Lactose Intolerance and Intestinal Villi Morphology in Thai People

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Abstract

Objective : To study the relationship of lactose intolerance and intestinal villi morphology in Thai people.

Material and Method : Subjects for this study were patients with functional dyspepsia 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 evidence of lactose malabsorption.

Results : The twenty-five subjects were twenty females (80.0%) and five males (20.0%) who ranged in age from 18 to 53 years (mean 31±8.29). Sixteen subjects belonged to the finger shaped villi group (64.0%), five to the mixed finger and leaf shaped villi group (20.0%) and four to the clubbing or blunting shaped villi group (16.0%). Results of breath hydrogen excretion test identified the prevalence of lactose intolerance in 68 per cent 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 in patients who had positive breath hydrogen analysis.

Conclusion : As shown in this study, the lactose intolerance is not related to intestinal villi morphology. It is implied that primary lactase deficiency is more common in Thai people than secondary lactase deficiency.

Key word : Lactose Intolerance, Intestinal Villi Morphology, Thai People

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Lactose is the sugar present in dairy products. The pathophysiologic mechanism of lactose malabsorption includes lactose load, level of intestinal lactase activity, gastric emptying rate, colonic compensation, race and ethic origin[1-3]. All of these could influence the prevalence of this condition. Defective synthesis or processing of lactose enzyme[4] and diseases that damage the luminal surface of villous cells are the major mechanisms causing lactose malabsorption[5,6]. The symptoms 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 ethnic origin influences the prevalence of lactose malabsorption e.g., Western populations show less prevalence than the Asian[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. The pathophysiologic mechanism is unclear; whether this tropical enteropathy is genetic or environmental in origin is debated. Infections in young people, malnutrition or genetic process are postulated to be the causes of tropical enteropathy. It was reported that, despite being in the tropics, Singapore, where water quality, sanitation and nutritional status are similar to those in industrialized countries, does not have tropical enteropathy[22]. Nowadays, Thailand's socioeconomic and public health have improved considerably and the prevalence of tropical enteropathy might have changed, and has provided another opportunity to look into the relationship between abnormal intestinal abnormalities and the prevalence of lactose intolerance in the region[12,13].

The development of breath hydrogen excretion testing provides a comfortable and simple method to evaluate intestinal lactose malabsorption

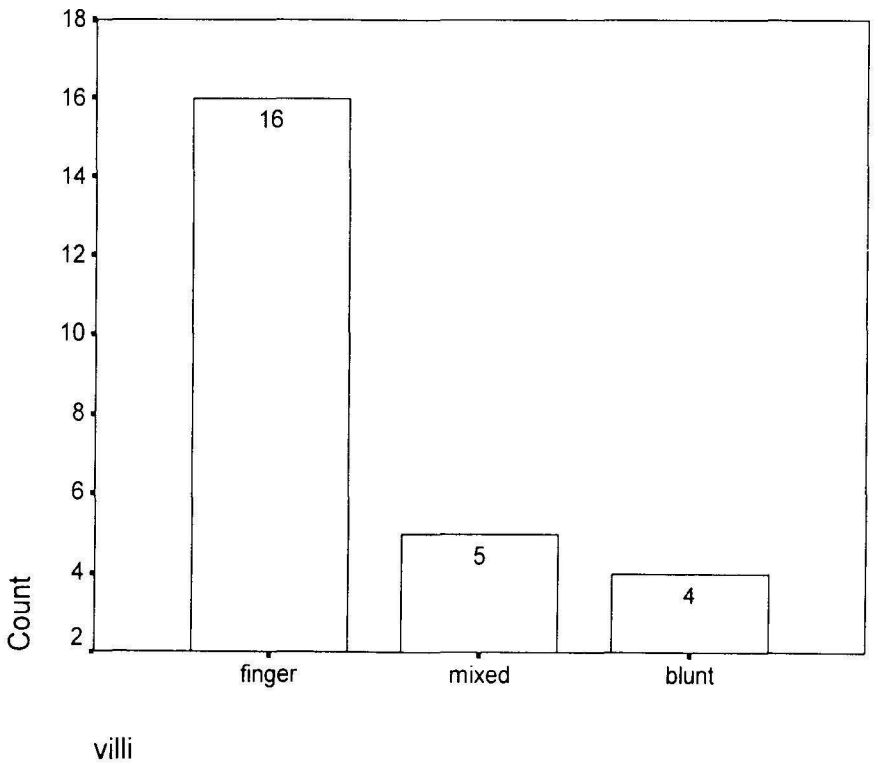

Fig. 1. Illustrates the patient groups classified by morpho-pathological assessment of duodenal villi.

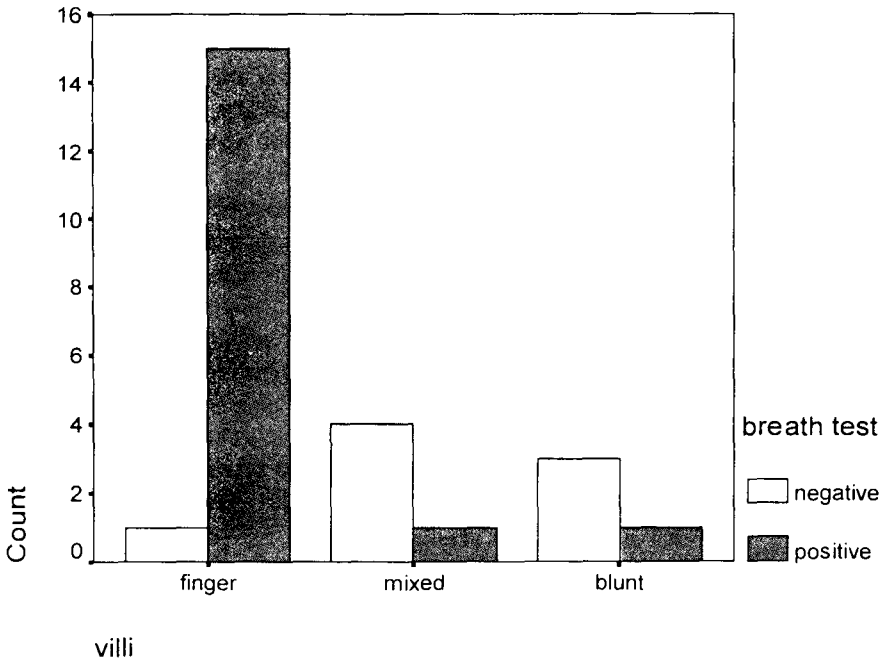

Fig. 2. Compares various groups of duodenal pathologic reports and results of breath hydrogen excretion test.

(14-17). In this study, the relationship of prevalence of lactose intolerance, using breath hydrogen excretion, and the different villous morphology are evaluated.

MATERIAL AND METHOD

Subjects

As part of a study of dyspepsia at King Chulalongkorn Memorial Hospital, all patients with normal findings by upper gastrointestinal endoscopy also had duodenal biopsy done. All patients with functional dyspepsia who were otherwise healthy, excluding subjects with a history of prior alimentary surgical resection except for appendectomy, were asked to participate.

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 would be canceled if there was a history of systemic illness, gastroenteritis, use of antibiotics or laxative within two weeks of testing. This test is based 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.

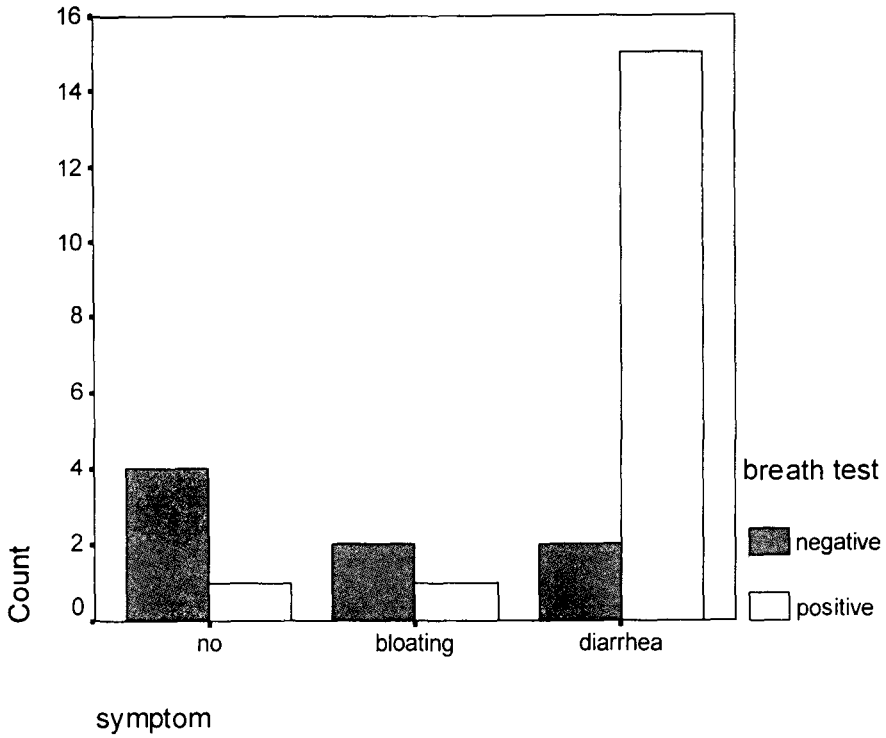

Fig. 3. The associated symptoms when taking the lactose test.

End expiratory breath were taken before the test meal and every 30 minutes 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 taken to the laboratory and analyzed for breath hydrogen using a Quintron Microlyzer. 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 as evidence of lactose malabsorption.

Statistic Analyses

Statistical methods used were Chi-square compared between various duodenal pathologic reports and results of breath hydrogen excretion test. Associated symptoms when taking the lactose test were recorded and analysed with Fisher's Exact test. The study was approved by the ethics committee of Chulalongkorn University.

Results

Twenty-five subjects volunteered for this study. They were twenty females (80.0%) and five males (20.0%) ranging in age from 18 to 53 years (mean age 31±8.29). They were classified according to morpho-pathology of duodenal biopsy into three groups : group I : finger shaped villi 16 (64.0%); group II : mixed finger and leaf shaped villi 5 (20.0%) ; group III : clubbing or blunting shaped villi 4 (16%) (Fig. 1). Results of breath hydrogen excretion test identified the prevalence of lactose intolerance in 68 per cent of the subjects. Lactose malabsorption, as defined by the breath hydrogen excretion test, was 15/16 (93.75%) the finger shaped villi group (Group I), 1/5 (20.0%) in mixed finger and leaf shaped villi group (Group II), and 1/4 (25%) in a clubbing or blunting shaped

villi group (Group III) (Fig. 2). The difference between group I and II, and group I and III was significant ($p<0.001$). In positive tests the associated symptoms were: no symptom in 5.9 per cent, bloating in 5.9 per cent and diarrhea in 88.24 per cent. The symptom of diarrhea after lactose loading correlated well with patients who had positive breath hydrogen analysis ($p<0.006$) (Fig. 3).

DISCUSSION

It is well known that lactose malabsorption is influenced by ethnic origin, age but not necessarily gender[1-3]. Western populations have less prevalence than the Asian population[9,10]. Welse et al[20] reported that age affects intestinal lactase activity. The mechanism of lactose malabsorption was associated with reduction in duodenal brush border mucosal disacharidase activity or glucose transport. Another mechanism was diseases cause lactose malabsorption[4,13].

In this study, we demonstrated higher prevalence of lactose intolerance in the group of subjects with finger shape villi when compared with the other two groups which were supposed to be abnormal. It can imply that lactose malabsorption in Thai people is due to lactase deficiency. The method that measures the lactase level is the best way to classify the causes but the technic is difficult. D-xylose test can be used to demonstrate duodenal absorptive function. Normal D-xylose test in lactose intolerant patients is defined to primary lactase deficiency. We are obliged to come back to the concept that lactose malabsorption is influenced more by ethnic origin and race than by duodenal villi morpho-pathology[2].

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REFERENCES

1. Feibusch JM, Holt PR. Impaired absorptive capacity for carbohydrate in the aging human. Dig Dis Sci 1982; 27: 1095-00.
2. Rao DR, Bello H, Warren AP, Brown GE. 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, Mishkin S. 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: 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, Stockbrugger RW. 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, Benyajati C, Kundel D, Halstead S. 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, Promadhat V, Anderson PR. Acquired lactose malabsorption in Thai children. Pediatrics 1969; 43: 540-5.
13. Debongnie JC, Newcomer AD, McGill DB, Phillips SF. 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, Hofmann AF. Prospective comparison of indirect methods for detecting lactase deficiency. N Engl J Med 1975; 293: 1232-6.
16. Caride VJ, Prokop K, Troncale FJ, Buddoura W, Winchenbach K, McCallum RW. Scintigraphic determination of small intestinal transit time: comparison with the hydrogen breath technique. Gastroenterol 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, Ras anen H, Julkunen R. 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, Stevenson DE. 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.
22. Farthing MJG. Tropical malabsorption and tropical diarrhea. In : Sleisenger & Fordtrans gastroentestinal and liver disease. Pathophysiology / Diagnosis / Management. 6th ed. Feldman M, Sleisenger MH, Scharschmidt BF, and Klein S. editors. Philadelphia: WB Saunders Company, 1998: 1574-84.

ภาวะการแพ้น้ำนมกับลักษณะพยาธิวิทยาของเยื่อบุลำไส้เล็กในคนไทย

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วัตถุประสงค์ : เพื่อศึกษาความสัมพันธ์ของภาวะการแพ้น้ำนมกับลักษณะพยาธิวิทยาของเยื่อบุลำไส้เล็กในคนไทย

วัสดุและวิธีการ : ศึกษาในผู้ป่วยที่มารับการส่องกล้องตรวจระบบทางเดินอาหารส่วนต้นซึ่งผลปกติและไม่มีประวัติของการแพ้น้ำนมมาก่อน ได้ทำการตัดชิ้นเนื้อของลำไส้เล็กเพื่อส่งตรวจทางพยาธิวิทยา แบ่งผลชิ้นเนื้อเป็น 3 กลุ่มคือ กลุ่ม 1 : ลักษณะเยื่อบุผิวคล้ายนิ้วมือ (finger shaped villi) กลุ่ม 2 : ลักษณะเยื่อบุผสมทั้งนิ้วมือและคล้ายใบไม้ (mixed finger and leaf shaped villi) กลุ่ม 3 : ลักษณะเยื่อบุคล้ายกระบองหรือแบนราบ (clubbing or blunting shaped villi) นำทุกคนมารับการตรวจภาวะการแพ้น้ำนมด้วยวิธี breath hydrogen analysis โดยได้รับน้ำตาลแลคโตสเป็นจำนวน 50 กรัม ตรวจวัดลมหายใจก่อนและหลังถ้าพบว่ามีการเพิ่มสูงขึ้นของก๊าซไฮโดรเจนจากลมหายใจมากกว่า 20 PPM ถือว่าได้ผลบวก

ผลการศึกษา : ผู้เข้าร่วมวิจัยทั้งสิ้น 25 คน เป็นผู้หญิง 20 คน (80.0%) เป็นผู้ชาย 5 คน (20.0%) อายุระหว่าง 18 ถึง 53 ปี (เฉลี่ย 31±8.29 ปี) พบว่าผลการตรวจพยาธิวิทยาของเยื่อบุลำไส้เล็กเป็นกลุ่ม 1 จำนวน 16 คน (64.0%) กลุ่ม 2 จำนวน 5 คน (20.0%) และกลุ่ม 3 จำนวน 4 คน (16.0%) ผลตรวจภาวะการแพ้น้ำนมด้วยวิธี breath hydrogen test พบอุบัติการณ์ของการแพ้น้ำนมในคนไทย 68% จำแนกตามลักษณะเยื่อบุลำไส้ได้ดังนี้ กลุ่ม 1 พบอุบัติการณ์ของการแพ้น้ำนม 15 คนจาก 16 คน คิดเป็น 93.75% กลุ่ม 2 พบอุบัติการณ์ของการแพ้น้ำนม 1 คนจาก 5 คน คิดเป็น 20.0% และกลุ่ม 3 พบอุบัติการณ์ของการแพ้น้ำนม 1 คนจาก 4 คน คิดเป็น 25% ตามลำดับ ความแตกต่างนี้มีนัยสำคัญทางสถิติ ($P<0.001$) นอกจากนี้อาการท้องเสียที่พบระหว่างการทดสอบมีความสัมพันธ์อย่างมากที่บ่งชี้ถึงอุบัติการณ์ของภาวะการแพ้น้ำนม

สรุป : การศึกษานี้แสดงให้เห็นถึงภาวะการแพ้น้ำนมในคนไทยไม่เกี่ยวข้องกับลักษณะเยื่อบุผิวของลำไส้เล็กซึ่งหมายถึงน่าจะเกิดจากการขาดเอนไซม์แลคเตสมากกว่าการผิดปกติในลำไส้

คำสำคัญ : ภาวะการแพ้น้ำนม, เยื่อบุลำไส้เล็ก, คนไทย

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