

Polling Question #1

What percentage of the U.S. population considers itself to be lactose intolerant?

- a. 0 – 25%
- b. 26 – 50%
- c. 51 – 75%
- d. 76 – 100%

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Polling Question #2

Which of the following are unintended health consequences associated with dairy avoidance?

- a. Diabetes, hypertension, osteoporosis, metabolic syndrome
- b. Low diet quality
- c. All of the above
- d. None of the above

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Polling Question #3

Should individuals diagnosed with lactose intolerance consume dairy foods?

- a. yes
- b. no
- c. maybe
- d. never

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Beginning With The End in Mind (Take Home Messages)

- Lactose intolerance is a real clinical condition but not as prevalent as previous literature suggests
- Inadequate dietary calcium and vitamin D intake predisposes individuals to certain diet-preventable chronic disease states, while a calcium-rich diet with fruits, vegetables, dairy foods and lean protein improves health
- Lactose intolerance does not necessitate dairy avoidance, especially when tips for tolerance are used

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Scientific Advances

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NIH Consensus Development Conference

- NIH Consensus Development Conference:
Lactose Intolerance
and Health

February 22–24, 2010
Bethesda, Maryland



Full report: <http://consensus.nih.gov/2010/lactose.htm>

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NIH Consensus Development Conference

- **Objective:** To provide health care providers, patients, and the general public with a responsible assessment of currently available data on lactose intolerance and health.

Participants:

- Panel: A non-DHHS, nonadvocate **14-member panel**
- Presenters: **22 experts** from pertinent fields presented data to the panel and conference audience.

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- What is the prevalence of lactose intolerance, and how does this prevalence differ by race, ethnicity and age?
- What are the health outcomes of dairy exclusion diets?
- What amount of daily lactose intake is tolerable in subjects with diagnosed lactose intolerance?

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- What strategies are effective in managing individuals with diagnosed lactose intolerance?
- What the future research needs for understanding and managing lactose intolerance?

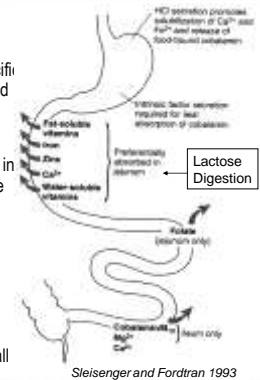
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What is the prevalence of lactose intolerance, and how does this prevalence differ by race, ethnicity and age?

Lactose Digestion

Normal Nutrition

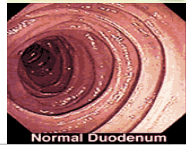
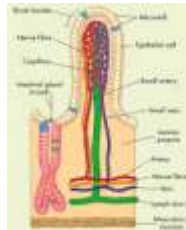
- Nutrient absorption is site-specific so potential deficiencies depend on the anatomy
- Carbohydrate digestion begins in the mouth and continues in the small bowel
- Protein digestion begins in the stomach and continues in the small bowel
- Fat digestion occurs in the small bowel



Sliesenger and Fordtran 1993

Small Intestine Villi

- Lactase is a brush border enzyme that hydrolyzes lactose to glucose and galactose
- Any process or illness that affects or damages the brush border of the villi will negatively impact absorption and digestion of nutrients



http://www.daviddarling.info/images/intestinal_villi.jpg

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Normal Lactose Digestion

- Lactase enzyme
 - Gene on chromosome 2
 - Specific for the milk sugar, lactose
- Genetic mutations
 - Genotype polymorphism CC-13910 most commonly associated with lactase non-persistence (hypolactasia) in adults
 - Mutation of C to T-13910 lactase persistence
 - Mutation of T to A-22018 lactase persistence

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Three Types Of Lactase Non-Persistence

- **Congenital lactase non-persistence**
 - Absence of lactase from birth
 - Two rare autosomal recessive genetic disorders
- **Primary lactase non-persistence**
 - Most common cause of deficiency in adults
 - Premature infants with under-developed GI tracts
 - 75% of cases of “lactase deficiency”

Arrigoni et al. *American Journal of Clinical Nutrition*, Vol 60, 926-929, 1994

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Primary Lactase Non-persistence

- This is the normal age-related decline in lactase activity in adults called “lactase non-persistence” or primary deficiency (occurs between 2-20 years of age)
- *This is not a disease!*
- Genetically regulated residual activity level
- Complete absence of lactase activity is rare

Kipple and Ornelas, *The Cambridge World History of Food 2000*
<http://www.cambridge.org/us/books/kipple/lactase.htm>, accessed 15 May 2009

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Secondary Lactase Non-persistence

- **Secondary lactase non-persistence**
 - Any disease or procedure that damages the mucosal lining of the small intestine can cause secondary non-persistence
 - Can occur after a prolonged course of antibiotics
 - Once the mucosa heals, the lactase activity returns to normal in approximately 3 weeks
 - Secondary lactase non-persistence does not automatically result in severe intolerance

Arrigoni et al. *American Journal of Clinical Nutrition*, Vol 60, 926-929, 1994

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Lactose Maldigestion

- “**Lactose maldigestion**” occurs when gut bacteria breakdown lactose not absorbed in the small bowel (an intraluminal process).
- This produces acids, hydrogen and methane gas but is an asymptomatic process in most adults

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Lactose Intolerance

- "Lactose intolerance" is the clinical condition that occurs when there are symptoms associated with lactose consumption.
- Symptoms may be caused by either:
 - Decreased lactase levels
 - Osmotic effects of the lactose and breakdown products

Scientifically sound screening tool for lactose intolerance not typically used in US

<http://www.3aday.org/My-Diet-And-Nutrition/Lactose-Intolerance/Pages/Lactose-Intolerance.aspx>
<http://digestive.niddk.nih.gov/ddiseases/pubs/lactoseintolerance/>; accessed December 15, 2009

Lactose Intolerance NIH Consensus Development Conference

Consistent Definition:

"Lactose intolerance" is the clinical condition that occurs when there are symptoms associated with lactose consumption.

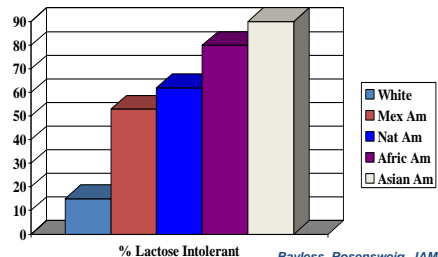
NIH Consensus Development Conference:

Clinical diagnosis of lactose intolerance requires **both** documented lactose maldigestion and the presence of symptoms

<http://digestive.niddk.nih.gov/ddiseases/pubs/lactoseintolerance/>; accessed December 15, 2009
<http://www.3aday.org/My-Diet-And-Nutrition/Lactose-Intolerance/Pages/Lactose-Intolerance.aspx>

Diagnostic Evaluation

Lactose Intolerance and Racial Composition (50 gram Lactose Breath Hydrogen Test)



Bayless, Rosensweig, JAMA 1966
Scrimshaw, Murray, AJCN 1988

Table 3. Survey Questions and Responses on Lactose Intolerance Among a Nationally Representative Sample of African Americans and the General US Population

Survey Questions African Americans (n = 2016) General Population (n = 1305)

Q9. Do you believe yourself to be lactose intolerant?

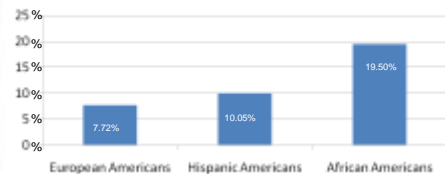
| | | |
|------------|-------------------------|-----------|
| Yes | 24% (486) ^a | 11% (143) |
| No | 58% (1166) ^a | 73% (948) |
| Don't know | 18% (364) | 16% (214) |

Keith et al. JNMA 2011

Lactose Intolerance Prevalence

12% of Adults Report Being Lactose Intolerant

Percent of Adults, by Ethnic Group, Who Self-Reported Lactose Intolerance



Source: Nicklas TA et al. Prevalence of Self-Reported Lactose Intolerance in a Multi-ethnic Sample of Adults. *Nutrition Today*, Sept/Oct 2009.

Objective Measures

- **Lactose Breath Hydrogen (Gold Standard)**
 - Uses 25 gram dose (super-physiologic)
 - 3 hour long test
 - May not correlate with symptoms
- **Hypolactasia Genetic Testing**
 - Not Widely Used
 - May be future gold standard
- **Mucosal Biopsy/ Lactase Assay**
 - Not routinely done
- **Stool pH testing**
 - Primarily used in pediatric populations

Keith et al. JNMA 2011

Q10. Why do you believe yourself to be lactose intolerant? (Among those who self-identified as being lactose intolerant, Q9)

- I experience physical discomfort after eating dairy foods
75% (365/486) 70% (100/143)
- I was diagnosed by a medical professional or specialist
19% (92/486)a 29% (42/143)
- Based on information from the news media or other source
24% (116/486) 27% (29/143)
- Based on family history
24% (114/486) 20% (29/143)
- Word of mouth, talking with friends
19% (90/486) 16% (23/143)
- Other reasons
4% (21/486) 5% (7/143)
- Don't know
2% (8/486)a 5% (7/143)

Keith et al. JNMA 2011

All That Rumbles Is NOT Lactose Intolerance! (Recognize The Masqueraders)

- Irritable Bowel Syndrome
- Celiac Disease
- Inflammatory Bowel Disease
- GERD

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What amount of daily lactose intake is tolerable in subjects with diagnosed lactose intolerance?

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- Adults and adolescents who have been diagnosed with lactose malabsorption can typically ingest at least **12** grams of lactose when administered in a single dose (equivalent to the lactose content found in **1 cup** of milk) with no or minor symptoms.
- Individuals with lactose malabsorption can tolerate larger amounts of lactose if ingested with meals and distributed throughout the day.

NIH Consensus Statement 2010

NIH Consensus Development Conference

- However, **50** grams of lactose (equivalent to the lactose content found in 1 quart of milk) usually induces symptoms in those adults with lactose malabsorption when administered as a single dose without meals.
- Some data suggest that the routine ingestion of lactose increases the amount of lactose that is tolerable in both adults and adolescents.

NIH Consensus Statement 2010

NIH Consensus Development Conference

- For women with lactose malabsorption, tolerance to dietary lactose may improve during pregnancy but then worsen after delivery.
- There is no scientific evidence to identify the tolerable dose of lactose for children with lactose malabsorption.
 - Lactose intolerance is rare in early childhood (Bhatia J, Greer F. Pediatrics 2008)
 - Most will not develop lactose intolerance until late-adolescence or adulthood, if ever (Scrimshaw NS et al. AJCN 1988; and Heyman MB. Pediatrics 2006)

NIH Consensus Statement 2010

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Milk Allergy

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Milk Allergy

- Reaction to the milk protein, **not** the milk sugar (i.e. lactose)
- Signs and symptoms range from mild to severe and can include wheezing, vomiting, itching, hives and digestive problems.
- Rarely, milk allergy can cause anaphylaxis — a severe, life-threatening reaction.
- Most children outgrow milk allergies by **age 3** allowing dairy to be re-introduced into the diet

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What strategies are effective in managing individuals with diagnosed lactose intolerance?

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Approach To The Patient

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The Lactose Intolerant Individual

A Condition Centered Approach
(Lactose Intolerance is **NOT** a disease!)

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Treatment Recommendations in Adult With Diagnosed Lactose Intolerance (Before You Treat)

- Pre-treatment: Confirmation of Findings
- Review (Key questions):
 - What was the method of testing
 - What was the amount of lactose used
 - Do the findings meet the definition of a positive test
 - Is there an association and timing of symptoms to lactose intake
- Do you agree with the diagnosis?

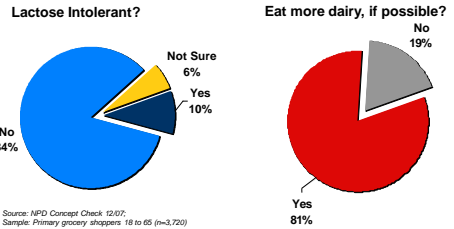
Meeting The Needs of The Patient

- First, **Inquire**
 - Perceptions of Tolerance
- Next, **Identify**
 - Address Patient Concerns
 - Race Specific Considerations
- Then, **Inform**
 - Review Lactose Digestion/Lactose Intolerance
 - Explain the Clinical Importance of Treatment
- Last, **Implement**
 - Provide Specific Recommendations
 - Culturally Sensitive and Relevant

Perceptions

Most Consumers Who Say They Are Lactose Intolerant Would Like to Eat More Dairy if Possible

Do you consider yourself to be lactose intolerant?
If you could avoid symptoms of lactose intolerance, would you . . . eat more cheese and dairy products?

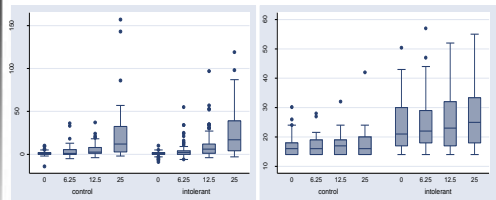


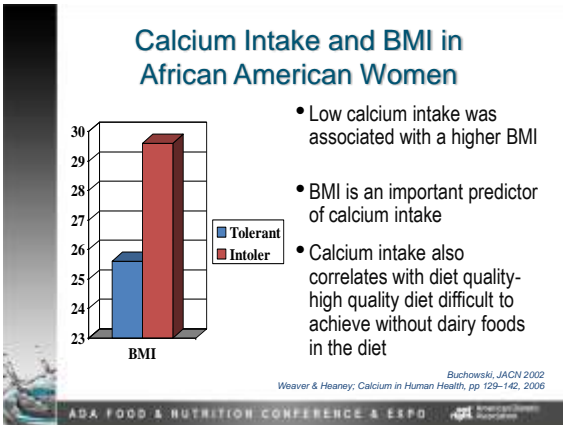
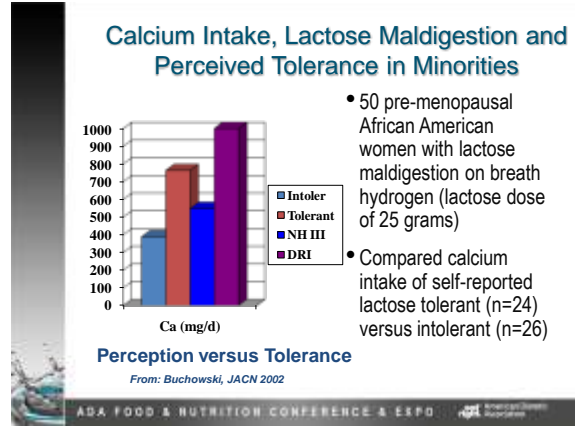
Lactose Digestion



- Other Factors that influence lactose digestion and tolerance:
- Fermentation of the dairy product
- Amount of lactose present
- Gastric emptying
- Adaptation to lactose
- Perception of tolerance

Misperception of Lactose Tolerance in African American Adults

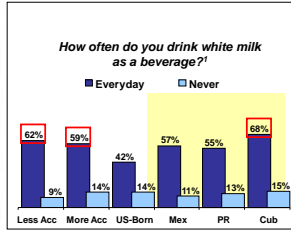




Racial, Cultural and Communication Challenges



Acculturation and Milk Consumption (Based on Primary Language)



- Milk is the #2 “at risk food/beverage” as Hispanics acculturate²
- Spanish dominant households buy 59% more milk than English dominant and 28% more milk than bilingual³

Sources:
¹ New American Dimensions, Driving Consumption Among Hispanic Consumers: Research Results, 2007
² NPD Foodworld, National Eating Trends Hispanic Database, 2004
³ The Nielsen Company, “Consumer Purchasing Among Hispanics and Non-Hispanics in the Milk, Cheese and Yogurt Categories,” 2008

Discuss Lactose Digestion



Lactose Digestion Provide A Consumer’s Definition

- **Lactose “Maldigestion”**
 Incomplete digestion of *lactose*, the natural sugar in milk, due to low activity of the *lactase* enzyme; may be asymptomatic
- **Lactose “Intolerance”**
 Gastrointestinal disturbances following the consumption of an amount of lactose greater than the body’s ability to digest and absorb

Explain the Health Consequences



Summary of Calcium Metabolism and Mechanisms of Disease

- **Decreased Calcium Reserve**
 - Osteoporosis
- **Decreased Food Residue Calcium in Chyme**
 - Colon cancer
 - Kidney stones
 - Lead Poisoning

Used with permission: Winston Price MD

Summary of Calcium Metabolism and Mechanisms of Disease

- **Adaptive Mechanisms Maintaining Extracellular Calcium**
 - Hypertension
 - Pre-eclampsia
 - Premenstrual syndrome
 - Obesity
 - Polycystic ovary syndrome (Hyperparathyroidism)
 - Insulin resistance syndrome
 - Abnormal serum lipids

Used with permission: Winston Price MD

DIET QUALITY ASSESSMENT

- 272 healthy premenopausal women*
- 7-day diet diaries
- Diets scored by giving one point for each of 9 key nutrients consumed at 70% or more of RDA
- Diets with scores below 5 rated "poor"

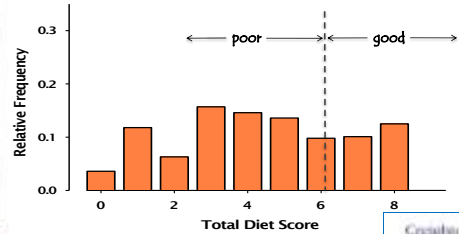
*Weaver & Heaney; Calcium in Human Health (2006), pp 129-142

Used with permission: R. Heaney, MD

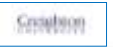


CALCIUM & DIET QUALITY

151 women with low Ca (i.e., low dairy) intakes

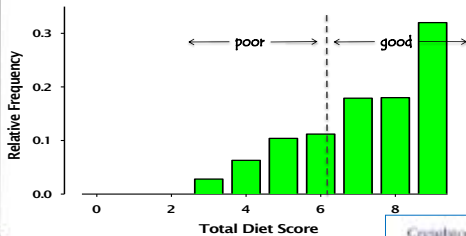


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CALCIUM & DIET QUALITY

121 women with high Ca (i.e., high dairy) intakes

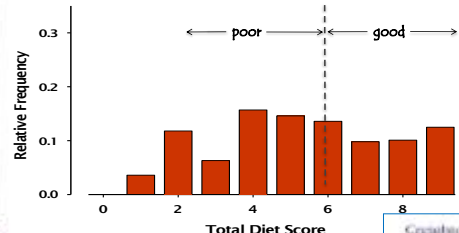


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CALCIUM & DIET QUALITY

151 women with low Ca (i.e., low dairy) intakes
56 still "poor" despite added Ca supplement



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Calcium Availability in Food Supply 1970-2004 USDA

<http://www.ers.usda.gov/Data/FoodConsumption/NutrientAvailIndex.htm>

| Food | 1970 | 2004 | Food | 1970 | 2004 |
|----------------------|------|------|-------------------------|------|------|
| Meat, fish & poultry | 2.7 | 3.4 | Vegetables | 6.2 | 7.0 |
| Dairy products | 76.3 | 71.7 | White potatoes | 0.9 | 0.9 |
| Eggs | 2.2 | 1.8 | Dark green, deep yellow | 1.0 | 1.4 |
| Fats and Oils | 0.6 | 0.3 | Other vegetables | 4.4 | 4.8 |
| Fruits | 2.3 | 2.6 | Grains | 3.3 | 4.9 |
| Citrus | 1.2 | 1.2 | Sugar/Sweeteners | 0.6 | 0.6 |
| Noncitrus | 1.1 | 1.4 | Misc | 2.3 | 3.3 |
| Legumes, nuts, soy | 3.5 | 4.3 | | | |

Osteoporosis and Osteopenia

- Fracture rates in minorities 1989:

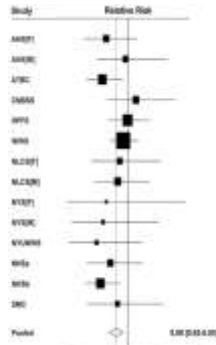
| | |
|------------------|---------------|
| African American | 57.3/100,000 |
| White | 140.7/100,000 |
- NORA 1999: % with osteopenia/osteoporosis:

| | |
|-------------------------|--------------|
| Asian (900) | 65.1/8.2 |
| Hispanic (1628) | 55.5/4.3** |
| Native American (421) | 58.9/9.5* |
| White (43,626) | 50.5/5.2 |
| African American (1695) | 38.2/4.0**** |

• Variations in calcium intake during childhood are thought to account for a 50% greater risk of hip fracture in adulthood, "Pediatric Disease with Geriatric Consequences!"

Silverman et al 1989
Sims et al 1999

Dairy Foods, Calcium, and Colorectal Cancer: A Pooled Analysis of 10 Cohort Studies
Cho, et al. JNCI Cancer Perspectives; vol 96 (3): 1015-1022, 2004.



Diabetes and Hypertension

- National sample of 3452 adults
- 12.3% perceived lactose intolerance
- Those with LI had:
 - Lower Ca intakes from dairy foods
 - Higher rates of physician-diagnosed diabetes and hypertension
- Odds of one of these diagnoses decreased by about one-third for each 1000 mg/d increase in Ca intake

Nicklas, TA, AJCN (2011); 94:191-8
 Used with permission: R. Heaney

African American Lactose Intolerance Understanding Study (AALIUS)

- Most African Americans surveyed were **unaware** of the health benefits of dairy products
- 25% (vs. 80 to 90%) of African Americans perceived themselves to be lactose intolerant
- African Americans were **383 times more likely** to have vitamin D deficiency compared to the general population
- Despite low incidence levels, real or perceived lactose intolerance was the main reason for dairy avoidance

Wooten W, Price W. JNMA 2004
 NMA Executive Summary JNMA 2009

Hypovitaminosis D

- Increased risk of metabolic syndrome, obesity, osteoporosis, cardiovascular disease, certain cancers and other chronic disease states associated with inadequate levels
- Low levels of vitamin D are seen in temperate climates due to limited sunlight but are common in adult populations regardless of location
- People with darker skin pigmentation require longer periods of exposure to the sun to produce equal levels of vitamin D
- Receptors may have racial and genetic differences
- New supplementation guidelines suggests higher levels of supplementation needed: Holick et al. J Clin Endocrinol Metab, July 2011, 96(7):1-20.

Remember the "Rules of 3"

- There are **3** types of lactase non-persistence
- Secondary lactase non-persistence generally resolves **3** weeks after mucosal healing
- Milk allergies usually resolve by age **3** years
- The optimal level of intake is **3** servings per day of dairy foods
- It take approximately **3** weeks for the gut to adapt to new lactose ingestion
- Limit tips for tolerance to **3** new suggestions at a time

Conclusion

- Lactose intolerance is a real clinical condition but not as prevalent as previous literature suggests
- Inadequate dietary calcium and vitamin D intake predisposes individuals to certain diet-preventable chronic disease states, while a calcium-rich diet with fruits, vegetables, dairy foods and lean protein improves health
- Lactose intolerance does not necessitate dairy avoidance, especially when tips for tolerance are used