INTRODUCTION

Lactose malabsorption (LM) or lactose intolerance (LI) is a “physiologic problem and is attributable to an imbalance between the amount of ingested lactose and the capacity for lactase to hydrolyze the disaccharide”1. Lactose intolerance in adults is common among Africans,2 Jews,3 Asians,4 and other Orientals.5 In subjects with LM, undigested lactose is fermented by colonic flora causing diarrhea, abdominal pain, and flatulence.6 The severity of symptoms depends on the degree of lactase deficiency,7 the amount of lactose ingestion,8 age,9 ethnicity,10 and the gastrointestinal transit time.7 In subjects with LI most people due to colonic adaptation to regular lactose ingestion can ingest up to 6 to 12 gm lactose (120–240 mL milk) without developing symptoms.11,12

We have paucity of data on LI. A study by Alam et al in Dhaka reported 67.5% prevalence of LI in patients with irritable bowel syndrome (IBS) diagnosed by Rome II criteria.11 In another study, LM among Bangladeshi village children was about 80% over 36 months of age, but none of the children under 6 months of age had LI.12

No gold standard is available for the diagnosis of LM. Lactose hydrogen breath test (H2-BT) is considered the most accurate noninvasive test to diagnose LI. Lactose tolerance test (LTT) has a reasonable sensitivity and specificity and there is good agreement between

ABSTRACT

Aims: To see the prevalence of lactose intolerance (LI) and related symptoms following oral lactose challenge in healthy volunteers.

Materials and methods: Symptoms of abdominal pain, nausea, borborygmi, flatulence, and diarrhea were noted for 24 hours and blood glucose was estimated at 0 hour and 30 minutes after 25 gm oral lactose load to healthy volunteers. Failure to rise blood glucose level ≥ 1.1 mmol/l at 30 minutes after lactose intake from fasting level was taken as lactose malabsorption (LM), i.e., LI.

Results: A total of 166 volunteers (123 males, 43 females) with a mean age 34.78 ± 11.45 years participated in this study. Lactose intolerance was found among 85.54% (n = 142, M = 104, F = 38). The main symptoms of LI were diarrhea (n = 83, 58.4.0%), borborygmi (n = 81, 57.04%), abdominal pain (n = 35, 24.65%), and flatulence (n = 27, 19.0%).

Conclusion: Lactose intolerance among healthy adults may be common in Bangladesh. Diarrhea and borborygmi were mostly associated symptoms of LI.

Keywords: Borborygmi, Healthy volunteers, Lactose intolerance.

How to cite this article: Saha M, Parveen I, Shil BC, Saha SK, Banik RK, Majumder M, Salam MU, Nazmul Islam ASM. Lactose Intolerance and Symptom Pattern of Lactose Intolerance among Healthy Volunteers. Euroasian J Hepato-Gastroenterol 2016;6(1):5-7.

Source of support: Nil

Conflict of interest: None

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H2-BT and LTT. But data regarding the prevalence and symptom pattern of LI among healthy adults in Bangladesh is inadequate. The present study was designed to find out the prevalence of LI and symptoms after ingestion of 25 gm lactose among the apparently healthy volunteers in the northeastern part of Bangladesh.

**MATERIALS AND METHODS**

Subjects in the vicinity of North East Medical College, Sylhet, were addressed through local leaders to volunteer to participate in the present study. A total of 174 apparently healthy volunteers were enrolled in this study. Not more than two members of same family were enrolled. Informed consents were taken from the participants. Persons having fasting blood glucose level above 7.0 mmol/l, IBS (by symptom criteria), or other organic GI disorders were excluded from this study. The study was approved by the ethical committee of North East Medical College and carried out from June 2014 to October 2014. Lactose tolerance test was performed on each of these subjects using 25 gm lactose in 500 mL water after overnight fasting. Two venous samples of blood, fasting and 30 minutes after lactose intake, were taken from each subject and blood glucose was estimated. The failure of blood glucose to rise by >1.1 mmol/l from the fasting value at 30 minutes after lactose ingestion was considered an abnormal LTT result. The symptoms developed after lactose intake were recorded from the participants for 24 hours by telephone call.

Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) 16 version with significance level set 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.

**RESULTS**

A total of 174 apparently healthy volunteers took part in this study. Among them 8 were excluded due to high level of fasting blood glucose (>7 mmol/l). Among the remaining 166 participants, 123 (74.1%) were male and 43 (25.9%) were female. The age of volunteers varied from 23 to 80 years with a mean age of 34.78 ± 11.45 years (Table 1).

A total of 142 (85.54%) subjects were found to be affected by LM. The mean blood glucose rise of the LI and non-LI subjects were 0.39 ± 0.402 and 1.600 ± 0.516 respectively, p = 0.0001. Lactose intolerance was found to be equally prevalent in both sexes (male = 104, 84.6%; female = 38, 88.4%, p = 0.623) (Table 1). The mean age and BMI of subjects with LI and non-LI were similar (Table 1).

The most common symptoms experienced by the participants having LI were diarrhea (n = 83, 58.45%), followed by borborygmi (n = 81, 57.04%) (Table 1). The sensitivity, specificity, and predictive values of individual symptoms are presented in Table 2. Diarrhea has the highest sensitivity (58.45%) and a positive predictive value of 90.22%. Next to it was borborygmi. Regression analysis showed that among the symptoms associated with LI, flatulence was the most common (OR 1.532).

A total of 33 (19.87%) persons did not develop any symptoms during the monitoring period and among these 7 (21.21%) had a negative LTT. Table 1 shows that prevalence of LI was found to increase from subjects developing no symptom (78.8%) to subjects developing up to ≥6 symptoms (78.8%) to subjects developing up to ≥6 symptoms (78.8%).

**Table 1: Demographic features and symptom prevalence among lactose malabsorbers and lactose non-malabsorbers**

| Symptom pattern                        | lactose malabsorbers | lactose non-malabsorers | Total/% | p-value |
|----------------------------------------|-----------------------|--------------------------|---------|---------|
| Volunteers                             | 123 (73.1%)           | 43 (25.9%)               | 166 (100)|         |
| Male                                   | 104 (84.6%)           | 19 (15.45%)              | 123 (73.1)| 0.623   |
| Female                                 | 38 (88.4%)            | 5 (11.63%)               | 43 (25.9)|         |
| Mean age (18–80 years)                 | 35.19±11.656          | 32.50±9.004              | 34.84±11.358| 0.301   |
| BMI                                    | 20.88±3.97            | 21.28±5.91               | 21.64±3.51| 0.694   |

**Symptom pattern**

| Symptom pattern                        | lactose malabsorbers | lactose non-malabsorers | Total/% | p-value |
|----------------------------------------|-----------------------|--------------------------|---------|---------|
| Diarrhea                               | 83 (58.45%)           | 9 (37.5%)                | 92 (55.42)| 0.170   |
| Borborygmi                             | 81 (57.04%)           | 10 (41.66%)              | 91 (54.82)| 0.336   |
| Flatulence                             | 27 (19.0%)            | 5 (20.83%)               | 32 (19.27)| 0.771   |
| Abdominal pain                         | 35 (24.65%)           | 7 (29.16%)               | 42 (25.3)| 0.440   |
| Nausea                                 | 5 (3.5%)              | 1 (4.16%)                | 6 (3.6)| 0.580   |

**Number of symptoms**

| Symptom pattern                        | lactose malabsorbers | lactose non-malabsorers | Total/% | p-value |
|----------------------------------------|-----------------------|--------------------------|---------|---------|
| None                                   | 26 (18.30%)           | 7 (29.16%)               | 33 (19.87)| 0.562   |
| 1 symptom                              | 38 (26.76%)           | 5 (20.83%)               | 43 (25.9)|         |
| 2 symptoms                             | 51 (35.91%)           | 5 (20.83%)               | 56 (33.7)|         |
| 3 symptoms                             | 24 (16.9%)            | 4 (16.66%)               | 28 (16.9)|         |
| 4 symptoms                             | 2 (1.4%)              | 0                        | 2 (1.2)|         |
| ≥6 symptoms                            | 3 (2.1%)              | 1 (4.16%)                | 2 (1.2)|         |
### Table 2: Sensitivity, specificity, PPV, and NPV of major symptoms after lactose intake

| Symptom          | Sensitivity | Specificity | PPV   | NPV   | PLR  | NLR   |
|------------------|-------------|-------------|-------|-------|------|-------|
| Diarrhea         | 58.45%      | 62.5%       | 90.22%| 20.27%| 1.56 | 0.66  |
| Borborygmi       | 57.04%      | 58.33%      | 89.01%| 18.66%| 1.37 | 0.74  |
| Flatulence       | 19.01%      | 79.16%      | 84.38%| 14.18%| 0.91 | 1.03  |
| Abdominal pain   | 24.3%       | 70.83%      | 83.33%| 13.70%| 0.83 | 1.07  |
| Nausea           | 3.5%        | 98.53%      | 83.33%| 13.48%| 0.84 | 1.00  |

PPV: Positive predictive value; NPV: Negative predictive value; PLR: Positive likelihood ratio; NLR: Negative likelihood ratio

### Table 3: Association of major symptoms with lactose malabsorbers

| Symptom          | Crude OR B | Significance p | OR  | Exp(B) | Lower 95.0% CI for OR | Upper 95.0% CI for OR |
|------------------|------------|----------------|-----|--------|-----------------------|-----------------------|
| Abdominal pain   | 0.225      | 0.670          | 1.253 | 0.444 | 3.535                 |
| Borborygmi       | –0.191     | 0.713          | 0.826 | 0.299 | 2.282                 |
| Flatulence       | 0.427      | 0.497          | 1.532 | 0.448 | 5.245                 |
| Diarrhea         | –0.678     | 0.196          | 0.507 | 0.181 | 1.419                 |
| Nausea           | –0.029     | 0.982          | 0.971 | 0.082 | 11.468                |

A good number of subjects developing symptoms escaped diagnosis with LTT. It is assumed that the yield could be higher if several methods could be employed simultaneously. Despite limitations the result of this study would definitely help our clinicians for better management of their patients. The findings of this baseline study will help future studies with appropriate investigations, larger sample size, and new dimensions.

### REFERENCES

1. Cox TM, Dissacharidase deficiency. In: Warrel DA, Cox TM, Firth JD, Benz Ej Jr, editors. Oxford Textbook of Medicine: 5th ed. Oxford University Press; 2003. p. 503-507.
2. Cook GC, Kabuki SK. Tribal incidence of lactase deficiency in Uganda. Lancet 1966 Apr 2;1(7440):725-729.
3. Gilat T, Kuhn R, Gelman E, Mizrahy O. Lactase deficiency in Jewish communities in Israel. Am J Dig Dis 1970 Oct;15(10):895-904.
4. Davis AE, Bolin TD. Lactose intolerance in Asians. Nature 1967 Dec 23;216(5121):1244-1245.
5. Huang SS, Bayless TM. Milk and lactose intolerance in healthy Orientals. Science 1968 Apr 5;160(3823):83-84.
6. Suarez F, Levitt M. Lactose malabsorption and diarrhea. Nutrition 1997 Jan;13(1):53-54.
7. Enck P, Whitehead WE. Lactase deficiency and lactose malabsorption. A review. Z Gastroenterol 1986 Mar;24(3):125-134.
8. Hertzler SR, Huynn VC, Saviano DA. How much lactose is low lactose? J Am Diet Assoc 1996 Mar;96(2):243-246.
9. Rana SV, Bashin DK, Naik N, Subiah M, Ravinder P. Lactose malabsorption in different age groups of north Indians. Trop Gastroenterol 2004 Jan-Mar;25(1):18-20.
10. Zheng JJ, Gong ZL, Xue LS, Zhu XS, Luo JY. Lactose malabsorption and its ethnic differences in Hans and Uygurs. Chin Med J (Engl) 1988 Apr;101(4):284-286.
11. Alam MM, Kabir MA, Saha M, Hasan M. Assessment of symptom based criteria (Rome II) for the diagnosis of irritable bowel syndrome. Bangladesh J Med 2004;15(1):5-8.
12. Brown KH, Lynn P, Khatoon M, Ahmed MG. Lactose malabsorption in Bangladeshi village children: relation with age, history of recent diarrhoea, nutritional status and breast feeding. Am J Clin Nutr 1979 Sep;32(9):1962-1969.
13. Hovde O, Farup PG. A comparison of diagnostic tests for lactose malabsorption – which one is the best? BMC Gastroenterology 2009 Oct 31;9:82.
14. Gupta D, Ghoshal UC, Mishra A, Choudhury G, Singh K. Lactose intolerance in patients with irritable bowel syndrome from northern India: a case control study. J Gastroenterol Hepatol 2007 Dec;22(12):2261-2265.
15. Matthews SB, Ward JP, Roberts AG, Campbell AK. Systemic lactose intolerance: a new perspective on an old problem. Postgrad Med J 2005 Mar;81(953):167-173.
16. Simon FJ. The geographic hypothesis and lactose malabsorption. A weighing of the evidence Am J Dig Dis 1978 Nov;23(11):963-980.
17. Babu J, Kumar S, Bahu P, Prasad JH, Ghoshal UC. Frequency of lactose malabsorption among healthy southern and northern Indian population by genetic analysis and lactose hydrogen and tolerance test. Am J Clin Nutr 2010 Jan;91(1):140-146.
18. Barling PM. Lactose tolerance and intolerance in Malaysians. IeJSME 2012;6(Suppl 1):S12-S23.