Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL13, ISSUE 07, 2022

Original Research Article

Prevalence of Lactose Intolerance In Healthy Subjects of Rural Area

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Abstract

INTRODUCTION: Lactose intolerance is very common in Indian population, however there has been a wide variation of prevalence among north Indians and south Indians ranging from 27.4 percent to 66.6 percent. Increased calcium intake through consumption of milk is an effective mechanism for increasing calcium uptake from the diet and thereby minimising the risk of development of osteoporosis in later life. Detailed information about rates of lactose intolerance, and adaptation to dietary lactose and its consequences, will help in the formulation of dietary advice. Lactose intolerance or mal absorption is the inability to breakdown lactose because of reduced concentration of enzyme lactase. **AIMS** To study the prevalence of lactose intolerance in healthy medical students of Urban area in India and related symptoms following oral lactose challenge in healthy volunteers.

MATERIALS AND METHODS: This is a prospective study conducted in the Department of Physiology at Tertiary Care Teaching Hospital from October 2021 to April 2022. We included 100 subjects in the study and expected that would be sufficient to find out the prevalence of lactose intolerance in our community. The disaccharide lactose is synthesized in the mammary gland of mammalians (except the sea lion) and is essential for the nourishment of newborn infants. In the small intestine brush border the lactase enzyme is responsible for the absorption of lactose.

RESULTS: Fifty eight were males and 42 were females, age range was between 17 years to 21 years. Fourty two (42 percent) were positive, that is lactose intolerant and Fifty eight (58

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percent) were negative , i.e. lactose tolerant . sixteen subjects had crampy abdominal pain and two had bloating post lactose ingestion all of them were lactose intolerant. A total of 42(42%) subjects were found to be lactose malabsorbers (LM). Lactose intolerance was found to be equally prevalent in both sexes (male = 58, 24% and female = 42, 18%, P=0.656) Commonest symptoms experienced by the lactose malabsorber participants of this study was diarrhea 30(30%).

CONCLUSION: Lactose may be consumed as a dairy food component in modest amounts, up to 12-24 g per day, preferably in small amounts across the day, in those whom lactase persistence is not physiological, without clinical symptoms. Lactose-free or lactase-supplemented foods are not necessary for those in whom lactase activity is not persistent beyond infancy. Lactose may favorably alter the colonic microbiota if it is not digested in the small intestine.

Keywords: Lactose Intolerance, Rural Area**,** Malabsorption

INTRODUCTION

Lactose intolerance is very common in Indian population, however there has been a wide variation of prevalence among north Indians and south Indians ranging from 27.4 percent to 66.6 percent.[1]

Increased calcium intake through consumption of milk is an effective mechanism for increasing calcium uptake from the diet and thereby minimising the risk of development of osteoporosis in later life. Detailed information about rates of lactose intolerance, and adaptation to dietary lactose and its consequences, will help in the formulation of dietary advice. [2]

Lactose intolerance or mal absorption is the inability to breakdown lactose because of reduced concentration of enzyme lactase. Thus lactose intolerance is not a disease rather than a normal physiological phenomenon as the infant's capacity to digest lactose is not retained into adult. [3]

Lactose intolerance has been implicated for many common gastro intestinal ailments like indigestion, bloating, gas and diarrhoea. Hydrogen Breath tests and lactose tolerance tests are currently used tests to diagnose Lactose Intolerance. [4]

Most people are born with the ability to digest lactose, the major carbohydrate in milk and the main source of nutrition until weaning. Approximately 75% of the world's population loses this ability at some point, while others can digest lactose into adulthood. [5]

A diagnosis of lactose intolerance can usually be made with a careful history supported by dietary manipulation. If necessary, diagnosis can be confirmed by using a breath hydrogen or lactose tolerance test. [6]

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Treatment consists primarily of avoiding lactose-containing foods. Lactase enzyme supplements may be helpful. The degree of lactose malabsorption varies greatly among patients with lactose intolerance, but most of them can ingest up to 12 oz of milk daily without symptoms. Lactose-intolerant patients must ensure adequate calcium intake. [7]

AIMS To study the prevalence of lactose intolerance in healthy medical students of Urban area in India and related symptoms following oral lactose challenge in healthy volunteers.

MATERIALS AND METHODS

This is a prospective study conducted in the Department of Physiology at Tertiary Care Teaching Hospital from October 2021 to April 2022.

We included 100 subjects in the study and expected that would be sufficientto find out the prevalence of lactose intolerance in our community.

The disaccharide lactose is synthesized in the mammary gland of mammalians (except the sea lion) and is essential for the nourishment of newborn infants. In the small intestine brush border the lactase enzyme is responsible for the absorption of lactose.

After the ingestion of lactose, the unabsorbable disaccharide is hydrolysed into the monosaccharides glucose and galactose, that are absorbed. If the lactase enzyme activity is inadequate, the unabsorbed lactose will reach the large intestine, where the gut flora ferments the sugar molecules into short-chain fatty acids, carbon dioxide (CO2), hydrogen (H2), and methane (CH4).

Hydrogen breath tests are widely used to explore pathophysiology of functional gastrointestinal (GI) disorders. Small intestinal bacterial overgrowth (SIBO)and carbohydrate malabsorption are disorders detected by these tests that havebeen proposed to be of great importance for symptoms of GI diseases.

Glucose hydrogen breath test is more acceptable for diagnosis of SIBO whereas lactose and fructose hydrogen breath tests are used for detection of lactose and fructose maldigestion respectively. Lactulose hydrogen breath test is also used widely to measure the orocecal transit time for GI motility. These methods are noninvasive and inexpensive.

Stool pH test is also done, Stools are acidic owing to bacterial fermentation of malabsorbed carbohydrates. Stool pH below 5.5 in a freshly passed stool is a highly suggestive, although rather insensitive indicator of carbohydrate malabsorption Hydrogen breath tests are specific and sensitive diagnostic tests that can be used to either confirm or eliminate the possibility of carbohydrate malabsorption or SIBO in such patients.

Breath tests, though valuable tools, are underutilized in evaluating dyspepsia and functional bloating and diarrhea as well as suspected malabsorption. However, because of their simplicity, reproducibility and safety of procedure they are nowbeing substituted to more

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uncomfortable and expensive techniques that were traditionally used in gastroenterology.

These students were subjected to Lactose Hydrogen Breath Test using 25 gm lactose. Gastrolyzer UK Bedfont Hydrogen Breath Analayser was used. Baseline three breath samples were noted and later 25 gm lactose was administered , six breath samples were recorded at 20, 40,60,80,100 and 120 minutes.

A rise of 20 ppm above baseline was taken as positive hydrogen breath test. Abdominal Symptoms like pain, discomfort, bloating and diarrhoea after lactoseingestion was also noted. Appropriate measures like overnight fasting were ensured and subjects with any ailments or antibiotics were excluded.

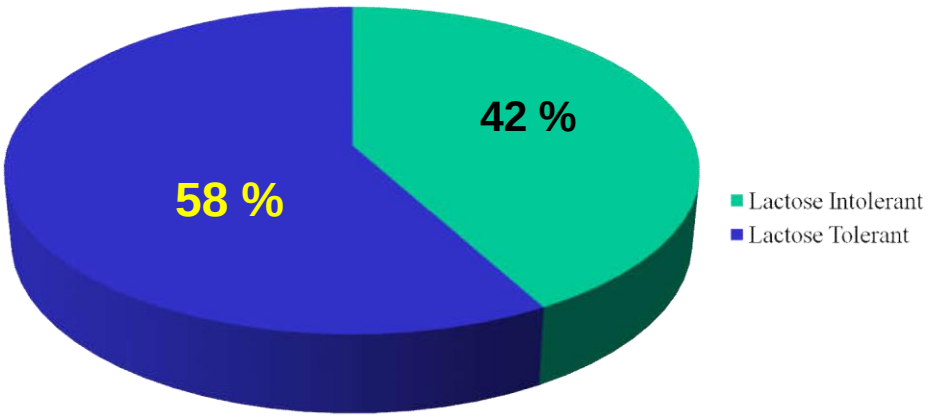
Statistical analysis

Statistical analysis was done using SPSS 16 version with significance levelset at ≤0.05. The chi-squared test was utilized to analyze differences between proportions. Differences in the mean age of patients with positive and negative breath test were compared by using the unpaired Student's 't' test. Correlations between variables were quantified by calculating the Spearman rank correlation coefficients. The significance level of all statistical analyses was set at alpha = 0.05. All sensitivity, specificity, predictive values and likelihood ratios (LR) were calculated by using the absence of the specific symptom or the absence of any symptom as reference (=test negative).

RESULTS

Fifty eight were males and 42 were females, age range was between 17 years to 21 years. Fourty two (42 percent) were positive, that is lactose intolerant and Fifty eight (58 percent) were negative , i.e. lactose tolerant . sixteen subjects had crampy abdominal pain and two had bloating post lactose ingestion all of them were lactose intolerant.

Graph 1: Among 42 subjects who are Lactose intolerant 17 subjects had Constipation.



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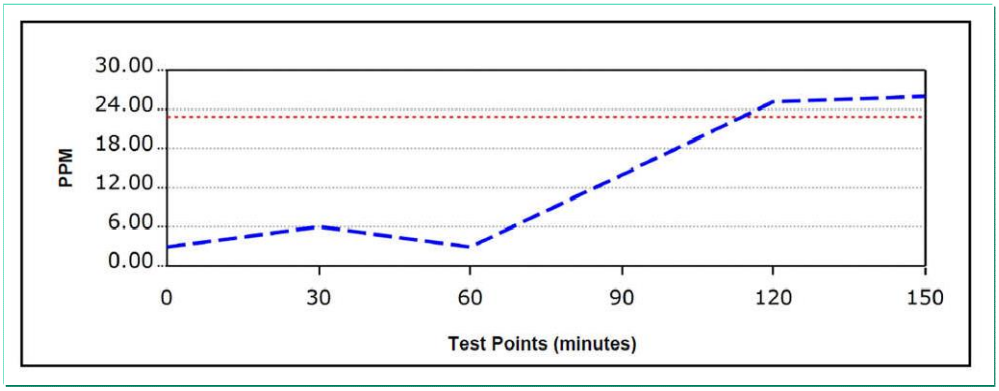
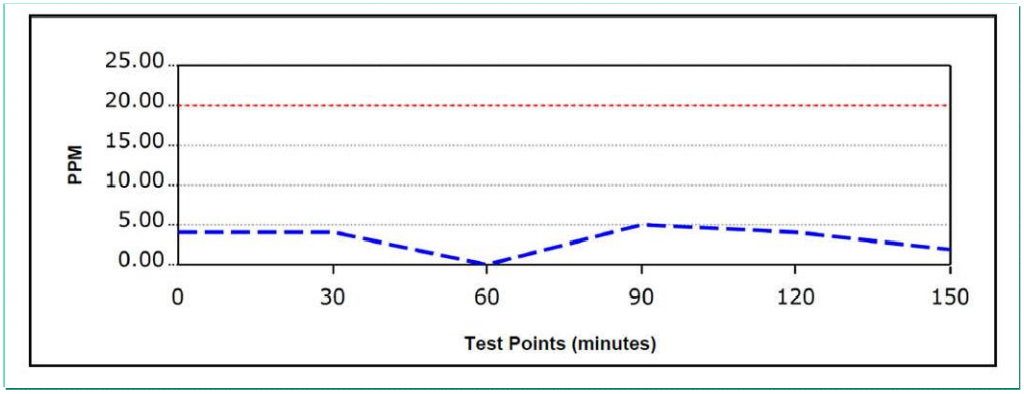
Graph 2: Positive Lactose Hydrogen Breath test



Graph 3: Negative Lactose Hydrogen Breath test



A total of 42(42%) subjects were found to be lactose malabsorbers (LM). Lactose intolerance was found to be equally prevalent in both sexes (male = 58, 24% and female = 42, 18%, P=0.656) Commonest symptoms experienced by the lactose malabsorber participants of this study was diarrhea 30(30%).

Other common symptoms were abdominal pain and flatulence experienced by 26 and 25 persons respectively. The sensitivity, specificity of individual symptoms are presented. Diarrhea has the highest sensitivity (66.0%) and a positive predictive value of 86.9%. Regression analysis showed among the symptoms, borborygmi and Diarrhea were mostly associated with LM (OR 1.957 & 1.872).

Any symptoms did not develop in 25(14.62%) patients during the monitoring period and among these 8(32%) had a negative lactose tolerance test. Lactose malabsorption prevalence was found to increase from subjects developing no symptom (68.0%) to subjects developing up to 3 symptoms (92.2%) following lactose load. Subjects developing 2 (16.7% vs. 41.8%, P=0.031) or 3 {2(6.7%) vs. 22(15.6%)} symptoms following lactose load mostly belonged to LM group.

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Table 1: Demographic distribution among Lactose Malabsorbers(LM) and Non LactoseMalabsorbers (NON-LM)

	LM NO (%)	NON-LM NO (%)	TOTAL (%)	P VALUE
Volunteers	42(42%)	58(58%)	100(100%)	
Male	24(41%)	34(58%)	58	0.656
Female	18(42%)	24(57%)	42	

Table 2: Symptom Prevalence among LM and NON-LM

SYMPTOMS	LM	NON LM	TOTAL(%)	P VALUE
Diarrhea	20	10	30(30%)	0.69
Flatulence	20	5	25(25%)	0.65
Abdominal	16	10	26(26%)	0.61
Pain	15	10	25(25%)	0.62

Table 3: Association of Major Symptoms with Lactose Malabsorption

	Crude Odds Ratio	Significance(P)
Abdominal Pain	0.228	0.677
Borborygmi	0.672	0.118
Flatulence	0.310	0.568
Diarrhea	0.627	0.137

Table 4: Sensitivity and Specificity of Major Symptoms after Lactose intake

Symptoms	Sensitivity	Specificity
Diarrhea	66%	53.3%
Borborygmi	56.7%	63.3%
Flatulence	22.7%	83.3%
Abdominal Pain	22%	83.3%
Nausea	5.0%	93.3%

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DISCUSSION

Lactose intolerance is a genetically programmed decrease of lactase level in adult. Approximately 70% of the world population has primary lactase deficiency which is common among Asians, South Americans and Africans. [8]

Reports from southern part of India shows that its prevalence is between 60- 70%, but it is lower (20-30%) in northern part of India. [9]

Lactose intolerance is a common problem. There is no cure to the lactose intolerance. [10] People who have trouble digesting lactose can learn which dairy products and other foods they can eat without discomfort and which ones theyshould avoid.

However, in our study the prevalence of lactose intolerance was 42%. Degree of Indo-Aryan migration and intermixing with the native population is the possible cause of this dissimilarity in prevalence. [11]

Patients should be informed that having lactose malabsorption does not meanthey are allergic to milk, dairy products, or dairy foods.

A milk allergy is related to the proteins in milk rather than the lactose. The degree of lactose malabsorption varies widely among patients, but most patients do not require a totally lactose-free or severely restricted diet.

Dairy products should not be totally eliminated because they provide key nutrients such as calcium, vitamins A and D, riboflavin, and phosphorus.

Adult patients with lactose intolerance should maintain a calcium intake of 1,200 to 1,500 mg per day, including actual dairy products up to their individual threshold for symptoms. Milk intake commonly has to be limited to less than 250 to 375 mL (8 to 12 oz) per day. [12]

Patients should consider drinking lactose-reduced milk or taking calcium supplements. Patients should also be advised to avoid medications that contain lactose as filler and certain food products that may contain unrecognized lactose.

Patient education is usually highly useful in patients with lactose intolerance. Patients with mild lactose malabsorption may benefit from using lactase enzyme supplements, such as Dairy Ease. The incubation of milk with lactase enzymes may also be helpful.

However, patients should be warned that the lactase enzymes might notcompletely relieve the symptoms because the digestion of lactose is incomplete or because it is difficult to determine the effective dose of lactase enzyme. [13] Therefore, enzyme supplementation should be an adjunct to, not a substitute for, dietary restriction. Nondairy synthetic drinks, such as Coffee-Mate, are a useful substitutefor milk.

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Soya milk and rice milk are also well-tolerated. Recent evidence suggests that patients with medically confirmed lactose malabsorption can ingest the number of servings of milk and dairy products recommended by the Dietetic Association without experiencing gastrointestinal discomfort. Some patients increase their tolerance to lactose with repeated intake.

Patients with secondary lactose intolerance require further investigation to identify the primary problem.

Effective treatment of the underlying condition, such as administration of metronidazole for treatment of giardiasis or a gluten-free diet for management of celiac disease, may not only ameliorate symptoms but also improve lactose intolerance.

The discovery of lactase-persistence alleles prompted use of genetic tests for diagnosis of lactase non-persistence by polymerase chain reaction restriction fragment length polymorphism, real-time polymerase chain reaction, and Pyrosequencing technology. [14]

Compared with the lactose hydrogen breath test, the genetic test is a simple, noninvasive, and more comfortable examination that does not provoke symptoms of lactose intolerance and is less cumbersome with easy transfer of a venous blood sample to the laboratory. [15]

However, other polymorphic variants in Europeans (*LCT*-13914G>A) and in African and Arab populations (*LCT*-13907C>G, *LCT*-13913T>C, and *LCT*-13915T>G, close to *LCT*-13910C>T) affect the diagnostic accuracy of *LCT*- 13910C>T typing by altering the melting profiles of the real-time polymerase chain reaction kit.

The reverse-hybridization strip assay based on multiplex DNA amplification and ready-to-use membrane test strips that detect *LCT* polymorphic variants (-13907C>G, -13910C>T, -13913T>C, -13914G>A, -13915T>G, and -22018G>A) represents a reliable tool for genetic diagnosis of lactase non-persistence, overcoming the interference of different melting profiles of the real-time polymerase chain reaction kit by the other polymorphic variants.

The genetic test provides a more direct result, i.e, a hypolactasia or lactase persistence genotype, whereas interpretation of the lactose breath test depends on the cutoff level, dose of lactose given, and duration of the test and age of the individual, among the other factors already discussed, and is costly.

The discovery of other single nucleotide polymorphisms associated with lactase persistence implies that DNA genotyping should provide information on the DNA sequence around the polymorphic site of the *MCM6* gene. In addition to the reverse-hybridization strip assay, Pyrosequencing technology may be a cost- effective for direct DNA sequencing, allowing genotyping of other single nucleotide polymorphisms.

The genetic test does not provide information on symptoms of lactose tolerance; however,

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measurement of lactase activity in intestinal biopsy does not provide it either.

CONCLUSION

Lactose may be consumed as a dairy food component in modest amounts, up to 12-24 g per day, preferably in small amounts across the day, in those whom lactase persistence is not physiological, without clinical symptoms. Lactose-free or lactase-supplemented foods are not necessary for those in whom lactase activity is not persistent beyond infancy. Lactose may favorably alter the colonic microbiota if it is not digested in thesmall intestine.

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