin D from sunlight, in addition to often decreased exposure (20). Therefore, many patients may benefit from a calcium supplement that also includes vitamin D. See Table 8 for vitamin D recommendations based on the DRIs (20).

carbonate taken with meals (20) or calcium citrate (24) may be better absorbed. Optimal absorption of calcium occurs with doses of <500 mg at a time (20), hence, smaller doses of calcium (<500 mg or less) over the course of the day rather than one large dose is recommended. Patients with severe lactose intolerance might need to check the calcium supplement for lactose content (see discussion of lactose in medications above).

**SECONDARY LACTASE DEFICIENCY**

The need for lactose restriction in patients at risk for secondary lactase deficiency may vary among individuals. For example, patients with Inflammatory Bowel Disease (IBD) are often routinely told to avoid dairy products due to fear of lactose intolerance. However, the incidence of lactose malabsorption in patients with ulcerative colitis is no greater than that of others of similar ethnic origin (26–28). Patients with Crohn's disease do seem to have an increased incidence of lactose malabsorption, especially during acute flares

**OTHER NUTRIENTS**

Adequate vitamin D is required for optimal calcium absorption. Fortified dairy products are the major

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**Table 9**  
**Summary Tips for Managing Lactose Intolerance**

- If a patient wishes to continue to consume lactose containing foods, try the following:
  - Smaller doses of lactose throughout the day
  - More easily tolerated dairy products (such as cultured yogurt, hard cheese)
  - Consumption of lactose containing foods with a meal
  - Trial of lactase enzymes, if needed
- Ensure adequate calcium intake
  - Consider current intake of calcium from food and supplements when making recommendations for additional calcium
  - Recommend supplements in doses of <500 mg at a time
- Ensure adequate vitamin D intake

## CONCLUSION

Lactose intolerance is a common clinical problem. Treatment is aimed at symptom relief and ensuring adequate calcium and vitamin D nutriture. Tables 9 and 10 provide a summary of guidelines for managing lactose intolerance and additional sources of information. ■

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(6,26); although this may or may not translate into lactose intolerance. Many, including the Crohn's and Colitis Foundation of America (CCFA), recommend avoiding routine restriction and instead basing recommendations on individual tolerances and preferences (27,29). Other conditions where lactose intolerance may be seen include: celiac disease, radiation enteritis, drug induced or infectious enteritis, HIV enteropathy, and Whipple's disease (2,5).

**Table 10**  
**Additional Sources of Information on Lactose Intolerance**

### Useful Web Sites

- Medline Plus Health Information (US National Library of Medicine and NIH): <http://www.nlm.nih.gov/medlineplus/lactoseintolerance.html>
- National Digestive Diseases Information Clearinghouse <http://www.niddk.nih.gov/health/digest/pubs/lactose/lactose.htm>
- The Crohn's and Colitis Foundation of America (CCFA) [www.ccfa.org](http://www.ccfa.org)

### Additional Resources

- *The Lactose Intolerance Nutrition Guide*; available through the American Dietetic Association at 1-800-877-1600 or [www.eatright.com/catalog/cat.php?CatNum=307x](http://www.eatright.com/catalog/cat.php?CatNum=307x)

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