Comparison of Lactose Intolerance in Healthy Kuwaiti and Asian Volunteers

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Key Words

Breath hydrogen · Lactose intolerance · Diarrhea · Flatulence · Abdominal cramps

Abstract

Objective: To study and compare the incidence of lactose intolerance among Kuwaiti and Asian healthy volunteers as measured by breath hydrogen level following challenge with lactose drink. **Subjects and Methods:** The study involved 70 Kuwaiti and 79 Asian healthy volunteers. The volunteers were physicians, medical students and other hospital workers. The study was carried out prospectively at Amiri Hospital, Kuwait. None of the volunteers was sick or had taken antibiotics or any other drug that could influence breath hydrogen level 2 weeks prior to the study. After an overnight fast 20-ml baseline samples of exhaled air were collected from each volunteer prior to oral administration of 40 g of lactose drink. Following this, the same amount of exhaled air was collected at 30-min intervals for 2 h. All samples were analyzed for hydrogen level using a Quintron microlyzer. Hydrogen level of 20 ppm more than baseline value was considered positive. **Results:** The basal breath hydrogen levels were 12.49 ± 8.4 and 6.97 ± 6.9 for Kuwaitis and

Asians, respectively. Thirty-three (47%) of the 70 Kuwaitis and 46 (58%) of the 79 Asians were positive for the breath hydrogen test. The clinical symptoms of flatulence, abdominal pain, and diarrhea were associated with high levels of breath hydrogen. **Conclusion:** The findings indicate that the Kuwaiti volunteers had higher breath hydrogen levels than Asians, but the incidence of lactose intolerance was similar in both groups.

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Introduction

Secondary lactose intolerance in adults is a common condition, particularly among non-Caucasian populations [1, 2]. In these populations the intestinal brush border enzyme lactase disappears during the late childhood [3, 4]. It is thought to be due to a genetic trait with age-dependent expression [5–7]. The incidence and severity of the symptoms depend on the amount of lactose consumed, the diet with which lactose is drunk [8] and the individual's sensitivity to lactose [9]. Although the incidence of adult lactose intolerance in Asian populations is high [10], its presentation as a clinical problem is relatively uncommon [11, 12].

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1011–7571/03/0123–0160\$19.50/0

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The type of test used for the diagnosis of lactose intolerance greatly influences the incidence reported. Currently used methods for the diagnosis of lactose intolerance include the breath hydrogen test (BHT), estimation of lactase enzyme from an intestinal biopsy and the lactose tolerance test. In this study, the BHT was used because it is easy to perform and is fairly dependable [13]. However, there still exists controversy in its interpretation, the amount of the substrate used for challenge and the magnitude of the hydrogen level in the breath to be taken as positive result [14]. To our knowledge very limited information is available on lactose intolerance in the Middle Eastern populations [15], but it is fairly well investigated in Asians [10–12]. Since a large population of Asians live in Kuwait and have common cultural and culinary habits, it was decided to study and compare the incidence of lactose intolerance in Kuwaitis and Asians.

Subjects and Methods

The research project was approved by the Ethics Committee, Amiri Hospital, Kuwait. A total of 149 adult volunteers, 70 Kuwaitis and 79 closely matched Asians, known not to have any gastrointestinal problems were selected for the study. Among the Kuwaitis, male and female were the same, 35 each, but among the Asians 35 were males and 44 females. The mean ages of the Kuwaitis and Asians were 33.4 ± 2.6 and 34 ± 2.84 years, respectively. The volunteers included physicians, nurses and hospital workers.

One of the investigators carefully explained the procedures to the volunteers in Arabic or English or the volunteer's own language. The volunteers were specifically asked about any illness, use of antibiotics or any other medications. They were also asked about any previous gastrointestinal problems following drinking of milk. Any one with a history of gastrointestinal problems following drinking of milk or on antibiotics within 2 weeks prior to the test was excluded. The BHT was performed after an overnight fast of at least 12 h. Twenty milliliters of end-expiratory air was collected in a plastic syringe connected through a nozzle to the bag into which the subject exhaled. After collection of a baseline sample of exhaled air, the volunteer was given 40 g of lactose dissolved in 250 ml of water to drink.

Breath sample were collected at 30-min intervals for the next 2 h. The hydrogen concentration in each breath sample was measured using a Quintron microlyzer (Quintron instrument model 12). Peak breath hydrogen was defined as the highest level of breath hydrogen obtained compared to the base level at any time during the subsequent sampling [16]. Hydrogen level of 20 ppm more than baseline value or a difference of 20 ppm between two readings was considered positive [17]. Positive BHT was made on individual readings and not on the average value. Symptoms suggestive of lactose intolerance such as nausea, vomiting, flatulence, abdominal pain and diarrhea were recorded during the next 12 h by directly asking the subjects. Symptoms were not graded according to severity.

Table 1. Breath hydrogen level (parts per million, ppm, mean $\pm$ SD) in the volunteer groups after challenge with lactose

Time, min	Group 1 Kuwaiti (n = 70)	Group 2 Asians (n = 79)	p
0	12.49 $\pm$ 8.4	6.97 $\pm$ 6.9	<0.05
30	NA	8.52 $\pm$ 9	NS
60	19.41 $\pm$ 23.6	15.67 $\pm$ 1.2	NS
90	19.20 $\pm$ 19.7	24.65 $\pm$ 29.2	NS
120	24.66 $\pm$ 23.6	31.42 $\pm$ 31.7	NS

NA = Not available.

Statistics

The SPSS version 9 statistical package was used for data analysis. Descriptive statistics, mean and standard deviations were used to describe the findings. Since the variable under study was found to deviate from Gaussian distribution irrespective of log transformation, a nonparametric method, the Kruskal-Wallis one-way ANOVA, was used to test the differences among three independent groups. The difference in proportions was tested by using Pearson χ^2 test. However, Fisher's exact test was used in case of 2×2 contingency tables with expected counts of less than five.

Results

Table 1 gives the various levels of breath hydrogen (mean $\pm$ SD) over the study period. The basal BHT level of the Kuwaitis was higher than that of the Asian subjects ($p < 0.05$). Of the 70 Kuwaitis, 33 (47%) and of the 79 Asians, 46 (58%) had a positive BHT result.

In table 2 is presented the comparison between the levels and the association of BHT levels and clinical symptoms. Of the 70 Kuwaitis, 12 (26.1%) had nausea and were BHT-positive compared to only 1 with nausea that was BHT-negative ($p < 0.05$). Among the Asians with nausea, 23 and 16.9% were BHT-positive and BHT-negative, respectively. Vomiting occurred only in 2 Kuwaitis who were BHT-positive. None of the Kuwaitis with negative BHT had flatulence, but 17 (37.8%) who were BHT-positive did ($p < 0.001$). Flatulence was not recorded in the Asian group by mistake. One Kuwaiti with abdominal pain had negative BHT, compared to 15 (32.6%) with positive BHT ($p < 0.001$). On the other hand, 4 (15.4%) of the Asians who complained of abdominal pain were BHT-negative, and 29 (54.7%) were BHT-positive ($p < 0.001$). Diarrhea was present only in 1 Kuwaiti with negative BHT and 9 (19.6%) with a positive BHT result ($p <$

Table 2. Association of gastrointestinal symptoms with breath hydrogen level (parts per million, ppm)

Symptoms	Kuwaiti (n = 70)		p	Asians (n = 79)		p
	BHT <10 (n = 24)	BHT >10 (n = 46)		BHT <10 (n = 26)	BHT >10 (n = 53)	
Nausea	1 (4.2)	12 (26.1)	<0.05	6 (23.1)	9 (16.9)	NS
Vomiting	0 (0.0)	2 (4.4)	NS	0 (0.0)	0 (0.0)	NS
Flatulence ¹	0 (0.0)	17 (37.8)	<0.001	–	–	–
Abdominal pain	1 (4.2)	15 (32.6)	<0.001	4 (15.4)	29 (54.7)	<0.001
Diarrhea	1 (4.2)	9 (19.6)	<0.001	9 (34.6)	37 (69.8)	<0.001

Percentage is given in parentheses.

¹ Flatulence was not recorded among the Asians.

0.001). Nine of the Asians (34.1%) with a negative BHT result had diarrhea compared to 37 (69.8%) with positive BHT.

Discussion

Our data indicate that the BHT after lactose challenge can diagnose 50–60% of adult volunteers of both Arab and Asian origin as lactose malabsorbers. The data also show that the positive BHT result is a good indicator of clinical symptoms. However, some of the subjects, both Arabs and Asians, had symptoms without positive BHT and vice versa: probably because it has been well documented that individuals with lactose maldigestion do not usually develop clinical symptoms, but those with lactose intolerance suffer from clinical symptoms and also become positive for the BHT [18]. Among the clinical symptoms, flatulence, abdominal pain and diarrhea seem to have a stronger association with a positive BHT. It is also known that development of clinical symptoms and their severity depend on the amount of milk consumed and whether or not milk is drunk alone or with food [5].

The incidence of lactose malabsorption that has been demonstrated in this study is similar to that reported previously [19]. The Caucasian population of North Western Europe has a very low incidence; Africans, Asians and Latin-American Indians have a high incidence [20, 21]. However, the incidence among the Arabs has not been studied adequately using satisfactory techniques [22]. It may be necessary to undertake a larger prospective study to explore this problem in the Arab population. Many of the Arab subjects demonstrated high levels of hydrogen in the breath even in the fasting state; the reason for this is

unclear. The present study was done with a relatively small number of subjects and a larger study is necessary for evaluating the incidence or prevalence of lactose intolerance in the Arab population.

Conclusion

Our findings indicate that a substantial percentage of the Kuwaiti population has lactose intolerance and the incidence is similar to that of the Asian population.

Acknowledgments

Authors gratefully acknowledge the valuable editorial comments of Prof. Jonathan C. Coleman, Professor of Virology, Faculty of Medicine, Kuwait University. We appreciate the statistical assistance of Mrs. Ajitha Suresh, Scientific Assistant, Department of Community Medicine, Kuwait University. Skillful secretarial assistance of Mrs. Bena Pereira is duly acknowledged.

References

- 1 Bayless TM, Rosensweig NS: A racial difference in incidence of lactase deficiency: A survey of milk intolerance and lactase deficiency in healthy adult males. *JAMA* 1966;197:968-972.
- 2 Sahi T: Genetics and epidemiology of adult-type hypolactasia. *Scand J Gastroenterol Suppl* 1994;202:7-20.
- 3 Cautrecasas P, Lockwood DH, Caldwell JR: Lactase deficiency in adults: A common occurrence. *Lancet* 1965;i:14-18.
- 4 Newcomer AD, McGill DB, Thomas PJ, Hofman AF: Prospective comparison of indirect methods of detecting lactase deficiency. *N Engl J Med* 1975;293:1232-1236.
- 5 Brown KH, Khatun M, Parry L, Ahmed G: Lactose malabsorption in Bangladeshi village children: Relation with age, history of recent diarrhoea, nutritional status, and breast feeding. *Am J Clin Nutr* 1979;320:1962-1969.
- 6 Kretchmer N: Lactose and lactase: A historical perspective. *Gastroenterology* 1971;61:805-813.
- 7 Rosensweig S: Adult lactase deficiency: Genetic control or adaptive response? *Gastroenterology* 1971;60:464-467.
- 8 Rosado JL, Gonzalez C, Lopez P, Palma M, Lopez B, Meija L, Baez MC: Lactose maldigestion and milk intolerance: A study in rural and urban Mexico using physiological doses of milk. *J Nutr* 1994;124:1052-1059.
- 9 Suarez FL, Savaiano DA: Lactose digestion and intolerance in adult and elderly Asian Americans. *Am J Clin Nutr* 1994;59:1021-1024.
- 10 Flatz G, Henze HJ, Palabiyi Koglu E, Dagalp K, Turkkan T: Distribution of adult lactase phenotypes in Turkey. *Geor Med* 1986;38:255-258.
- 11 Bolin TD, Davis AE, Seah CS, Chua KL, Yong V, Kho KM, Siak CL, Jacob E: Lactose intolerance in Singapore. *Gastroenterology* 1970;59:76-84.
- 12 Bolin TD, Pirola RC, Davis AE: Adaptation of intestinal lactase in the rat. *Gastroenterology* 1969;57:406-409.
- 13 Douwes AC, Fernandes J, Degenhart HJ: Improved accuracy of lactose tolerance test in children, using expired H₂ measurement. *Arch Dis Child* 1978;53:939-942.
- 14 Solomons NW, Garcia-Ibanez R, Viteri FE: Hydrogen breath test of lactose absorption in adults: The application of physiological doses and whole cow's milk sources. *Am J Clin Nutr* 1980;33:545-554.
- 15 Barr RG, Watkins JB, Perman JA: Mucosal function and breath hydrogen (H₂) excretion: Criteria for normal response (abstract). *Pediatr Res* 1979;13:395.
- 16 Solomons NW, Barillas C: The cut-off criteria for a positive hydrogen breath test in children: A reappraisal. *J Pediatr Gastroenterol Nutr* 1986;5:920-925.
- 17 Veligati LN, Treem WR, Sullivan B, Burke G, Hyams JS: Δ 10 ppm versus 20 ppm: A reappraisal of diagnostic criteria for breath hydrogen testing in children. *Am J Gastroenterol* 1994;89:758-761.
- 18 Simoons FJ: The geographic hypothesis and lactose malabsorption: A weighing of the evidence. *Am J Dig Dis* 1978;23:963-980.
- 19 Bose DP, Welsh JD: Lactose malabsorption in Oklahoma Indians. *Am J Clin Nutr* 1973;26:1320-1322.
- 20 Ransome-Kuti O, Kretchmer N, Johnson JD, Gribble JT: A genetic study of lactose digestion in Nigerian families. *Gastroenterology* 1975;68:431-436.
- 21 Huang SS, Bayless TM: Milk and lactose intolerance in healthy orientals. *Science* 1968;160:83-84.
- 22 Cook GC, Al-Torki MT: High intestinal lactase concentration in adult Arabs in Saudi Arabia. *BMJ* 1977;iii:135-136.