The effect of dietary lactose on the early recovery from protein-energy malnutrition. II. Indices of nutrient absorption[1-5]

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ABSTRACT Absorption of dietary energy, nitrogen, carbohydrates and calcium, and retention of nitrogen and calcium were studied in 20 children with protein-energy malnutrition of the edematous type, using metabolic balance techniques and breath H_2 analysis, to assess the advisability of using lactose-containing formulas in the rehabilitation of severely malnourished children. Ten patients received for 45 days a diet formula based on cows' milk (intact milk) and 10 similar children received the same formula pretreated with β-galactosidase to hydrolyze the lactose (hydrolyzed milk). Dietary intakes were gradually increased to reach, on the 8th day, 4 g of protein and 150 kcal/kg. There were no differences between groups with respect to absorption or retention of the index nutrients. Postprandial carbohydrate malabsorption was occasionally observed in two patients with servings of the intact milk formula, and in one with the hydrolyzed milk diet. When the nutritional quality of a diet is assessed, the amount of nutrients that are absorbed and utilized are more important than the small, incompletely absorbed fractions that do not have significant metabolic or clinical implications. Therefore, the use of milk as the protein source for recovery diets is not contraindicated in the routine treatment of PEM. *Am J Clin Nutr* 1984;40:601–610.

KEY WORDS Calcium, dietary therapy, dietary carbohydrates, dietary proteins, intestinal absorption, lactase, lactose intolerance, milk, nitrogen balance, protein-energy malnutrition

Introduction

Although milk is a source of excellent dietary protein and is often available for the treatment of malnutrition in developing countries in which protein-energy malnutrition (PEM) is highly prevalent, many clinicians have been reticent to advocate the use of whole cows' milk as the basis of recovery diets for severely malnourished children (1–3). The technology for reducing or removing the lactose content of milk provides a potential solution to any difficulties that might be attributable to the carbohydrate. However, before justifying the additional expense of providing low-lactose or lactose-free milk, the cost-effectiveness of the performance of unaltered whole cows' milk should be as-

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sessed. In comparing intact milk with low-lactose milk, not only are effects on clinical recovery, growth and stool characteristics of concern, but also the absorption and utilization of nutrients.

Since the decreased transit time and net accumulation of fluid in the intestinal lumen expected to result from major malabsorption of lactose might reduce the efficiency of the digestion and/or absorption of other dietary constituents, it is reasonable to investigate whether the utilization of dietary nitrogen or energy are impaired when lactose-containing foods are consumed by lactose-malabsorbers. Graham and Paige (3) reported an acute, transient decrease in nitrogen absorption in lactose-intolerant children who were fed a formula that had a lactose content of more than twice the lactose/protein proportion in cows' milk. In studies by Bowie (4) and Brown et al (5), in which the delivery of lactose in the diet was more moderate, no reduction in the apparent absorption or retention of macronutrients was observed.

Adequate calcium nutriture is critical to the child recovering from PEM to provide for skeletal mineralization in situations during which longitudinal catch-up growth rates of up to 2 cm per month can be achieved. Lactose promotes calcium absorption in experimental animals (6–11), while lactose-hydrolyzed milk produced inferior calcium bioavailability for human subjects (12–14). A decreased absorption of calcium was reported in lactose-malabsorbers consuming intact milk, however (14–16).

In the context of the exploration of the effects of lactose on clinical features and growth during the early recovery of Guatemalan preschool children with severe PEM of the edematous type (17), we have also examined the efficiency of absorption of protein, calcium, total energy, and carbohydrates in two well-matched cohorts of patients treated with intact milk (IM) or lactose-hydrolyzed milk (HM).

Patients and Methods

Subjects

Twenty Guatemalan boys of Maya or ladino (Maya-Caucasian) descent, 15 to 36 months old, with severe, acute edematous PEM (kwashiorkor or marasmic-kwashiorkor) participated in the study for 45 to 50 days. They were assigned at the time of admission to either one of two dietary treatment groups by stratified binary-choice allocation. Both groups of children were similar in age, severity of edema, anthropometry, and history of diarrhea. The criteria for selection, the characteristics of the patients and the therapeutic regimens were described in an accompanying article (17). Informed consent was obtained from the children's parents upon admission to the Clinical Research Center. The research protocols were approved by INCAP's Committee on Human Research and MIT's Committee on the Use of Humans as Experimental Subjects.

Diets

As described in the companion article (17), the two groups of children received either a diet based on intact, whole cows' milk as the protein source, or the same formula after adding a β-galactosidase (lactase, LactAid, SugarLo Company, Pleasantville, NJ) to hydrolyze more than 90% of the dietary lactose into its constituent monosaccharides. On the 1st day, the children received 0.7 g casein and 70 kcal/kg/day. The experimental diets contained milk protein and total energy, which were increased on days 2, 4, 6, and 8, respectively, to 1 g and 100 kcal, 2 g and 120 kcal, 3 g and 150 kcal, and 4 g and 150 kcal/kg/day. This level of intake was maintained constant for the remainder of the study. Soybean oil was added to the dried, whole cows' milk to provide a total of 40% of dietary energy as fat, and the balance of the prescribed energy was provided by sucrose. The diets were supplemented with adequate amounts of vitamins, minerals, and electrolytes. The diets were divided into five equal meals, fed at 3 h intervals, during the course of the day. On days 2 to 5, the children ingested with each meal, as an average, 0.45 g of either intact or hydrolyzed lactose per kg body weight, and from day 8 onwards, 1.2 g/kg. The group receiving the untreated formula was designated as the intact milk or IM group; the children receiving the lactase-treated formula diet were identified as the lactose-hydrolyzed milk or HM group. Aftr day 45, the 10 children in the HM group were fed the HM formula for 5 more days.

Metabolic balance studies

Complete collection of urine and stools were made in all children during days 2 to 5, 12 to 14, 22 to 24, 32 to 34, and 42 to 44. Collections were also made on days 48 to 50 in those children initially assigned to group HM, but subsequently switched to the intact milk formula after day 45. During the first two balance periods, the children usually did not walk and were confined to a metabolic bed with a weighed fecal basin in place and a plastic urine collector diverting the urine into a separate bottle containing 5 ml of 50% hydrochloric acid as preservative. Once the child was ambulatory and advised the nursing staff about defecating or his pattern of defecation was known, he was allowed to move around freely in the Clinical Research Center facilities and playground, wearing a self-adhesive polyethylene urine collection bag. All stools were collected into preweighed, plastic basins, and the weight of each stool was recorded. Stools were refrigerated during the duration of each balance period, and then pooled proportionately and frozen. Later, stools were dried in ovens at 90 to 100°C until they reached a constant weight, prior to analysis. Previous experiments showed no differences in fecal fat, nitrogen, or total energy between this procedure and drying in a vacuum oven at 30 to 40°C. Brilliant blue was used as fecal marker to identify the beginning and end of the collection period.

Duplicate samples of diets were collected and frozen for analysis. Accurate records of the weights of diets consumed in each meal were kept by the nursing staff.

Determination of nitrogen absorption and retention

The nitrogen contents of diets, urine and feces were determined in duplicate using a micro-Kjeldahl method. "True" nitrogen digestibility and "true" nitrogen retention were calculated by the following equations:

% true N digestibility

$$= \frac{\text{ingested N} - (\text{fecal N} - \text{endogenous N})}{\text{ingested N}} \times 100$$

true N retention = ingested N

$$- [\text{fecal N} + \text{urinary N} + \text{insensible N losses}]$$

Endogenous N, or obligatory fecal N loss, was assumed to be 20 mg N/kg/day (18). Insensible N losses were assumed to be 8 mg N/kg/day during the first balance period and 14 mg N/kg/day thereafter, based on integumental N losses with different amounts of protein intake (19). Nitrogen retention was related to the *average* weight of the child during the metabolic balance period for its final expression as mg N/kg/day.

Determination of calcium absorption and retention

An aliquot of 0.5 g of dried stools was incinerated at 650°C for 16 h; this second fecal ash was dissolved in 100 ml of 1 N HCl. Five-gram aliquots of diets were homogenized by sonication, dried at 95°C for 36 h, and incinerated at 650°C for 16 h; the ash was dissolved in 100 ml of 1 N HCl. Aliquots of 200 μl of urine were dilutes 10:1, and 200 μl of the dissolved diets and feces were diluted 20:1 in 0.15% aqueous solution of lanthanum chloride. Calcium concentrations were determined by atomic absorption spectrophotometry (model A 775, Varian Techtron Pty Ltd, Melbourne, Australia).

The apparent calcium absorption and apparent calcium retention (ie, without accounting for endogenous or integumental Ca losses) were determined using the equations:

% apparent Ca absorption

$$= \frac{\text{ingested Ca} - \text{fecal Ca}}{\text{ingested Ca}} \times 100$$

apparent calcium retention

$$= \text{ingested Ca} - [\text{fecal Ca} + \text{urinary Ca}]$$

This was also related to the average weight of the child during the balance period for its expression as mg Ca/kg/day.

Determination of total energy absorption

The energy contents of dried homogenized aliquots of diets and stools were determined in duplicate by adiabatic bomb calorimetry on a Gallenkamp calorimeter, using certified benzoic acid as standard (British Chemical Standard N-190J, Middlesbrough, Teeside, England). Apparent energy absorption was calculated in an analogous fashion to that of calcium absorption, using bomb calorimetry data for ingested and fecal energy. The energy of combustion of 100 g of diet, which contained 4 g protein, 4.4 g fat, and 23.5 g carbohydrate, was, theoretically; 159 kcal (ie, 5.6, 9.4, and 4.1 kcal/g of protein, fat, and carbohydrate, respectively). The "metabolizable" energy of those ingredients, based on the Atwater factors, was 150 kcal. Therefore, the net (or "metabolizable") energy intake was calculated multiplying the bomb calorimetry measurements of the diet (gross energy) by 0.943 (ie, 150/159).

Hydrogen breath tests

H_2 breath tests were performed serially throughout the study. Samples of exhaled air were collected in the rubber bag through a respiratory face mask and a small, low-resistance Rudolph valve (Warren Collins, Braintree, MA), as previously described by Solomons et al (20, 21). Hydrogen concentration was quantified using a thermal conductivity gas-solid chromatograph (MicroLyzer, Quintron Instruments Co, Milwaukee, WI) (22) calibrated with certified gases containing hydrogen at 53 or 99.8 ppm (Supelco, Bellefonte, PA, or Linde Division, Union Carbide, N Chicago, IL). The chromatograph has a coefficient of error of 2% in the 0 to 100 ppm range. Breath samples were collected after an overnight fast and at 3 or 4 h intervals after the administration of breakfast or following an oral dose of 6.7 g of the nonabsorbable dissacharide, lactulose (4-0-β-D-galactopyranosyl-D-fructofuranose), administered as a flavored syrup (Cephulac, Merrill-National Laboratories, Cincinnati, OH). The test with lactulose was performed on admission and 1 wk later in order to determine the competence of the colonic bacterial flora to metabolize unabsorbed carbohydrate with augmented H_2 excretion in expired air, since diarrhea (23, 24), antibiotics (22, 25) and the debilitation of severe malnutrition (26) can reduce the rate of production and/or respiratory excretion of H_2. If the patient did not have a positive response initially, the lactulose test was repeated 1 day before or after each scheduled, weekly postprandial breath H_2 study until the child had demonstrated a colonic flora capable of mounting an H_2 response; only in the presence of a positive breath H_2 response after an oral of 6.7 g of lactulose would a flat curve be interpreted as truly negative following a feeding of the diet.

The postprandial tests were done after breakfast at 7-day intervals until day 45, and again on days 46 and 50 in the patients of the HM group when switched to IM. On day 3, the test-meal contained 0.3 g of lactose (IM formula or of galactose and glucose (HM formula); thereafter it contained 1.2 g of the carbohydrates from milk. The child remained awake during the 3 to 4 h of the test, and was allowed water ad libitum but no further food. To quantify the breath-test response to the various carbohydrates, the total breath H_2 concentration and the maximum increment above fasting levels were determined. A test was considered "positive," that is indicative of carbohydrate malabsorption, when the increase in breath H_2 concentration was ≥20 ppm (27, 28).

Statistical analyses

The differences between treatment groups were examined using "Student's" *t* test or analysis of variance. The changes over time with respect to dietary treatment were evaluated by analysis of covariance for repeated measures of the same individuals after the method of Winer (29).

Results

Nitrogen absorption and retention

Table 1 provides results on the "true" nitrogen retention and absorption for both the beginning and during the period of full-strength nutritional treatment. Actual protein intakes on days 8 to 45 were 3.88 ± 0.10 g/kg/day (mean ± SD). No statistically significant differences in absorption related to lactose intake (Table 1) or as a function of time (Fig 1*A*). There were no differences between groups in nitrogen retention (Table 1), and the only significant change in nitrogen retention with time occurred at the beginning of dietary protein repletion with full protein intake (Fig 2).

Energy absorption

Table 1 lists the net (metabolizable) energy intakes and the apparent fractional absorption of energy. Neither between treatment nor as a function of time (Fig 1*B*) were any statistically significant differences found.

Calcium absorption and retention

Table 1 shows the dietary calcium intakes and absorption efficiencies. There were no statistically significant differences between groups nor as a function of time (Fig 1*C*), nor were differences in calcium retentions observed (Fig 3). The within-group variables in absorption and retention of calcium were several times greater than those of nitrogen and energy.

Carbohydrate absorption

The initial lactulose test on the first day of hospitalization was positive in only five patients assigned to the IM group and four of the HM group. The inability to produce a positive response persisted in several children for variable periods after beginning treatment. Also, some children with an initial positive response lost the capacity to respond to lactulose due to treatment of infections with antibiotics. Thus, 33% of all the H_2 breath tests after breakfast had an associated negative lactulose test.

The original analytical plan had been to interpret each postprandial H_2 breath test as a discrete diagnostic entity, but given the high proportion of tests associated with negative lactulose tests, we performed a global, intergroup comparison of the *pattern* of H_2 excretion in those postprandial breath tests in which the H_2 producing capacity was assured. In neither the pattern of *absolute* H_2 excretion (data not shown) nor that for the postmeal *rise* in breath H_2 concentration (Fig 4) was an excess frequency of incom-

TABLE 1
Metabolic balance and intestinal absorption of dietary protein (1 g = 157 mg N), energy, and calcium of malnourished children treated with IM or lactose HM milk formulas

		First balance period (days 2 to 5)			Composite of second through the fourth balance periods (after day 8)		
		Intake	Retention	Absorption	Intake	Retention	Absorption
		mg/kg/day	*mg/kg/day*	*%*	*mg/kg/day*	*mg/kg/day*	*%*
Nitrogen	IM	226 ± 27*	125 ± 41	86 ± 10	611 ± 16	271 ± 70	91 ± 6
	HM	242 ± 28	140 ± 35	91 ± 5	606 ± 17	287 ± 67	91 ± 5
Energy	IM	104 ± 11		88 ± 6			94 ± 3
	HM	107 ± 10		91 ± 4			94 ± 2
Calcium	IM	87 ± 16†	36 ± 16	43 ± 15	147 ± 10	54 ± 28	39 ± 17
	HM	86 ± 13†	37 ± 15	45 ± 13	144 ± 16	53 ± 27	39 ± 17

* Mean ± SD.
† Ca CO_3 was added to the formulas on days 2 to 5.

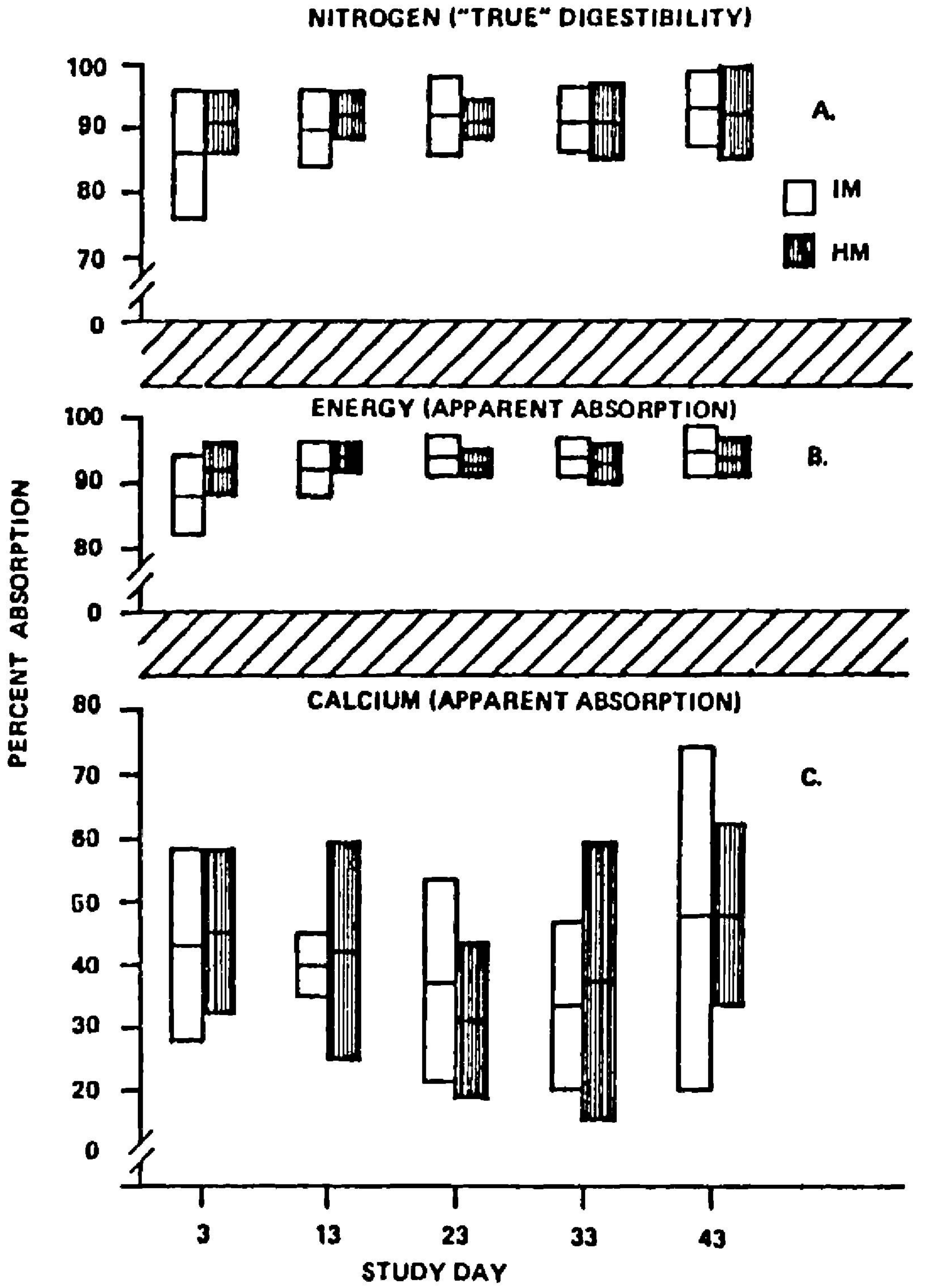

FIG 1. Absorption of dietary nitrogen (*A*), energy (*B*) and calcium (*C*) during 3- or 4-day balance periods at 10-day intervals, with diets based on intact (*IM*) or lactose hydrolyzed (*HM*) milk (mean ± SD). Average intakes were 234 mg N, 106 kcal, and 86 mg Ca/kg/day on the first balance period, and 608 mg N, 143 kcal, and 146 mg Ca/kg/day thereafter, including inorganic Ca supplement given during the first balance.

plete carbohydrate removal in the small intestine evident. On only four occasions in three different patients—two from the IM and one from the HM group—were the increments in postprandial breath H_2 concentrations in excess of 20 ppm. The IM group child with a positive response on two occasions and the only HM group child with a positive response, were among the two children in each group who frequently had large or abnormal stools throughout the study. The four positive tests represented 6% of all valid, morning meal experiences. Barr (30) and Bayless (31) have argued that incomplete absorption of carbohydrate substrates can be diagnosed by an increment of only ≥10 ppm. If this criterion were applied to our results, we still would classify ony 12 tests (18% of total) as compatible with incomplete absorption of carbohydrate and, once again, the distribution of positive test were almost identical in the two dietary treatment groups.

Switch from hydrolyzed to intact milk

When the children in the HM group were switched to the intact milk diet for 5 days, there were no significant changes in the absorption of nitrogen, energy, or calcium. Only one child manifested a positive H_2

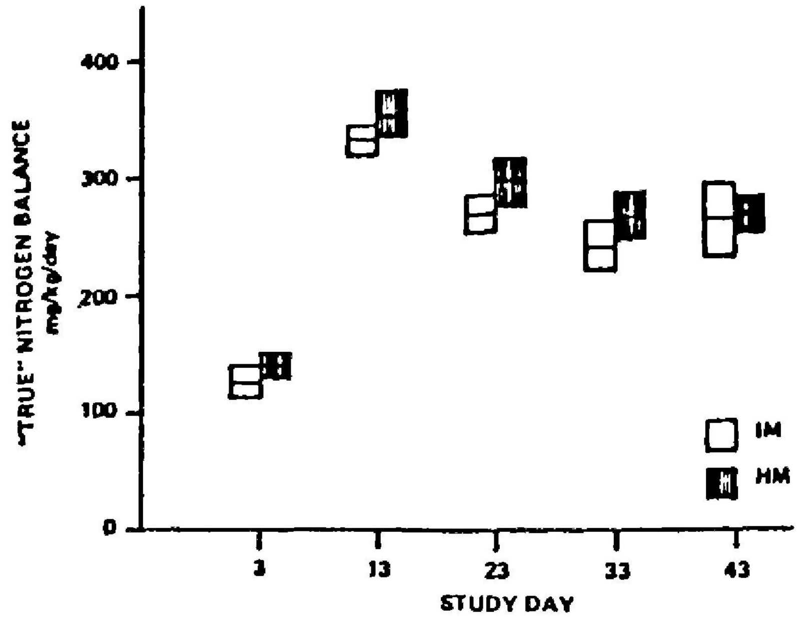

FIG 2. True nitrogen balance, including estimates of insensible N losses, measured for 3 or 4 days at 10-day intervals with intact (*IM*) or lactose-hydrolyzed (*HM*) milk diets (mean ± SEM). Average intakes were 234 mg N (1.49 g protein)/kg/day on the first balance period and 608 mg N (3.88 g protein)/kg/day thereafter.

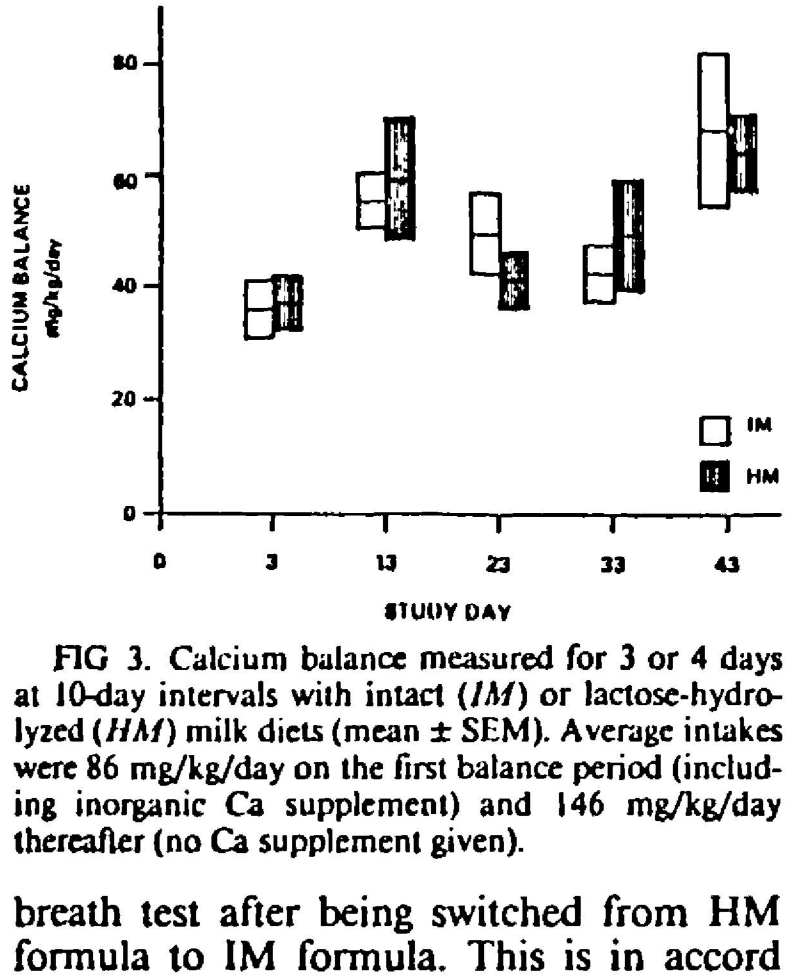

FIG 3. Calcium balance measured for 3 or 4 days at 10-day intervals with intact (*IM*) or lactose-hydrolyzed (*HM*) milk diets (mean ± SEM). Average intakes were 86 mg/kg/day on the first balance period (including inorganic Ca supplement) and 146 mg/kg/day thereafter (no Ca supplement given).

breath test after being switched from HM formula to IM formula. This is in accord with the absence of alterations in diarrhea or fecal characteristics (17). Curiously, a greater retention of nitrogen with the intact milk formula (298 ± 49 mg N/kg/day) occurred than had been seen in the final balance period on the HM diet in this group when compared by paired *t* test ($p < 0.05$) or when analyzed over time by analysis of covariance ($p < 0.05$) (29). Calcium retention did not change with the dietary modification.

Discussion

The controversey about the possibility of deleterious effects of dietary lactose is important in relation to two nutritional issues: *1*) the loss of dietary energy in the form of lactose that is not absorbed; and *2*) the loss of other nutrients that are incompletely absorbed due to changes in intestinal transit and fluid movements produced by the malabsorption of dietary lactose. Such issues are particularly relevant in the treatment of malnourished patients since it is known that gastrointestinal malfunctions such as low pancreatic enzyme outputs (32), altered micellarization and malabsorption of fats (33–38), and in some instances, lower nitrogen absorption (33, 39) can be present in severe PEM. The therapeutic regimens followed in the present study, however, resulted in very good intestinal absorption of dietary energy, nitrogen, and calcium, independent of the lactose contents of the formula diets. The retentions of these nutrients were highly satisfactory with either the intact or hydrolyzed-milk treatments, coinciding with the equally good clinical and anthropometric results obtained with both regimens (17). Lactose, itself, was also well handled in the intestine, as the diets seldom resulted in increased breath H_2 concentrations or excretion of fecal reducing substances or acidic stools (17). The few instances of incomplete carbohydrate absorption were evenly distributed between the lactose-containing and the lactose-free diet groups, and neither regimen produced abdominal discomfort or important diarrhea (17).

Although we did not measure fecal fat excretion, results of a number of investigations indicate that lactose does not impair the absorption of lipid by malnourished children (3, 4). Moreover, the absence of an effect of lactose on total dietary energy absorption in the present study agrees with the results of reports where diets containing either lactose or glucose were fed to black South African children with kwashiorkor (4) and to children from Bangladesh who had weight-for-height from 74 to 108% of standard (5).

Nevertheless, the incomplete absorption of carbohydrate in the small intestine does

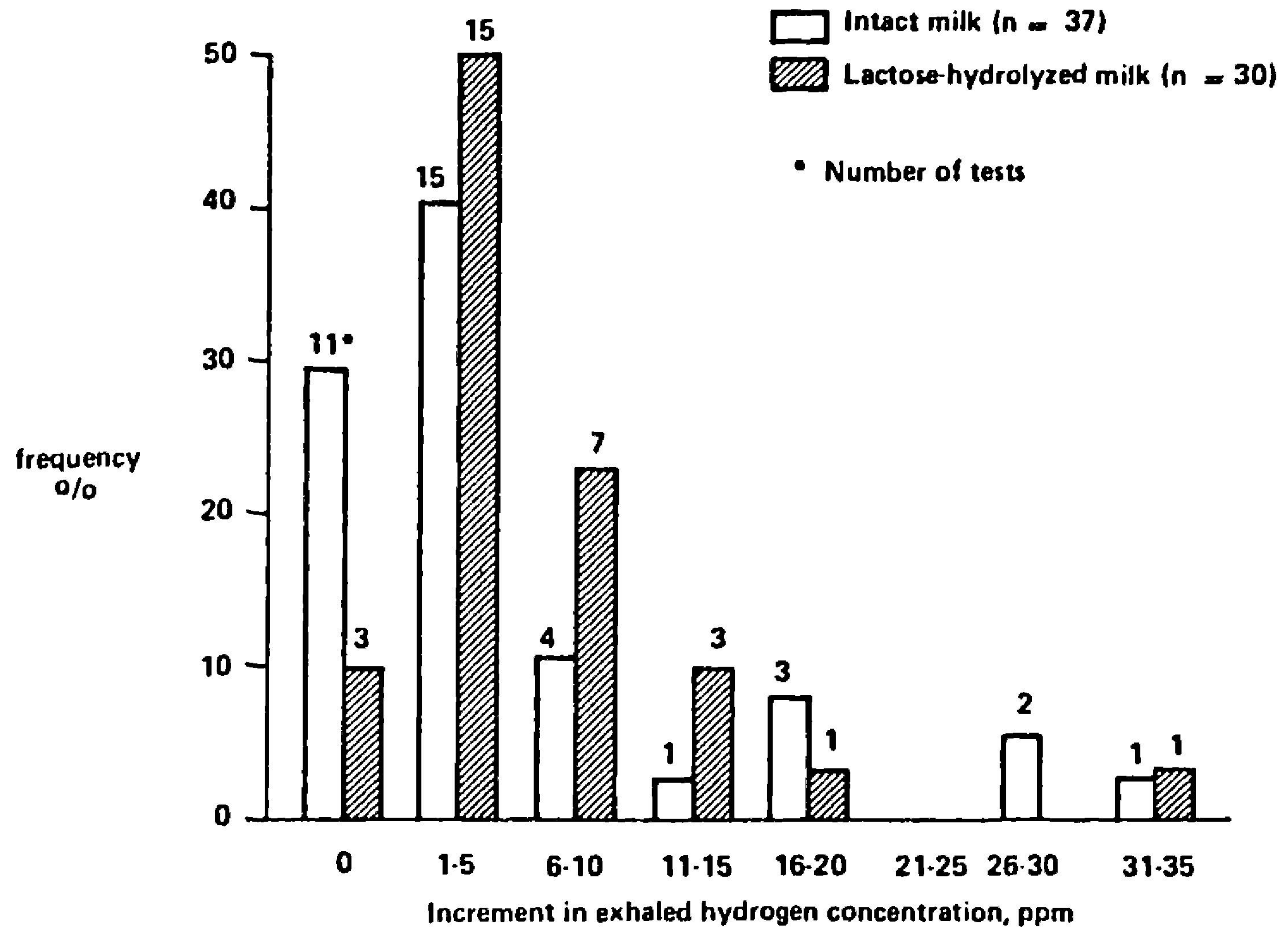

FIG 4. Pattern of maximal increments in exhaled hydrogen concentration above baseline (fasting) levels, within 3 h after breakfast with intact (*IM*) or lactose-hydrolyzed (*HM*) milk diets. The tests were performed during 7 wk of dietary therapy. Only the data of patients with a positive hydrogen response to lactulose are shown.

not necessarily produce a loss of dietary energy equivalent to the amount of nonabsorbed carbohydrate (40, 41). Conclusions about the operation of an effective colonic salvage of carbohydrates that escape absorption in the small intestine derive from experiments by Bond and co-workers (42, 43) on the fecal versus pulonary excretion of radioactivity from ^{14}C-labelled sugars instilled into the cecum of rats and man, and in human intestinal perfusion studies by Ruppin et al (44) with volatile short-chain fatty acids, the degradation products of fermented sugars. Given the low incidence of positive breath H_2 tests after meals, it would appear that the predominant site of intestinal uptake of carbohydrate energy from the formula diet occurred in the small intestine, not in the colon. We are reasonably confident of the conclusions of these H_2 breath test data since the appropriate precautions to preclude the pitfalls of interpreting pulmonary H_2 excretion responses in severely ill children (45, 46) were observed.

In relation to protein metabolism, our results showed no influence of lactose on nitrogen absorption or retention. Some previous reports do not fully coincide with these results, while others do. Brown et al (5) found no differences in the nitrogen absorptions or retentions of lactose-malabsorbing children fed a mixed rice-vegetable diet containing either glucose or lactose. In contrast, Graham and Paige (3) found better nitrogen absorptions and retentions in four lactose-malabsorbers when fed a sucrose-formula than when they were fed a lactose formula. It should be noted, however, that their diets provided 7.8 g of lactose and a lactose protein ratio of 4:1, which is much higher than the 1.5:1 ratio in the cows' milk that would normally be used as the base of a dietary formula for preschool children. Bowie's (4) studies in children with kwashiorkor indicated a lower nitrogen absorption with milk than with the glucose-based diet, but there was a compensatory decrease in urinary nitrogen, such that no differences in nitrogen balance were observed overall. The divergence between this last study and our nitrogen absorption results could be due to the fact that our therapeutic diets provided initially low amounts of energy and protein which were then gradually increased to reach, after 8 days, the levels which Bowie introduced from the very beginning of his treatment regimen. Furthermore, Bowie's studies consisted of three balance periods during only 11 days of observation. It is possible that the gradual advancement of nutrient content and the longer duration of our study allowed better metabolic and gastrointestinal adaptation to therapy, and resulted in better nitrogen absorption as well as less diarrhea than experienced in Bowie's subjects (4, 17).

It is interesting to note the increase in nitrogen retention observed when the children were switched for a few days from the lactose-hydrolyzed to the intact milk formula. This was not accompanied by changes in nitrogen, energy, or calcium absorption, nor altered stool characteristics (17). It is difficult to establish a cause-effect relationship between lactose intake and increased nitrogen retention, because we did not do a complete crossover experiment which would have also involved switching the IM group to hydrolyzed milk. Although the significance of this observation should be further explored, we can conclude that the intake of 1.2 g lactose per kg body weight per meal, after eating essentially no lactose for 45 days, did not impair nutrient absorption or retention, and did not cause intestinal discomfort (17).

The potential relationship between lactose intake and dietary calcium absorption could have had two opposing consequences; on the one hand, lactose malabsorption could have led to *decreased* calcium absorption (14–16), and on the other hand, lactose in the intestinal lumen might have *enhanced* calcium absorption (6–13, 16, 47). We did not find an important lactose malabsorption, while calcium absorption and retention were high and equal in both treatment groups. This latter finding agreed with the short-term observations of Graham and Paige (3) in preschool children. The absence of a lactose effect on calcium absorption in our study could be due to the high calcium intake, which was 2 to 4 times higher than current recommendations, and probably overshadowed any potential enhancing influence that the disaccharide might have had on absorption of the mineral. In any event, the high absorption led to high calcium retentions that are closer to the calcium accretion of a rapdily growing 35-wk human fetus (48) than to the 12 to 14 mg/kg/day expected in a child 2 to 3 yr old (49). This could be due to greater demands for calcium in malnourished children who may have some degree of skeletal mineralization deficit and who are trying to catch-up not only in terms of weight, but also of length.

In summary, the amount of lactose accompanying doses of milk protein added as the dietary intake was advanced from 1 to 4 g protein/kg/day, were not associated with any decrease in the absorption of total dietary energy or carbohydrate, nor with any decrease in the digestibility or retention of nitrogen during treatment of severe PEM. The presence or absence of lactose did not produce either an increase or a decrease in the uptake and retention of calcium from the milk-based diet, in comparison with a hydrolyzed-milk preparation. This parity of nutritional response was observed even during the early phase of recovery, when the children on the IM diet had more frequent and more liquid stools. Therefore, we conclude that neither clinical considerations nor nutritional or gastrointestinal considerations are sufficient to justify any proscription of the routine use of intact milk as the base of therapeutic diets for children with severe PEM. Reduction of the lactose content can be reserved for the occasional patient with PEM who manifests severe malabsorption or intolerance of this carbohydrate. It should be borne in mind from a nutritional point of view that the amounts of dietary nutrients *absorbed* and *utilized* are more important than small losses of incompletely absorbed nutrients that do not limit metabolic processes or nutritional repletion. In a practical sense, for consideration in nutritional recovery centers in the developing world, the minor discomfort that loose evacuations might cause during the first few days of dietary therapy with a milk-based formula is not as important as the net effective delivery of nutrients to the malnourished child.

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