ing with amounts normally synthesized by other animals.

Robert B. Rucker

Michael A. Dubick

Department of Nutrition
University of California
Davis, California 95616

References

1. Rucker RB, Dubick MA, Mouritson J. Hypothetical calculations of ascorbic acid synthesis based on estimates in vitro. Am J Clin Nutr 1980; 33:96
2. Ginter E, Cerna O, Bobek P, Mikus L, Herbrikova T, Cernacek M. Optimum dose of vitamin C for human organism. Voprosy Pitaniia 1979; 4:9
3. Pauling L. Are recommended daily allowances for vitamin C adequate? Proc Natl Acad Sci USA 1974; 71:4442
4. Kleiber, M. The fire of life: an introduction to animal energetics. New York: Wiley and Sons, 1976.

INCAP Publication I-1229

Milk tolerance, gastric emptying, and breath hydrogen excretion

Dear Sir:

The observations of Ellestad-Sayed et al. (1) on milk intolerance and lactose absorption in Manitoban Indians raise interesting questions about the role of the rate of gastric emptying in affecting the validity of the H_2 breath-analysis test. In discarding the possibility that differences in gastric emptying explained their differences in H_2 production 2 h after the administration of diluted evaporated milk or reconstituted skimmed milk powder of equivalent lactose content (1), the authors cite our observations in preschool children given equivalent amounts of lactose in milk or as an aqueous solution (2). It is appropriate to extend the discussion of this phenomenon. I would maintain that two major differences qualify a comparison of the two studies' fundings. First, our Guatemalan subjects were preschoolers with a mean age of 2 yr whereas the Manitoban subjects averaged 10 yr. Second, we used a drastic contrast in our experimental design, comparing a *nonmeal* (aqueous solution) with a *meal* (whole milk) situation. As aqueous solutions are conventionally used to provide the dose of carbohydrate for lactose tolerance tests, we believed that our design focused on the question of why some individuals, particularly children, who experienced symptoms during a formal test might be able to tolerate fluid milk in the diet.

An age dependence of this phenomenon is apparent insofar as milk and aqueous solutions of lactose produced *equivalent* amounts of H_2 in lactose-malabsorbing adults (3). This is in accordance with other observations in *adult* subjects that the H_2 breath test is relatively free of gastric emptying dynamics (4, 5). The issue is less clear in the school-aged population, precisely the group addressed in the study by Ellestad-Sayed et al. (1). The authors argue that if the amounts of protein and fat were responsible for differences between the H_2 production after ingesting evaporated milk versus skimmed milk, then the addition of a peanut butter sandwich to the meal would have reduced H_2 production still further. This tendency was seen with both of the milk preparations, but in neither case did its magnitude reach statistical significance. We must consider the possibility that *among* lactose-containing meals of distinct composition the differences in gastric emptying rates are less drastic than *between* a lactose-containing meal and an aqueous lactose solution as an explanation for this observation.

The procedures used by Ellestad-Sayed et al. (1), however, permit a comparison of initial, fasting rates of H_2 production with postprandial rates only at 2 h. Although this time point seemed to correspond to the point of maximal gas production in response to a milk meal in preliminary studies (1), the failure to assay breath H_2 excretion at other intervals does not allow us to *exclude* the possibility that a less abrupt and more prolonged course of the H_2 response was occurring with the evaporated milk meal due to slower gastric emptying and that a single 2-h postprandial sampling interval failed to reflect this phenomenon. We have recommended that multiple postdose sampling intervals can improve

Am. J. Clin. Nutr., 34(7): 1451-1452, 1981. (Letters to the Editor).

the sensitivity of the H_2 breath test in detecting malabsorption. Inclusion of other time points in the study by Ellestad-Sayed et al. (1) would have definitively allayed any suspicion that the differential H_2 response to the milk preparations tested was based on differential gastrointestinal transit of the fluid meals.

The practical question of milk utilization in school-feeding programs which prompted the studies in Manitoba reflects a world-wide concern about policies of milk distribution (6). The finding that 250 ml of milk is generally tolerated by most members of all populations targeted for milk distribution (6) has once again been reinforced by the report of Ellestad-Sayed et al. (1). We believe that part of the explanation for this tolerance of milk in a *dietary* context is the more gradual intestinal delivery of lactose consumed along with the fat and protein that constitute a customary meal.

Noel W. Solomons, M.D.

Department of Nutrition and Food Science
Massachusetts Institute of Technology
Cambridge, Massachusetts and
the Division of Human Nutrition and Biology
Institute of Nutrition of Central America and Panama
Guatemala City, Guatemala

References

1. Ellestad-Sayed JJ, Levitt MD, Bond JH. Milk intolerance in Manitoba Indian school children. Am J Clin Nutr 1980;33:2198-201.
2. Solomons NW, Garciá-Ibañez R, Viteri FE. Reduced rate of breath hydrogen excretion with lactose intolerance tests in young children using whole milk. Am J Clin Nutr 1979;32:783-6.
3. Solomons NW, Garciá-Ibañez R, Viteri FE. Hydrogen (H_2) breath test of lactose absorption in adults: the application of physiological doses and whole cow's milk sources. Am J Clin Nutr 1980;33:545-54.
4. 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.
5. Bond JH, Levitt MD: Use of breath hydrogen (H_2) in the study of carbohydrate absorption. Am J Dig Dis 1977;22:379-82
6. Torun B, Solomons NW, Viteri FE. Lactose malabsorption and lactose intolerance: implications for general milk consumption. Arch Latinoam Nutr 1979;29:445-94.

Reply to letter by Solomons

Dear Sir:

Dr. Solomons has called attention to the need for further work in the development and application of the breath hydrogen test. Hopefully, a standardized test will soon evolve and it will be logistically possible not only for clinical studies but also for population studies in remote areas. There are, as yet, no clear answers about the interrelationships among breath hydrogen production, age, rate of gastric emptying, and the effect of milk processing, and perhaps other unidentified factors as well.

It has been demonstrated, however, that not only North American Indian children (1), but other populations as well can tolerate the lactose contained in 250 ml of milk. This is of public health significance in a population similar to the northern Manitoba Indians, whose intake of vitamin D and calcium is marginal (2, 3). Whether this tolerance is due to the gradual intestinal delivery of lactose per se, or the biochemical action of intestinal flora, or the creation of other conditions that promote lactose hydrolysis remains to be demonstrated.

J. J. Ellestad-Sayed, Ph.D.

Assistant Professor and Director
Nutrition Research Laboratory
Health Services Building, Room 200
Victoria Hospital
South St. Campus
London, Ontario, N6A 4G5
Canada

M. D. Levitt

J. H. Bond

Department of Medicine
Gastroenterology Section
Veteran's Administration Hospital
54th St. and 48th Ave. South
Minneapolis, Minnesota 55417