Lactose Tolerance in a Jewish Population

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In order to investigate the possible effect of environment on lactose deficiency, lactose tolerance tests were performed on 32 healthy Jewish adults living in Western Canada. The results were compared with those obtained in Jewish communities in Israel. There were 20 males and 12 females, 20–47 years of age, with a mean of 27.2 years. The tests revealed that 22 (68.8%) of the subjects were lactose intolerant on the basis of a maximal blood glucose rise of less than 20 mg/100 ml above the fasting level after the lactose load. The mean maximum blood glucose rise was 4.1 mg/100 ml in the 22 lactose-intolerant subjects and 33.6 mg/100 ml in the 10 lactose-tolerant subjects. Gastrointestinal symptoms during the test were observed in 95.5% of the subjects with a low rise in blood glucose, and in 10% of those with a normal rise in blood glucose. There was no relationship between lactose tolerance and milk intake. The results suggest a high incidence of lactose intolerance among North American Jews, and are similar to findings in Jewish communities in Israel.

Lactose intolerance in adults, due to primary lactase deficiency, has recently been described in various areas of the world (1–19). The marked difference in the incidence of lactose intolerance among the various population groups remains presently unexplained. Some investigators believe that primary lactase deficiency is an adaptation to decreased milk consumption in adulthood, while others suggest that it is under genetic control.

If lactase deficiency is a genetic phenomenon, then there should be no difference in its incidence in a particular ethnic group living in different areas of the world. Gilat et al (13) have recently studied lactase deficiency in Jewish communities in Israel, and reported an overall incidence of 71.1%. Lactose tolerance studies on Jews in North America and Europe would help to elucidate the question of whether adult lactase deficiency is acquired or genetically determined.

The purpose of this investigation was to determine lactose tolerance among North American Jews of European extraction (Ashkenazi) presently living in Western Canada, and to compare the results with those obtained in Jewish communities in Israel.

MATERIALS AND METHODS

Lactose tolerance tests were performed on 32 healthy Jewish adult volunteers living in Vancouver, British Columbia. There were 20 males and 12 females, 20–47 years of age, with a mean of 27.2

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years. All of the subjects were of European extraction (Ashkenazi). Nineteen were born in Canada, 9 in the continental United States, and 4 in Eastern Europe. Subjects with diabetes were excluded from the experiment, but otherwise, volunteers were not selected. Lactose tolerance tests were performed in the morning after an overnight fast. Venous blood samples were taken while subjects were fasting and at 15, 30 and 60 minutes after oral administration of 50 g lactose dissolved in 330 ml of water. Subjects were asked about their milk-drinking habits and if they experienced any symptoms when lactose was administered during or after the test. A rise in the level of blood glucose of less than 20 mg/100 ml over the level of fasting blood glucose was thought to indicate lactose intolerance. Blood glucose was determined by the glucose oxidase method (20) within a few days after the lactose tolerance test.

RESULTS

Results of the lactose tolerance test are shown in Fig 1. A rise in blood glucose level of less than 20 mg/100 ml over the level of fasting blood glucose was found in 22 of 32 subjects (68.8%). The mean rise in blood glucose was 4.1 mg/100 ml (range, 0–18.3) for the lactose intolerant group, and 33.6 mg/100 ml (range, 23.5–53.1) for the lactose tolerant group; the difference was statistically highly significant ($P<0.001$). The mean peak rise in blood glucose occurred in the 30-minute sample for both groups. The lactose load test produced gastrointestinal symptoms in 21 (95.5%) of 22 subjets with the low rise in blood glucose, and in only 1 (10%) of 10 subjects with the normal rise in blood glucose. Administration of lactose induced symptoms within 40 minutes to 5 hours after the test was started. Symptoms included abdominal cramps, flatulence, bloating and diarrhea.

The frequency of flat blood glucose curves in this study was higher in males (80.0%) than in females (50.0%). There was no effect of age on the incidence of lactose intolerance.

About 50% of the subjects consumed more than a glass of milk per day, while the other half consumed less than a glass daily. Most of the subjects were consuming various milk products regularly. The amount of milk consumption seemed to bear little relation to the results of the lactose tolerance test. Only 1 of the subjects was aware of abdominal discomfort caused by milk intake.

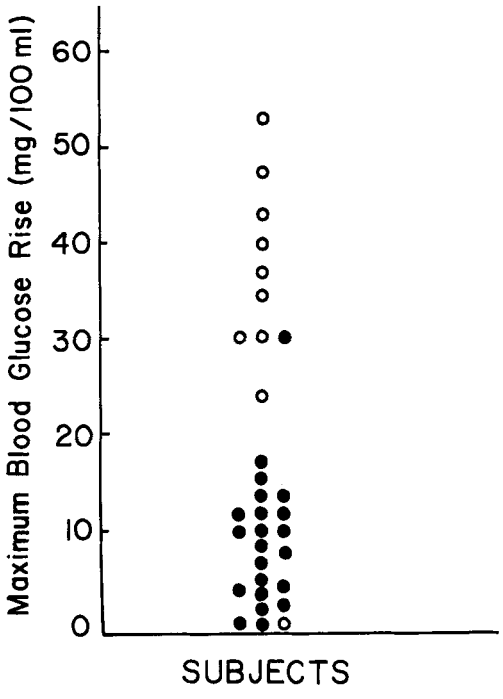

Fig 1. Maximum rise in blood glucose (mg/100 ml) over fasting levels during lactose tolerance tests. ●, Subjects reporting gastrointestinal symptoms during study; ○, no symptoms reported.

DISCUSSION

Lactase deficiency is defined in terms of both lactase activity and intolerance to a relatively physiologic dose of lactose. The lactose tolerance test alone has been shown to be a reliable method for diagnosing lactase deficiency, especially when the low

rise in blood glucose is accompanied by gastrointestinal symptoms (21). Gilat et al (13) also reported a good correlation (90%) between lactase activity of intestinal biopsy samples and the lactose tolerance test. It has also been shown that blood sampling periods of up to 60 minutes are adequate for the lactose tolerance test, because the maximum rise in blood glucose is usually prior to the 60-minute sample (13, 19). The lactose tolerance test, therefore, is a very useful screening method for lactase deficiency.

Results of this study indicate that there is a high incidence of lactase deficiency (68.8%) among Ashkenazi Jews living in North America. The overall incidence of lactase deficiency in Jewish communities in Israel was 71.1% (13), which is almost identical to the findings in this study. The incidence of lactase deficiency in Ashkenazi Jews in Israel was slightly higher (79.2%). However, most of the Ashkenazi Jews studied by Gilat et al (13) were hospital patients ranging in age from 20 to 70 years (mean, 47.9 years). It should be pointed out that in a previous study in this laboratory (19), lactose tolerance tests were performed on 16 young healthy British Columbia students of Northern European extraction, only 1 of whom had a low rise in blood glucose, but no symptomatic response.

Bolin and Davis (22) and others (10, 23) stated that if adult lactase deficiency is under genetic control, then the same incidence of lactase deficiency should be found in a particular ethnic group irrespective of their country of residence and independent of lactose consumption. In view of this theory, findings in this investigation suggest that lactase deficiency is a genetic trait, since the incidence of lactase deficiency is similar among Jews living in North America and in the major Jewish communities in Israel, despite their environmental and dietary differences. Dietary differences exist particularly between Jews of European and Afro-Asian extraction; however, milk-drinking habits were similar among the 3 major Jewish communities (Ashkenazi, Sephardi and Orientals) in Israel (13).

Analogous evidence in favor of a genetic rather than an adaptive response theory for lactase deficiency is found in the similar incidence of lactase deficiency among African and American Negroes. The incidence of lactase deficiency in American Negroes reported by various workers (1–4) was 70–77%; in African Negroes (Baganda and other Bantu tribes of Uganda), it was 81% for children under 10 years of age; and in adults, about 89% (5). It should also be pointed out that the diet of the American Negro today has apparently little resemblance to the diet of the African Negro.

REFERENCES

1. Cuatrecasas P, Lockwood DH, Caldwell JR: Lactase deficiency in the adult. Lancet 1:14–18, 1965
2. Bayless TM, Rosensweig NS: A racial difference in incidence of lactase deficiency. JAMA 197:968–972, 1966
3. Welsh JD, Rohrer V, Knudsen KB, et al: Isolated lactase deficiency. Arch Intern Med 120:261–269, 1967
4. Littman A, Cady AB, Rhodes J: Lactase and other disaccharidase deficiencies in a hospital population. Israel J Med Sci 4:110–116, 1968
5. Cook GC, Kajubi SK: Tribal incidence of lactase deficiency in Uganda. Lancet 1:725–730, 1966
6. Davis AE, Bolin T: Lactose intolerance in Asians. Nature 216:1244–1245, 1967
7. Chung MH, McGill DB: Lactase deficiency in Orientals. Gastroenterology 54:225–226, 1968
8. Huang SS, Bayless TM: Milk and lactose intolerance in healthy Orientals. Science 160:83–84, 1968
9. Bolin TD, Davis AE: Asian lactose in-

tolerance and its relationship to intake of lactose. Nature 222:382–383, 1969
10. Murthy MS, Haworth JC: Intestinal lactase deficiency among East Indians. Amer J Gastroent 53:246–251, 1970
11. McMichael HB, Webb J, Dawson AM: Jejunal disaccharidases and some observations on the cause of lactase deficiency. Brit Med J 2:1037–1041, 1966
12. Gudmand-Hoyer E, Jarnum S: Lactose malabsorption in Greenland Eskimos. Acta Med Scand 186:235–237, 1969
13. Gilat T, Kuhn R, Gelman E, et al: Lactase deficiency in Jewish communities in Israel. Amer J Dig Dis 15:895–904, 1970
14. Gilat T, Gelman Malachi E, Shochet SB: Lactose tolerance in an Arab population. Amer J Dig Dis 16:203–206, 1971
15. Elliot RB, Maxwell GM, Vawser N: Lactose maldigestion in Australian Aboriginal children. Med J Austral 1:46–49, 1967
16. Alzate H, Gonzalez H, Guzman J: Lactose intolerance in South American Indians. Amer J Clin Nutr 22:122–123, 1969
17. Newcomer AD, McGill DB: Disaccharidase activity in the small intestine: prevalence of lactase deficiency in 100 healthy subjects. Gastroenterology 53:881–889, 1967
18. Jussila J, Isokoski M, Launiala K: Prevalence of lactose malabsorption in a Finnish rural population. Scand J Gastroent 5:49–56, 1970
19. Leichter J, Lee M: Lactose intolerance in Canadian West Coast Indians. Amer J Dig Dis 16:809–814, 1971
20. Raabo E, Terkildsen TC: On the enzymatic determination of blood glucose. Scand J Clin Lab Invest 12:402–407, 1960
21. McGill DB, Newcomer AD: Comparison of venous and capillary blood samples in lactose tolerance testing. Gastroenterology 53:371–374, 1967
22. Bolin TD, Davis AE: Primary lactase deficiency: genetic or acquired? Amer J Dig Dis 15:679–692, 1970
23. Rosensweig NS: Adult lactase deficiency: genetic control or adaptive response? Gastroenterology 60:464–467, 1971