ORIGINAL Article

Lactose Intolerance is Associated with Changing of Intestinal Villi in Thai People

*Duangporn Thong-Ngam, M.D.**
*Jintana Prempracha***
*Pongsapeera Suwangool, M.D.****

ABSTRACT

Objectives: To determine the prevalence of lactose intolerance in patients with functional dyspepsia and to document the association of changing in duodenal villi in Thai patients with lactose malabsorption by using breath hydrogen excretion test.

Patients and Methods: Functional dyspepsia patients who had no history of milk allergy and underwent gastroduodenoscopy. Two mucosal biopsy specimens were taken from beyond the distal end of the second part of the duodenum. The specimens were carefully orientated and were graded according to the following scheme: group I : finger shaped villi; group II : mixed finger and leaf shaped villi; group III : clubbing or blunting shaped villi. All subjects were tested for lactose malabsorption by breath hydrogen analysis after consuming 50 gram lactose. Breath hydrogen concentration was analyzed in samples collected intermittently by end-expiratory technique. A rise in breath hydrogen concentration of 20 PPM over baseline was considered an evidence of lactose malabsorption.

Results: Twenty-five subjects were twenty females (80.0%) and five males (20.0%) ranging in age from 18 to 53 years (mean 31(8.29). Sixteen subjects belong to a finger shaped villi group (64.0%), five to a mixed finger and leaf shaped villi group (20.0%) and four to a clubbing or blunting shaped villi group (16.0%). Results of breath hydrogen excretion test identified the prevalence of lactose intolerance in 68% of the subjects: 15/16 (93.75%) of group I ; 1/5 (20.0%) of group II and 1/4 (25%) of group III respectively ($P<0.001$). The symptom of diarrhea after lactose loading was correlated well with patients who positive of breath hydrogen analysis.

Conclusion: The changing of decreased prevalence in tropical enteropathy is found and the lactose intolerance is not associated with changing of intestinal villi in Thai people.

Key words : Lactose intolerance, intestinal villi, functional dyspepsia

[Thai J Gastroenterol 2004; 5(1): 14-18]

**Department of Physiology, **Gastroenterology unit, Department of Medicine,*
****Department of Pathology, Faculty of Medicine, Chulalongkorn University Hospital, Bangkok 10330, Thailand.*

BACKGROUND

Lactose is the sugar present in dairy products. The pathophysiologic mechanism of lactose malabsorption is including lactose load, level of intestinal lactase activity, gastric emptying rate, colonic compensation, race and ethic origin[1-3]. All of these could be influenced the prevalence of this situation. Defective synthesis or processing of lactose enzyme[4] and diseases that damage the luminal surface of villous cell are the major mechanism cause lactose malabsorption[5,6]. The symptom of lactose intolerance are variable including no symptom, abdominal pain, bloating, flatus and watery diarrhea[7,8].

Lactase deficiency leading to lactose malabsorption is probably genetically determined. The ethic origin influence the prevalence of lactose malabsorption that the Western population found less prevalence than the Asian population[9,10]. Small bowel morphology of inhabitants of tropical countries differs from that of white Europeans and North Americans; blunted villi and increased inflammatory cell infiltrates are common even in asymptomatic people[11]. The tropical enteropathy is described in Asian population which the pathophysiologic mechanism is unclear whether this tropical enteropathy is genetic or enveronmental in origin. The indirect evidence suggest that infection in the young age, malnutrition or genetic process are postulated to be causes of tropical enteropathy. Nowaday Thai's socioeconomic and public health are improved than previous. The prevalence of tropical enteropathy and lactose intolerance may be changed[12,13].

The development of breath hydrogen excretion testing provides a comfortable and simple method to evaluate intestinal lactose malabsorption[14-17]. In this study, to determine the prevalence of lactose intolerance in patients with functional dyspepsia and to document the association of changing in duodenal villi in Thai patients with lactose malabsorption by using breath hydrogen excretion test.

PATIENTS AND METHODS

Subject

The 25 patients from the clinical practice of King Chulalongkorn Memorial Hospital who suffering from functional dyspepsia attended in this study. The term of functional dyspepsia was used to describe patients with abdominal discomfort, bloating who were seen normal appearance of demonstrable gastrointestinal endoscopic examination. A duodenal biopsy was taken from these patients by means of a pathologic study was determined on the mucosal samples by pathologist.

Duodenal Morpho-pathological Assessment [11,18]

Two mucosal biopsy specimens were taken from beyond the distal end of the second part of the duodenum. The specimens were carefully orientated with the villous surface uppermost. Orientation was checked using dissecting microscopy and biopsy specimens were graded according to the following scheme: group I : finger shaped villi; group II : mixed finger and leaf shaped villi; group III : clubbing or blunting shaped villi. The mounted specimens were embedded in paraffin wax and 3 micron sections were cut and stained with haematoxylin and eosin. Stained sections were identified blind by one observer.

Breath Sampling Techniques

Patients were asked not to consume any food after midnight prior to testing for lactose malabsorption. The patients who smoked were asked to refrain from smoking during the test period. The test was canceled if there was a history of systemic illness, gastroenteritis, use of antibiotics or laxative used within two weeks of testing. Excluded from the study were subjects with a history of prior alimentary surgical resection except for appendectomy.

This test is besed on the principle that in patients with lactase deficiency, lactose is not hydrolyzed in the small intestine and ultimately is degraded by colonic bacteria. This results in the production of hydrogen gas, which is excreted by the lungs and can be quantified with a breath hydrogen analyzer.

Fifty grams of lactose in 250 ml water were drunk in the morning after an overnight fast. End expiratory breath were taken before the test meal and every 30 minute afterwards for 3 hours. Standard breath sample collection bags obtained from Quintron were used for collection of end alveolar breath samples. All of the participants received instructions and brief training for breathing end alveolar breath into collection bags. All the sample bags were brought to the laboratory and analyzed for breath hydrogen using a Quintron Mocrolyzer Model. The concentration was measured in parts per million (PPM).

Criteria for Positive Breath Hydrogen Excretion Test

A rise in breath hydrogen concentration of 20 PPM over baseline was considered an evidence of lactose malabsorption.

Statistical Analysis

Statistical methods used were Chi-square compared between various group of duodenal pathologic reports and results of breath hydrogen excretion test. Associated symptom when taking the lactose test was recorded and analysed with Fisher's Exact test.

RESULTS

Twenty-five functional dyspepsia adults attended at King Chulalongkorn Memorial Hospital ranging from 18 to 53 years in age (mean age 31 ± 8.29). There were twenty females (80.0%) and five males (20.0%). All of these patients had no history of milk allergy underwent the gastroduodenoscopy. The duodenal biopsy was performed then classified patients into three groups as follow: group I : finger shaped villi; group II : mixed finger and leaf shaped villi; group III : clubbing or blunting shaped villi depended on morphopathologic assessment. Sixteen patients were a finger shaped villi group (64.0%), five patients were a mixed finger and leaf shaped villi group (20.0%) and four patients were a clubbing or blunting shaped villi group (16.0%) (Figure 1). Results of breath hydrogen excretion test identified the prevalence of lactose intolerance in 68% of functional dyspepsia patients. Compared between various group of duodenal pathologic reports and results of breath hydrogen excretion test was in a finger shaped villi group, lactose intolerance was demonstrated in 15/16 (93.75%), in mixed finger and leaf shaped villi group was 1/5 (20.0%) and in a clubbing or blunting shaped villi group was reported in 1/4 (25%) (P <0.001) (Figure 2). T he mean level of changing of end alveolar breath hydrogen in a group of test negative was 8.75 ± 8.46 PPM, in a group of test positive was 66.94 ± 20.46 PPM (Figure 3). The associated symptom when taking the lactose test in case of positive test was no symptom in 5.9%, bloating in 5.9% and diarrhea in 88.24%. The symptom of diar-

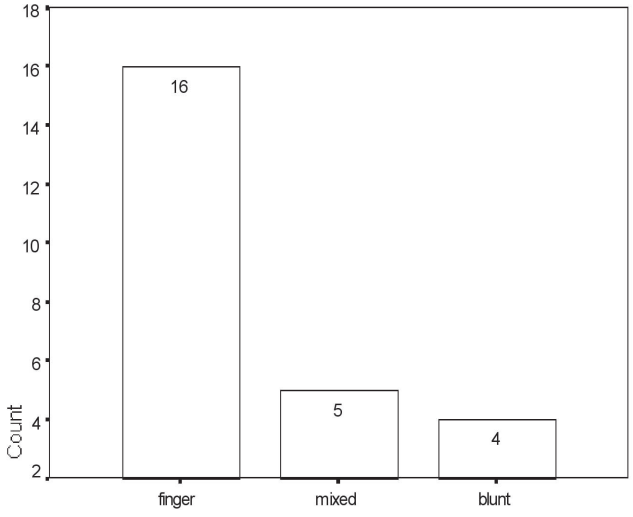

Figure 1 Illustrated the patients group classified by morpho-pathological assessment of duodenal villi

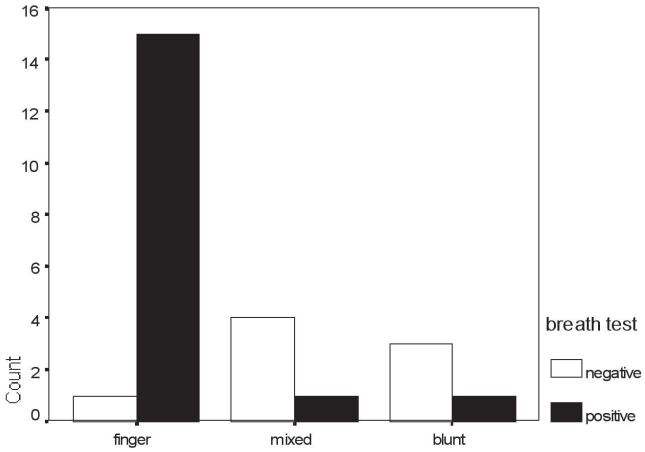

Figure 2 Compared between various group of duodenal pathologic reports and results of breath hydrogen excretion test

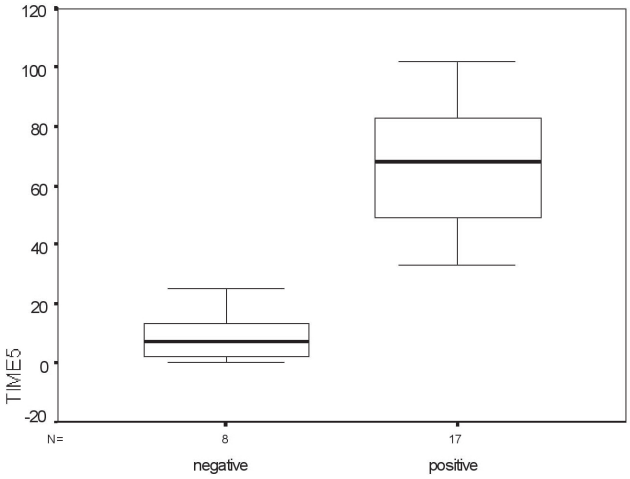

Figure 3 Illustrated the mean change level of breath hydrogen excretion test

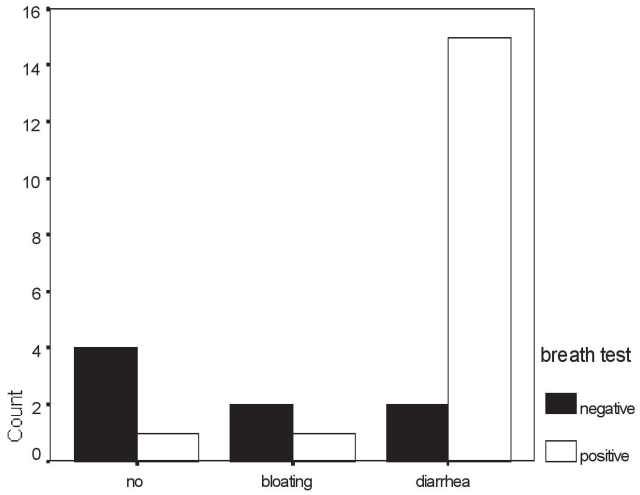

Figure 4 The associated symptoms when taking the lactose test

rhea after lactose loading was correlated well with patients who positive of breath hydrogen analysis ($p < 0.006$) in Figure 4. The diarrheal symptom was self limited, did not required specific treatment.

DISCUSSION

Lactose intolerance may be the imply condition in patients who suffering from functional dyspepsia that had no history of milk allergy. Study of prevalence of lactose intolerance in Finland was reported 9%[19]. In this study, the prevalence of lactose malabsorption was found in 68% in functional dyspeptic patients. In the last three decades much work has been done to clarify the pathophysiologic mechanisms responsible for lactose malabsorption. It is well known that the lactose malabsorption is influenced by ethnic origin, age but not necessarily gender[1-3]. The Western population found less prevalence than the Asian population[9,10]. Welse *et al*[20] reported that age affects intestinal lactase activity. Scattergrams of lactase activity against age indicated that lactase activity continues to decline with age. Progressive decline of lactase activity seen in the 25-55 age group as well as the known increased prevalence beyond age 55. The mechanism of lactose malabsorption was associated with reduction in duodenal brush border mucosal disacharidase activity or glucose transport. The another mechanism was diseases that damage the luminal surface of villous cell could cause lactose malabsorption[4,13].

Thailand has also achieved higher socioeconomic development in the past few decades. There are some supporting evidences such as the progressive decline of positive serology to hepatitis A virus in children from almost 100% in 1970 to 30% in 1990[21]. If this is the case, tropical enteropathy might also be disappearing from Bangkok, Thailand.

In this study, the prevalence of tropical enteropathy was decline when compare to the past few decades. However, the prevalence of lactose malabsorption was not decline. Moreover, the prevalence of lactose intolerance more common in the group of patients that had finger shaped villi than the rest groups. This means the lactose malabsorption is influenced by ethnic origin and race more stronger than is influenced by duodenal villi morpho-pathology[2].

Abdominal complaints in patients with lactose malabsorption are not necessarily related to the degree of lactose malabsorption. Many factors, such as gastrointestinal motility and visceral perception, are essential in the development of abdominal symptoms. The majority of symptoms correlated with lactose malabsorption probably are due to an increased production of intestinal gas. Gas production is due to lactose fermentation by intestinal bacteria in the lower small bowel and in the colon. Measurement of diarrhea appears to be a reliable symptom of lactose malabsorption[7].

CONCLUSIONS

In this study found the changing of decreased prevalence in tropical enteropathy and the lactose intolerance is not associated with changing of intestinal villi in Thai people.

REFERENCES

1. Feibusch JM, Holt PR. Impaired absorptive capacity for carbohydrate in the aging human. Dig Dis Sci 1982; 27: 1095-100.
2. Rao DR, Bello H, Warren AP, *et al*. Prevalence of lactose maldigestion. Influence and interaction of age, race, and sex. Dig Dis Sci 1994; 39: 1519-24
3. Mishkin D, Sablauskas L, Yalovsky M, *et al*. Fructose and sorbital malabsorption in ambulatory patients with functional dyspepsia: comparison with lactose maldigestion/malabsorption. Dig Dis Sci 1997; 42: 2591-8

4. McMichael HB, Webb J, Dawson AM. Jejunal disaccharidases and some observations on the cause of lactase deficiency. Br Med J 1966; 2(521): 1037-41.
5. Shaw AD, Davies GJ. Lactose intolerance: problems in diagnosis and treatment. J Clin Gastroenterol 1999; 28: 208-16.
6. Parnes HL, Fung E, Schiffer CA. Chemotherapy-induced lactose intolerance in adults. Cancer 1994; 74: 1629-33.
7. Hermans MM, Brummer RJ, RuiJgers AM, *et al*. The relationship between lactose tolerance test results and symptoms of lactose intolerance. Am J Gastroenterol 1997; 92: 981-4.
8. Bianchi Porro G, Parente F, Sangaletti O. Lactose intolerance in adults with chronic unspecific abdominal complaints. Hepatogastroenterology 1983; 30: 254-7.
9. Flatz G, Saengudom Ch, Sanguanbhokhai T. Lactose intolerance in Thailand. Nature 1969; 221: 758-9.
10. Sprinz H, Sribhiphadh R, Gangarosa EJ, *et al*. Biopsy of small bowel of Thai people with reference to recovery from Asiatic cholera and to an intestinal malabsorption syndrome. Am J Clin Pathol 1962; 38: 43-51.
11. Wood GM, Gearty JC, Cooper BT. Small bowel morphology in British Indian and Afro-Caribbean subjects: evidence of tropical enteropathy. Gut 1991; 32: 256-9.
12. Keusch GT, Troncale FJ, Miller LH, *et al*. Acquired lactose malabsorption in Thai children. Pediatrics 1969; 43: 540-5.
13. Debongnie JC, Newcomer AD, McGill DB, *et al*. Absorption of nutrients in lactase deficiency. Dig Dis Sci 1979; 24: 225-31.
14. Isokoski M, Jussila J, Sarna S. A simple screening method for lactose malabsorption. Gastroenterol 1972; 62: 28-32.
15. Newcomer AD, McGill DB, Thomas PJ, *et al*. Prospective comparison of indirect methods for detecting lactase deficiency. N Engl J Med 1975; 293: 1232-6.
16. Caride VJ, Prokop K, Troncale FJ, *et al*. Scintigraphic determination of small intestinal transit time: comparison with the hydrogen breath technique. Gastroenterology 1984; 86: 714-20.
17. Tedesse K, Smith D, Eastwod MA. Breath hydrogen (H2) and methane (CH4) excretion patterns in normal man and in clinical practice. Q J Exp Physiol Cogn Med Sci 1980; 65: 85-97.
18. Snow AD, Altmann GG. Morphometric study of the rat duodenal epithelium during the initial six months of 1,2-dimethylhydrazine carcinogenesis. Cancer Res 1983; 43: 4838-49.
19. Heikkinen M, Pikkarainen P, Takala J, *et al*. Etiology of dyspepsia: four hundred unselected consecutive patients in general practice. Scand J Gastroenterol 1995; 30: 519-23.
20. Welsh JD, Poley JR, Bhatia M, *et al*. Intestinal disaccharidase activities in relation to age, race, and mucosal damage. Gastroenterology 1978; 75: 847-55.
21. Poovorawan Y, Theamboonlers A, Chumdermpadetsuk S. Changing seroepidemiology of hepatitis A virus infection in Thailand. Southeast Asian J Trop Med Public Health 1993; 24: 250-4.