Med. J. Cairo Univ., Vol. 62, No. 3, September (Suppl.): 177 - 184, 1994.

Lactose Malabsorption in Persistent Diarrhea

AHMED M. EZZAT SHASH, M.D.; OSAMA EL SHAER, M.D.

The Departments of Pediatrics and Clinical Pathology, Benha Faculty of Medicine, Zagazig University.

Abstract

One hundred and forty infants below 2 years of age suffering from diarrhea (70 persistent and 70 acute cases) were included in this study. Laboratory manifestations of lactose malabsorption (acidic stool and/ or positive clinitest) were found in 40.7% of total diarrhea cases. The magnitude of this problem was 52.8% and 28.6% in persistent and acute diarrhea cases respectively. The majority of cases with positive stool tests (45% of the acute and 54.1% of the persistent) were between 6 and 12 months of age. Malnutrition was significantly predominant in persistent cases with positive stool tests. Although there was no significant difference in feeding pattern between persistent and acute cases with positive stool tests, but it was observed that the majority of persistent cases with laboratory manifestations of lactose malabsorption were non-breast fed. The frequency distribution of various enteropathogens among diarrhea cases with lactose malabsorption was 25%, 20%, 15% in acute cases and 8.1% , 18.9% and 5.4% in persistent ones for rota virus, EPEC and protozoa (GL, EH) respectively.

Introduction

THE frequent occurrence of lactose malabsorption in diarrheal disease may be due to the fact that lactose is the most superficial of the brush border oligosaccharidases. Its activity is rate limited and its concentration is considerably lower than the other brush border enzymes [1]. The duration and severity of the diarrhea may be related more to carbohydrate

transport abnormalities than to the infective agent that triggered the illness [2]. Persistent diarrhea is frequent in children from deprived communities. Its cause is still largely unknown. Though there is no general agreement, persistent diarrhea has been defined as an episode of apparently acute diarrhea that, however, lasts for more than 14 days [3]. Lactose malabsorption is an important factor in the subgroup of children whose diarrhea becomes persistent [4].

This study was undertaken to determine the magnitude of the problem of lactose malabsorption in persistent versus acute diarrhea cases using noninvasive stool analysis tests. In addition, the stools of cases with lactose malabsorption were examined for detection of the underlying enteropathogens.

Subjects and Methods

This study was carried out in the oral rehydration center and department of pediatrics of Benha University Hospital. One hundred and forty infants below 2 years of age suffering from diarrhea, 70 acute (the duration of diarrhea being 7 days or less) and 70 persistent (the duration of diarrhea being 14 days or more), were included in this study. Both acute and persistent cases were subjected to the following:

1. Detailed history and complete clinical examination. The nutritional status was assessed according to McLaren classification [5].
2. Stool tests for lactose malabsorption: stool pH is less than 6 [6], while stool reducing substances were detected by clinitest, positive test was considered when reducing substances were more than 0.5 gm %, [7].
3. For diarrhea cases with positive stool tests for lactose malabsorption, a fresh stool specimen was examined using methylene blue for detection giardia lamblia (GL) and E. histolytica (EH) trophozoites [8]. Also, stool cultures and ELISA were done for identification of the possible pathogenic bacteria or rota virus.

Results

The results of this study were statistically analyzed in tables (1-4) and Fig. (1). Lactose malabsorption presented by acidic stool and/or positive clinitest was found in 40.7% of total diarrhea cases. The magnitude of this problem was 52.8% in the acute group and 28.6% in the persistent one (table 1 and Fig. 1). In the persistent group with positive clinitest, 70.4% of cases had pH < 6 compared to only 15.9% of cases of the acute group. The difference was statistically significant, $p = 0.001$ (table 2). Most of the cases with positive stool tests of lactose malabsorption were between 6 and 12 months age (45% of acute and 54.1% of the persistent cases). Malnutrition was found in 67.8% of the persistent cases with positive stool tests compared to 30% of the acute cases. The difference was statistically

significant, $p < 0.01$. In the persistent group with positive stool tests, 62.2% of cases were non-breast fed compared to 37.8% of cases of the acute group (table 3). the most common enteropathogens detected in diarrhea cases with lactose malabsorption were EPEC (18.9% in the persistent group and 20% in the acute one), rota virus (8.1% in the persistent group and 25% in the acute one), giardia lamblia and E. histolytica (5.4% in presistent group and 15% in the one), (table 4).

Table (1): The Magnitude of Lactose Malabsorption in Persistent and Acute Diarrhea Cases According to Stool Analysis.

Stool pH and / or reducing substance.	Diarrhea cases				Total	
	Persistent		Acute			
	No.	%	No.	%	No.	%
Positive Cases	37	52.8	20	28.6	57	40.7
Negative Cases	33	47.2	50	71.4	83	59.3
Total	70	100	70	100	140	100

$x^2 = 7.576$ $p = > 0.05$

Table (2): Stool pH in Relation to Clinitest in Persistent and Acute Cases.

Stool pH	Persistent				Acute				Total	
	+ ve clinitest		- ve clinitest		+ ve clinitest		+ ve clinitest			
	No.	%	No.	%	No.	%	No.	%	No.	%
< 6	19	70.4	0	0	7	25.9	1	3.7	27	100
> 6	18	15.9	33	29.2	12	10.6	50	44.3	113	100
Total	37	26.4	33	23.6	19	13.6	51	36.6	140	100

$x^2 = 7.576$ $p = > 0.05$

Table (3): Diarrhea Cases (Acute and Persistent) with Positive Stool Tests in Relation to Some Clinical Data.

Clinical Data	Cases With + ve stool tests				Significance	
	Acute (No. = 20)		Presistent (No. = 37)			
	No.	%	No.	%	x^2	p
Age (mo):						
< 6	5	25 %	9	24.3 %	0.583	> 0.05
6 - 12	9	45 %	20	54.1 %		
> 12	6	30%	8	21.6 %		
Nutritional status:						
Wellnourished	14	70 %	12	32.4 %	5.95	< 0.01
malnourished	6	30 %	25	67.8 %		
Feeding pattern:					0.368	> 0.5
BF	10	50 %	14	37.8 %		
Others*	10	50 %	23	62.2 %		

* BF = breast feeding
Others = formula, animal milk, or weaning food.

Table (4): Frequency Distribution of Enteropathogens among Diarrhea Cases with Laboratory Manifestations of Lactose Malabsorption.

Enteropathogens	Cases with positive stool tests			
	Acute (No. = 20)		Presistent (No. = 37)	
	No.	%	No.	%
Rota virus	5	25	3	
EPEC	4	20	7	28.6
Protozoa (GL, EH)	3	15	2	71.4
Staph. aureus	-	-	1	
Salmonella	-	-	2	100
No isolation	8	40	22	

EPEC = Enteropathogenic E. coil
GL = Giardia lamblia , EH = Entamoeba histolyica.

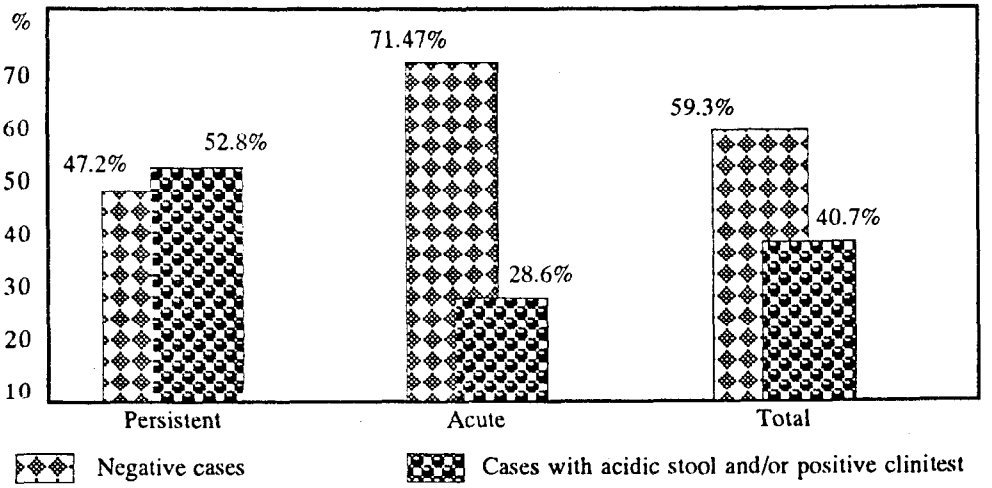

Fig. (1): Lactose malabsorption in persistent and acute diarrhea cases.

Discussion

Carbohydrate (CHO) intolerance is a clinical syndrome characterized by diarrhea with acid stools and carbohydrates in feces. It is a very frequent sequelae of acute diarrhea and has been observed in 78% of a large group of infants with severe diarrhea [9] and as well as in infants with mild diarrhea [10].

The results of this study revealed that 40.7% of total cases had acidic stool and/or positive clinitest. In fact, the magnitude of lactose malabsorption among diarrheal cases is from 33% to 78% in different reports [3,11]. This variation may be attributed to variation in host factors, etiology of diarrhea [3], the activity of intestinal flora [12] and the drugs prescribed to the cases as well as different techniques used for diagnosis of lactose malabsorption [13].

In our study, 52.8% of persistent diarrhea cases had positive stool tests for lactose intolerance versus 28.6% of acute diarrhea cases. In fact, CHO malabsorption causes delayed recovery from acute diarrhea in infancy [14], and the duration and severity of the diarrhea may be related more to carbohydrate transport abnormalities than to the infective agent that triggered the illness. Whatever the mechanisms responsible for the diminished absorption of carbohydrates in infants with diarrhea, the consequence is prolongation of diarrhea [2].

It was observed in our study that almost all diarrhea cases with an acidic

stool (pH < 6) had also positive clinitest (only one acute case was negative). On the other hand, some diarrhea cases with alkaline stool (pH > 6) had a positive stool clinitest. This can be explained by the fact that the concentration of carbohydrates, lactic acid and fecal pH change very rapidly due to exogenous bacterial fermentation [9]. Also, antibiotic therapy and the type of sugar in the diet must be considered in interpreting the results of the measurements of pH and sugar in stools [2]. Although, lactose intolerance is the most likely cause of an acid stool, yet, fecal pH is considered a screening test rather than a defininte proof of diagnosis [15,16]. On the other hand, clinitest for reducing sugars in stool is the most widely available and convenient form. It is very suggestive of CHO malabsorption when it is positive [17].

In our study, the majority of cases with lactose malabsorption were between 6 and 12 months of age. This was observed in the persistent (54.1%) as well as in the acute diarrhea group (45%). Similar results were reported by Kretchmer [18] and Johnson [19]. The authors explained these results by decreased production of lactase enzyme at the weaning time so that its activity might be one third to one twentieth at weaning in comparison to what it was at birth.

A lot of our cases with lactose malabsorption were malnourished. Malnutrition was predominantly noticed in the persistent group (67.8% of cases) in comparison with the acute group (only 30% of cases). The difference was statistically significant ($p < 0.01\%$). In fact, malnutrition is an important cause of lactose malabsorption. The mucosal lesion produced by malnutrition leads to diminution of receptors, enzymes and transport sites in the apical membrane of the enterocytes resulting in malabsorption of disaccharides and even monosaccharides [20].

Although there was no significant difference reported in our study between feeding pattern and laboratory manifestations of lactose malabsorption in both persistent and acute diarrhea cases, but the majority (62.2%) of persistent cases with positive stool tests were non best fed infants. Abramowitz et al. [21] suggested that lactase enzyme activity is dependent on the amount of dietary lactose and most of the artificial dried milks are of lower lactose content than breast milk. Also, it has been reported that continued feeding of cow's milk, especially at full strength can lead to prolonged diarrhea in some children who become lactose deficient during the acute episode [22].

In our study, the frequency distribution of enteropathogens among diarrhea cases (persistent and acute) with positive laboratory manifestations for lactose malabsorption was 25%, 20% and 15% in acute cases and 8.1%, 18.9% and 5.4% in

persistent ones for rota virus, enteropathogenic E.coli (EPEC) and protozoa (GL,EH) respectively. Infectious diarrhea in infancy is a principle cause of lactose malabsorption and rota virus is the outfront winner when it comes to cause lactose intolerance [23]. Moreover, it has been suggested that lactase might be the receptor and uncoating enzyme for rota virus [24]. Also, Giardia lamblia and EPEC adhere to the intestinal surface and cause characteristic damage to the brush border [25].

Conclusion:

On dealing with persistent diarrhea, biochemical stool tests for lactose malabsorption and stool examination for underlying enteropathogens must be done in every case, simply because the treatment is only modulation of lactose content in the diet and specific antibiotic or according to underlying enteropathogens. In addition, we emphasize again on the importance of breast feeding and prevention of malnutrition in decreasing the occurrence of lactose malabsorption and in turn persistence and prolongation of diarrhea.

References

1. PERGLIZZI, RF, LIFSHITZ, S. RECHBERY and WAPNIR R. A.: Interaction between dietary CHO and intestinal disaccharidase in experimental diarrhea. Am. J. Clin Nutr., 30: 482, 1977.
2. LIFSHITZ F, OLELLO - RAMIREZ P and CONNADO - CORNET MC.: CHO intolerance in infants with diarrhea, J. Pediat. 79: 670-767, 1991.
3. ROY SK, HAIDER R and AKAVAR MS.: Clinical efficacy and nutrient absorption with a rice bases diet. Arch. Dis. Child., 65: 291-197, 1990.
4. W.H.O.: Persistent diarrhea in developing countries. Memorandum from a W.H.O meeting. Bull W.H.O. 66: 709-717, 1988.
5. MCLAREN, DS.: Nutrition and its disorders. Ist ed. Churchill Livingstone, Edinburg, London, New York, 1976.
6. LINQUIST, B1 and WRANNEL.: Problems in analysis of fecal sugar. Arch. Dis. Child., 51:319-23, 1976.
7. GRACEY M, CULLITY GJ and SUHARYONO, S.: The stomach in malnutrition. Arch. Dis. Child., 52:325, 1977.
8. CLIFFORD, W. L. and WALKER WA.: Chronic protracted diarrhea in infancy. A nutritional disease, Pediatrics, 72: 786, 1983.
9. ANGELIDES, AC andDAVIDSON M.: Lactose intolerance and diarrhea: are they related? Pediatr. Ann., 14 (1): 62-63, 1985.
10. MUNIR M.: Determinants of chronic diarrhea in infants in Manado. Pediatr. Indones, 25 (1-2): 22-32, 1985.

11. KHASHABA A, EL SADANY A, HASSANIEN B and EL SABAGH A.: A case control hospital study of risk factors in persistent diarrhea Med. J. Cairo Univ., 60: 2, 1992.

12. DAVIDSON, GP, GOODWING D ANDK TREVOR A.: Incidence and duration of lactose malabsorption: study in a well nourished urban population. J. Ped., 105 (3): 587-89, 1984.

13. DAVIDSONN GB and ROBB TA.: Value of BH analysis in managenment of diarrheal illness. J. Pediatr. Gastr. Nutr., 4 (3): 381-87, 1985.

14. BROWN, K. H., WILLIAM C., and MCLAREN, J.R.: Malnutrition and malabsorption. Pediatrics, 73:111-25, 1984.

15. TALBOOM, JM, MOTEETN M, KAUTIN H and FEMARDES J.: Incomplete lactose absorption from breast milk during acute GE. Acta. Ped. Scand., 75: 151-55, 1986.

16. DIALOGUE ON DIARRHEA.: Issue 37, published by AHRTAG London: 6-8, 1989.

17. SILVERMAN A and RAY C:Tests for sugar in feces. In Pediatric Clinical Gastroenterology, 3rd ed. St., Louis CV Mosby: 893, 1983.

18. KRETCHMER N.: Lactose and Lactase, Am. J. Sci., 277:70, 1972.

19. HOHNSON J.D., KRECTHMER N and SIMOONS F. J.: Lactose malabsorption. Advances in Pediatrcs, 21: 1970199 1974.

20. KREJS AJ and FORDTRAN J.S.: diarrhea. In Gastrointestinal Disease. 3rd Ed., Slisenger MH and fordtran J.S. Philadelphia, W. B. Saunders, pp: 257 280, 1983.

21. ABRAMOWITZ A, GRANOT E and TAMIR I.: Two hour Lactose BHT., T. Pediatr. Gastr. Nutr., 5, 133-33, 1986.

22. CASTEEL HB Aand FIEDOREK SC.: Oral rehydration therapy. Ped. Clin. North Am., 37 (2): 295-99, 1990.

23. KHOSHOO V, BHAN MK and JAYASHRE S.: Rota virus infection and persistent diarrhea in young children. Lancet, 336: 1315, 1990.

24. HOLMES IH, SCHANGI RD, and RODGER SM.: Is Lactase the receptor and uncoating enzyme for infantile enteritis rota viruses. Lancet, 1387, 1982.

25. SALATO RA and AVCOTT JN.: Infectious diseases: Parasitic infections in Behrman RE, Nelson WE & Vaughan V. (eds.) Nelson Textbook of Ped. 14th ed Saunders Co., Philadelphia, p 872, 1992.