Original Article

Effects of Lactose-Restricted Regimen in Breastfeeding Children with Acute Diarrhea

Abstract

Background: Acute diarrhea is a major cause of mortality in children. Few studies have addressed the administration of lactose-restricted diets in breastfed children with acute diarrhea. The present study was conducted to investigate the effects of a lactose-restricted regimen on breastfed children with acute diarrhea treated with zinc supplements. **Methods:** The present single-blind randomized clinical trial was conducted on children aged 6-24 months in Amirkola Children's Hospital (2015-2017). 90 children were randomly assigned to two groups. Group A was daily treated with 20 mg of zinc and a lactose-restricted diet and breast milk for two weeks. Group B received 20 mg of zinc and breast milk and an age-appropriate diet for two weeks. The data collected in all the subjects included the frequency of diarrhea and the mean duration of hospitalization and recovery from diarrhea. **Results:** The two groups were not significantly different in terms of mean age, weight and ratio of males to females. The mean duration of hospitalization was found to be 3.1 ± 0.8 days in group A and 3.2 ± 0.6 in group B ($P = 0.3$), the mean duration of recovery to be 2.9 ± 0.8 in group A and 2.6 ± 1.1 in group B ($P = 0.2$) and the mean frequency of diarrhea 2.9 ± 0.7 in group A and 2.8 ± 0.8 days in group B ($P = 0.5$), suggesting no significant differences between the two groups. No adverse effects associated with zinc therapy were reported. **Conclusions:** A lactose-restricted regimen was found not to be beneficial for children with acute diarrhea under continuous breastfeeding and zinc therapy.

Keywords: *Breastfeeding, children, diarrhea, lactose-restricted, zinc*

Sanaz Mehrabani, Mohammadreza Esmaeili, Leila Moslemi[1], Reza Tarahomi[2]

Non-Communicable Pediatric Diseases Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Iran, [1]Health Reproductive Research Center, Sari Branch, Islamic Azad University, Sari, Iran, [2]Student Research Committee, Babol University of Medical Sciences, Babol, Iran

Introduction

Acute diarrhea is considered the second leading cause of mortality in children in developing countries.[1] Despite the stringent measures taken to control and manage diarrhea, this disease contributes to 10% of deaths in children under the age of five years, which is annually equivalent to approximately 500,000 deaths in developing countries.[2] A median of 3.2 episodes of diarrhea per year and a median of 4.9 deaths in every 1000 years have been reported in children under the age of 5 years in developing countries.[3] Fluid and electrolyte imbalance contribute to the majority of deaths in these children.[3] The proper management of this condition involves fluid and electrolyte therapy, administering appropriate antibiotics and having adequate nutrition.[1] In 2004, the World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF) recommended the application of zinc supplements in

children with diarrhea,[4] while zinc therapy had been already found to reduce the frequency and intensity of diarrhea.[4]

Moreover, lactose-free regimens have been found to help manage acute diarrhea in children by lowering the duration and frequency of diarrhea, increasing weight gain and ameliorating dehydration.[5,6]

Lactose-free diets can benefit young children by inhibiting the generation of lactase;[7] nevertheless, the benefical efffects of lactose-free regimens on children with acute diarrhea is a controversial issue.[5,8,9]

The present research was performed to investigate the effects of a lactose-restricted regimen in breastfed children with acute diarrhea treated with zinc supplements, given the few studies conducted on administering this type of diet in these children.

Methods

The present single-blind randomized clinical trial was conducted on children hospitalized in Amirkola Children's

Address for correspondence:
Dr. Sanaz Mehrabani, Non-Communicable Pediatric Diseases Research Center, No 19, Amirkola Children's Hospital, Amirkola, Babol - 47317-41151, Mazandaran Province, Iran.
E-mail: mehrabanisanaz@gmail.com

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Hospital in the north of Iran. This study was approved by the Ethics Committee of Babol University of Medical Sciences, Babol, Iran (Mubabol.HRI.REC.1394.6) and registered in the Iranian Registry of Clinical Trials (IRCT ID: N12016031326973).

The eligible candidates comprised breastfed children aged 6-24 months with acute diarrhea associated with acute gastroenteritis, a fecal WBC of below 5/HPF and mild-to-moderate dehydration presenting to the hospital from March 2015 to March 2017. Diarrhea is defined as a daily discharge of at least three loose or liquid stools or a more often than normal discharge.[10] It is also considered acute if it lasts below two weeks.[11]

The exclusion criteria comprised diarrhea lasting for more than three days, bloody stools, consuming infant formula or antibiotics, severe malnutrition, a history of chronic diseases or any types of food allergy, diarrhea-associated ileus, parenteral diarrhea and incomplete Gastrofix consumption.

The sample size was estimated at 45 in each group using the data obtained in an article,[12] comparing two mean values and considering a confidence interval of 95% and a test power of 90%. After obtaining informed consent from their parents, a computerized random number table was used to assign the children to two groups, namely A: Lactose-restricted, and B: Control.

Demographic data, including age, gender and weight, was collected during the first visit of the children, and their clinical history was obtained and physical examination performed upon admission to determine the duration, type and intensity of diarrhea and assess the associated clinical features such as fever, vomiting, dehydration, abdominal pain and distension. Rehydration therapy involving 10 ml/kg of ORS for each watery or loose stool was performed as per WHO guidelines, including maintenance and replacement therapy.[10]

The intervention performed in the children of group A included their breastfeeding by their nursing mother and the daily administration of 20 mg of zinc sulfate syrup (manufactured by Alhavi Company, Tehran, Iran) for two weeks and a lactose-restricted regimen containing an age-adjusted food free from dairy products and a lactose-free complement consisting of 250 g of Gastrofix and dried milk made in BELGIUM and distributed by Behdasth Kar Company, Tehran, Iran. Gastrofix is free from lactose and gluten and consists of digestible fat and protein, i.e. whey and casein. 7 pieces of Gastrofix dissolved in 210 ml of water were administered in the children below the age of 12 months, and 8 pieces dissovled in 240 ml of water divided into 5 doses in those over one year of age. Group B underwent zinc therapy (20 mg daily) and received breast milk and an age-appropriate diet for two weeks.

All the cases were under observation for two weeks. Upon hospitalization, frequency of defecation, duration of hospitalization and duration of recovery from diarrhea were recorded using the Bristol stool chart[13] and the adverse effects of zinc were evaluated by an expert nurse. The mothers were asked to insert these data into a record form after discharge and announce them to the nurse through telephone contact during the follow-up. To identify the side effects of zinc from the beginning of the treatment until two weeks later, a list prepared to record these effects upon hospitalization was evaluated by the nurse. The parents were also asked to present in person or call the nurse if their children experienced any side effects.

The nurse in the ward in charge of evaluating the primary and secondary outcomes of the study and the mothers in charge of reporting the data after discharge were unaware of the type of the intervention performed in the groups.

The frequency of defecation was the primary outcome of the present study and duration of hospitalization and duration of recovery constituted the secondary outcomes. Duration of recovery from acute diarrhea was defined as the interval in hours between admission and the cessation of diarrhea or the first normal bowel movement, which is equivalent to obtaining a score of below five from the Bristol stool chart.[13]

All the data were analyzed in SPSS-20 (IBM Corp., Armonk, N.Y., USA). The continuous variables were expressed as Mean ± Standard Deviation and compared with one another using the independent *t*-test, and the categorical variables were expressed as frequency and compared using the Chi-squared test. *P* values below 0.05 were considered statistically significant.

Results

Out of 100 eligible infants in 2 groups of 50, five in each group withdrew before beginning the study owing to their parents refusing consent for their participation in the study. A total of 90 subjects with a mean age of 14.6 ± 6.58 months were therefore analyzed in groups A and B. Table 1 presents the demograyhich information of the participants. None of the participants in these groups had metabolic acidosis or a history of medical diseases. According to Table 2, the two groups were not significantly different in terms of mean duration of hospitalization, mean duration of recovery and frequency of defecation. None of the adverse effects associated

Table 1: Demographich information

	Group A	Group B	*P*
Age (months)	14.5±6	14.3±6.3	0.8
Gender (%)			0.8
Female	24 (53.3%)	26 (57.8%)	
Male	21 (46.7%)	19 (42.2%)	
Weight (kg)	10.4±2.6	10.1±2.7	0.6
Defecation frequency (Mean±SD)	5.8±1.5	5.7±1.4	0.8

Table 2: Duration of hospitalization and recovery and frequency of defecation

Variable (Mean±SD)	Group A	Group B	*P*
Frequency of defecation/day	3.1±0.8	3.2±0.6	0.5
Duration of hospitalization (day)	2.9±0.7	2.8±0.8	0.3
Recovery duration (day)	2.9±0.8	2.6±1.1	0.2

with zinc therapy were also reported, including vomiting, nausea, stomach pain and allergy.

Discussion and Conclusion

The main objective of treating infants with diarrhea is to reduce the duration of hospitalization and diarrhea. ORS is recommended for the initial treatment of dehydration associated with diarrhea.[14] Although ORS replaces fluid and electrolyte, it does not substantially shorten the diarrhea duration. Additional therapeutic methods have been therefore widely evaluated.

The present study results showed that lactose-restricted regimens do not reduce the frequency and recovery duration of diarrhea in breastfed children treated with zinc supplements. Moreover, managing acute diarrhea in children is a concern for pediatricians. Diarrhea can be managed in children through oral rehydration therapy and proper nutrition and the cause of delay re-feeding[5]

Dalgic *et al*.[9] evaluated the effects of zinc, probiotic bacteria and lactose-free formula on diarrhea in children, and observed no significant differences between the groups.

The results of studies on the role of lactose-free regimens in managing acute diarrhea in children appear inconsistent.

Saneian[1] found lactose-free formula to precipitate recovery from diarrhea in infants. Xu and Huang[6] found diarrhea to be significantly shorter in the lactose-free formula group compared to in the formula group. Simakachorn *et al*.[5] found the median duration and frequency of diarrhea, and the recovery duration of moderate acidosis up time to be significantly lower in the lactose-free group.

A randomized clinical trial showed a low-lactose hydrolyzed milk formula to be more effective in managing diarrhea in infants with gastroenteritis compared to a lactose-free corn syrup-based milk formula and a standard lactose-containing formula.[8]

A meta-analysis by Brown *et al*.[15] showed that routinely using a lactose-free formula is nonessential. Saunders and Friedman[16] found acute diarrhea to be treated faster in children using a lactose-free diet. MacGillivary *et al*.[7] also found lactose-free milk to cause a more rapid treatment of diarrhea in children compared to lactose-containing milk.

The results of these studies were consistent with those obtained in the present research given the effectiveness of a lactose-free formula in the dietary management of non-breastfed children with acute diarrhea.[17] The present study however was conducted on breastfed infants and breast milk containing lactose, and compared them with those receiving regimens free of lactose.

Gastrofix, a well-known registered nutritional supplement, was found to be more effective than placebo in the duration of diarrhea and hospitalization in children aged 6-120 months with acute gastroenteritis.[18] In contrast to the present study, the study cited included older children, conducted a single intervention using Gastrofix, investigated no dietary changes and involved a shorter follow-up.

In 2004, WHO recommended the administration of zinc for treating diarrhea in children.[4] Zinc has been reported to contribute to managing diarrhea through the stimulation of the immune system, the regeneration of intestinal mucosa and exertion of anti-secretory effects.[19,20]

Passariello *et al*.[21] found the rate of recovery from diarrhea and the total ORS intake within the first 24 hours of rehydration to be significantly higher in the group receiving hypotonic ORS containing zinc plus prebiotics compared to in the group receiving standard hypotonic ORS.

Milk constitutes the main diet for infants, and a review of literature suggests breastfeeding increases survival from diarrhea and acute lower respiratory infection (ALRI), and the antibody activity of immunoglobulins to affect the control of infections.[22] Lopez *et al*.[23] found diarrhea to be significantly shorter in the breastfed group of children compared to the partially breastfed and fully breastfed groups.

Infant with diarrhea are usually no appetite and they tend to milk more epically breastfed infant because they get the emotional support that need more in times of illness. So, they usually don't eat fully prescribed diets. The effects of lactose-restricted regimens on acute diarrhea appear to be more easily identified in older children.

The present study limitations comprised being conducted in a tertiary hospital and including a small sample. Multicenter studies are therefore recommended to be conducted in the future using larger samples.

To the best of the authors' knowledge, the effects of lactose-restricted regimens on breastfed children with acute diarrhea had not been addressed in literature before. The present study therefore pioneered the examination of these effects in the north of Iran over two weeks. Future studies are recommended to apply the findings of the present study despite its weaknesses, including failing to use a placebo in the control group given the impossibility of performing a double-blind trial.

The present article concludes by suggesting a lack of support for the use of lactose-restricted regimens in breastfed children with acute diarrhea.

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