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Optimization of Diagnosis and Treatment of Lactose Intolerance in Infants

Noila Tolipova[1], Sevara Azimova[2], Dilorom Ataeva[1, *]

[1]Department of Children's Disease №2, Tashkent Medical Academy, Tashkent, Uzbekistan

[2]Department of Normal and Pathologic Physiology, Tashkent Medical Academy, Tashkent, Uzbekistan

Email address:
goodluck_0714@mail.ru (D. Ataeva)

[*]Corresponding author

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Abstract: The paper presents the results of a study of the Benedict test for deciding the diagnosis of lactose intolerance in children and the effectiveness of lactase drugs. Benedict test is one of the standard methods for the diagnosis of lactose intolerance in children. Drugs with lactase enzyme that helps break down lactose (hydrolysis) into two simple sugars, glucose and galactose, which simplifies digestion. Lactase drugs has been shown to be the best way to preserve natural feeding in children with lactose intolerance, since the lactase composition is involved in the breakdown and absorption of carbohydrates and proteins, produce essential vitamins for improving the health and immunity of the child, normalize the composition of the intestinal flora. The use of mothers in the diet of easily digestible carbohydrates significantly increases the lactose content in breast milk, significantly increases the risk of developing lactose intolerance in children. When coprological study noted the disappearance of signs of excessive fermentation. It is shown that lactase drugs is an innovative and effective solution to lactose intolerance, the best way to preserve the natural feeding of children with lactose intolerance, as it reduces the load on the intestinal mucosa, preventing the development of characteristic symptoms of lactose intolerance in infants.

Keywords: Lactose, Lactase, Lactose Intolerance, Lactose Resistance, Lactase Deficiency, Benedict Test, Diarrhea, Flatulence

1. Introduction

For newborns the predominant carbohydrate in mother's milk is lactose. After digestion with lactase (parietal digestive enzyme), lactose is absorbed in the form of glucose and galactose. Fetal lactase activity can be determined at 10-12 weeks of pregnancy. Lactase activity remains low until 36 weeks of gestation [1]. Based on the weak activity of lactase at an early stage of pregnancy and the estimated length of the intestinal fetus, it was estimated that it can be assumed that a premature baby weighing 1300-1400 g absorbs only 30-50% of the lactose consumed. Lactose, which is not completely absorbed, serves as a food source for the bacterial flora in the colon, where it is transformed into short fatty acids and then absorbed [2]. Lactose is one of the important sources of energy, and it accounts for 40% of the energy in infants, contained in breast milk and dairy products [3]. An estimated 30-50 million Americans are diagnosed with lactose intolerance. Approximately 75% of African Americans have low lactase levels [4]. Currently, only 35% of the world's population has lactose resistance, and the prevalence varies depending on age, ethnicity and geographic location [5]. The lactase level is reduced <10% in the childhood period [6]. A recent systematic review has shown that a lactose free diet that is not included in human milk can result in shorter diarrhea in children [7]. A lactose-free diet reduces the duration of diarrhea by 47% [8]. The introduction of lactose higher than 5 g / kg / day can lead to a quick cleaning of the intestines and impaired treatment. An alternative strategy for reducing the load on lactose in breastfeeding malnourished children with prolonged diarrhea is to replace milk with cereal products and fermented dairy products like yogurt [9]. The number of calprotectin, a neutrophilic peptide, produced in inflammatory diseases of the intestinal tract in children increases with transient lactose deficiency by 300.3 ± 124 mg

kg – 1, p = 0.60 [10]. Lactase deficiency causes lactose intolerance, which leads to spasms and bloating, nausea. Lactase positive probiotic strains are successfully used to relieve discomfort from lactose intolerance. [eleven]. There are a number of unfavorable pathogenetic factors in lactase deficiency: the absence/decrease in the activity of brush border disaccharidases; inhibition of carbohydrate transporters by deconjugated bile acids (lower pH and enterocyte damage); accumulation of potentially neurotoxic gases (hydrogen, methane, CO2, etc.); damage to the villi / microvilli of the intestine; production of lactate and short chain fatty acids (systemic acidosis); disruption of the normal bacterial landscape of the small intestine; excessive elimination of macro- and micronutrients with feces (in the presence of diarrheal syndrome) [12]. The problem of diagnosis and treatment of lactose intolerance is extremely important in pediatric practice, in medicine in general, and acquires national importance. The efficacy and acceptability of the Benedict test for the determination of the diagnosis of lactose intolerance in children is not well understood.

The aim of this study is optimization of complex treatment of lactose intolerance, detected by the method of Benedict in infants.

2. Materials and Methods

The survey was conducted on 60 children with lactose intolerance. Diagnosis was carried out on the basis of an analysis of the clinical data of the Benedict sample and a coprological study. Benedict's test was performed from 2016 to 2018 in the departments of pathology of newborns and infants at the 1-Clinic of the Tashkent Medical Academy. Depending on the type of feeding, the children were divided into 3 groups: 1 - exclusively breast milk (10 children - 16.7%), 2 - adapted milk formula as the main food and supplement (10 children - 16.7%), 3 - pre-mix as the main food, supplement and applied lactase drugs (40 children - 66.6%). The age of children predominantly ranged from a newborn to 12 months, i.e. coincided with a period of hindered digestibility of lactose and a reduced amount of endogenous lactase in children. Inclusion criteria were the presence of breastfeeding, babies in adapted breast formula, formula-fed babies, premature babies, children with cystic fibrosis, and children who had rotavirus infection. The exclusion criteria for the study were significant pathology during childbirth, malformations, confirmed intrauterine infection, adverse living conditions, incomplete family, the presence of an infectious disease. Of these newborns a cohort was formed, which included children with bouts of diarrhea at least 6 times a day, depending on the age of the child. All mothers of 60 children kept a food diary. All mothers were measured lactose content in breast milk by glucose after hydrolysis. The first group consisted of 40 children with lactose intolerance, who used lactase drugs. The control group consisted of 20 children with lactose intolerance who did not use lactase drugs. At the trial of Benedict, the chair was assembled after spontaneous defecation in a disposable plastic container with an airtight lid, avoiding the impurity of urine and discharge of genital organs. The biomaterials were sent to the laboratory within 4 hours after the act of defecation, stored at 2-80°C. At the same time, overfeeding or underfeeding with breast milk was avoided in order to avoid a false positive or false negative result, respectively. After removing the stool from a sterile container, the same amount of distilled water is added to one volume of feces. The mixture is homogenized and centrifuged at 3000 rpm for 10 minutes. After centrifugation, 2.5 ml of Benedict prepared from sodium citrate and copper sulfate was added to 10 drops of the supernatant. The tube is heated in a boiling water bath for 10 min. Statistical data processed using student's criterion.

3. Results

When comparing the weight-bearing indices, weight gain, lactose and lactase levels, total protein and blood albumin, blood lymphocyte levels in children with lactose intolerance, in the 3rd group, the above indicators were within the normal range. Children of the 1st group had a higher level of lactose. In the 2nd group, the lactose level was average. In the 3rd group, the lactose level was low. Lactose reduction and lactase increase can be regarded as a correction for lactose intolerance in children.

Table 1. *The clinical picture in children with lactose intolerance.*

Indicators	**The number of children participated in clinical research (n=60)**	
	Number of children	**%**
Osmotic diarrhea with frothy structure	60	100
Flatulence	59	98,3
Lactase reduction	59	98,3
Intestinal colic	59	98,3
Rumbling in the stomach	58	96,6
The presence of a sharp sour smell of the chair	58	96,6
Weight loss	56	93,3
Crying after breastfeeding	55	91,6
Regurgitation	54	90
Breastfeeding failure	19	31,7
Vomiting	8	13,3

In 60 children with lactose intolerance, under our supervision, Benedict was tested for rectal discharge for the presence of carbohydrates before and after complex treatment with lactase drugs. Benedict's reagent varied depending on the sugar content

in the faeces.

Table 2. *Semiquantitative evaluation of the result of the study was carried out on a chilled test tube on a color scale.*

Sample colour	Sugar concentration in %	interpretation of results
Unchanged (blue)	0	No sugar
Green (no sediment)	0,05 – 0,15	+
Green with sediment	0,2-0,4	++
Olive-yellow	0,5-0,75	+++
Orange	1,0-1,65	++++
Light red	2,0 and above	+++++

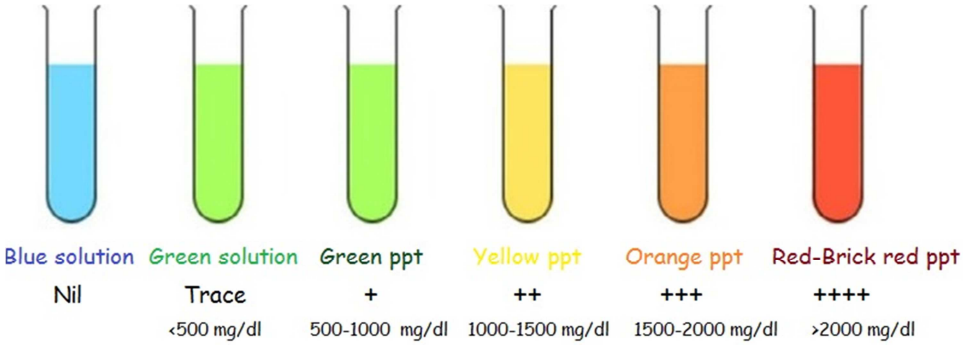


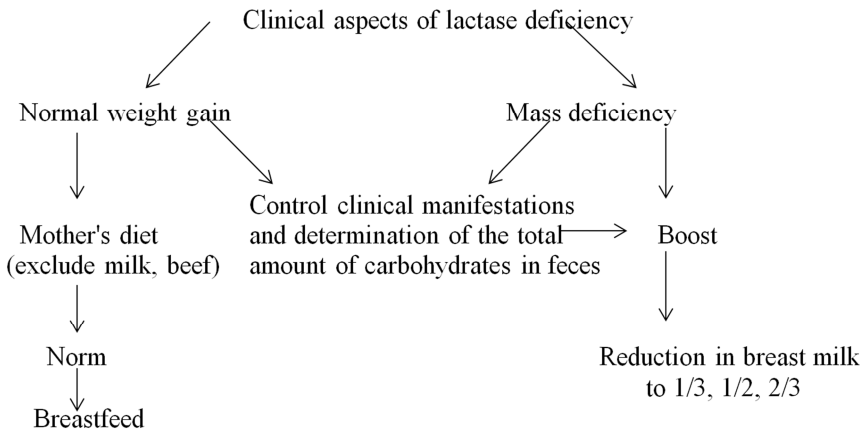
Figure 1. *Result Interpretation of Benedict's Test.*

Carbohydrates should not be contained in the stools of children with a normal state of health, as carbohydrates begin to be processed immediately in the oral cavity by enzymes and are broken down to organic compounds in the intestine under the influence of lactase and absorbed. The normal result for the Benedict test is the percentage of carbohydrates from 0 to 0.3% in infants. The carbohydrate index of about 0.3-0.5% indicates a slight excess of the carbohydrate level, which is not considered a deviation if the infant does not have a lack of appetite or weight loss. Excess carbohydrates in the stool above 1% in infants suggests a high probability of the presence of lactose intolerance.

The main indicators of lactose intolerance in the coprogram of children is the pH of feces below 5.5 (increased stool acidity). Lactose tolerance tests and test results, and test results. be carried out. It can be a sign of lactose intolerance.

Table 3. *Coprogram in children with lactose intolerance.*

Indicators	First group (n=40)	Control group (n=20)
Consistency	Mushy	Watery
Form	Decorated	Unformed
pH	5,2±0,5	3,9±1,2
Odour	Specific	Sour milk
Fatty acid	Not found	++++
Mucous	Not found	+++
Iodophilic flora	Not found	++
Leucocytes	3-4/1	1-2/1



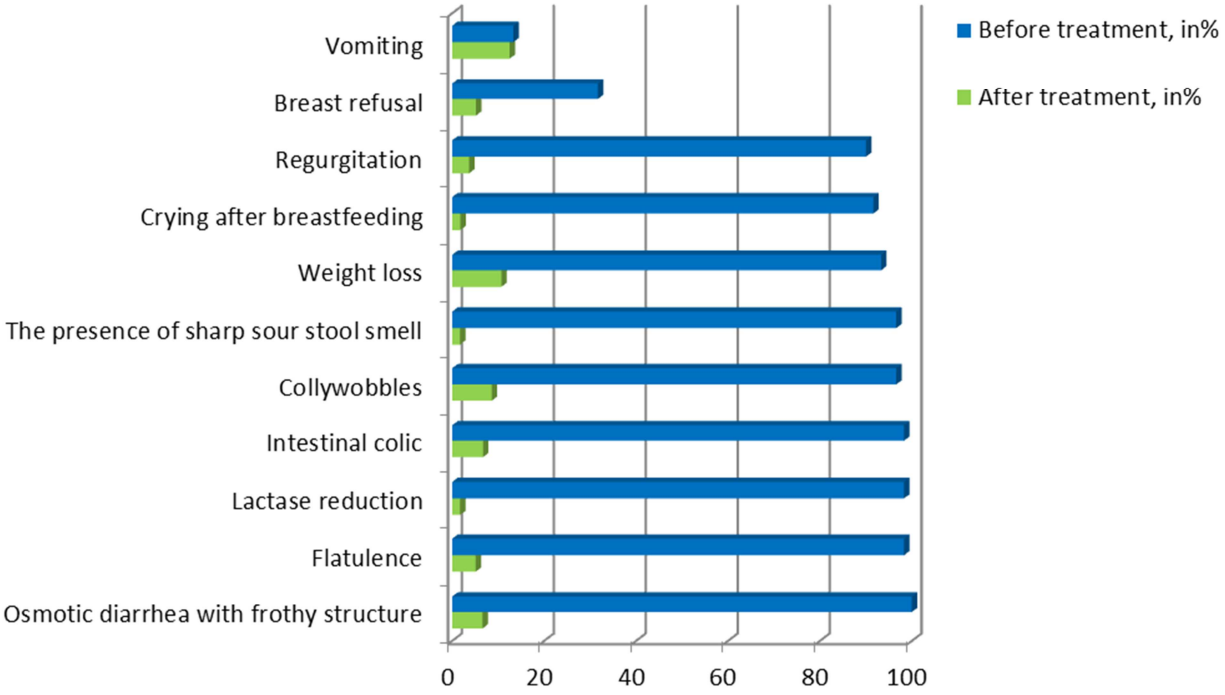


Figure 2. *Comparison of children's conditions before and after complex treatment with lactase drugs.*

4. Discussion

Children with lactose intolerance do not produce enough lactase, so lactose stays in the digestive system where it is fermented by bacteria. This leads to the production of various gases, which cause the symptoms associated with lactose intolerance. Common symptoms of lactose intolerance include vomiting, bloating, explosive and watery diarrhea cramps, and dehydration [13]. Faecal reducing substances: arrival of undigested lactose to the large bowel leads to the presence of reducing sugars in the faeces [14]. Positive Benedict's Test: Formation of a reddish precipitate within three minutes. Reducing sugars present. Example: Glucose. Negative Benedict's test: No color change (Remains Blue). Reducing sugars absent. Example: Sucrose. False positive reactions may also be obtained if certain drugs are present, e.g. salicylates, penicillin, streptomycin, isoniazid, and p-aminosalicyclic acid. EasycolBABY is a lactase enzyme that helps break down lactose (hydrolysis) into two simple sugars, glucose and galactose, which simplifies digestion.

5. Conclusions

Lactose intolerance can affect macronutrients, energy consumption and growth, and the development of the nervous system. Benedict sample showed normalization of fecal excretion of carbohydrates, which did not exceed 0.05%. This proves that the Benedict test is one of the standard methods for the diagnosis of lactose intolerance in infants, shows all the required characteristics and is economical, quick, and sensitive. During treatment with lactase drugs, a distinct positive dynamics was observed: a decrease in the intensity of flatulence, anxiety after feeding, a decrease in regurgitation, rumbling in the abdomen, the disappearance of failures from breastfeeding, and body weight returned to normal. A decrease in intestinal colic was noted already after 2.5 ± 0.5 days. The relief of diarrhea syndrome was noted after 4.2 ± 2.5 days. The mean stool frequency during treatment decreased to 2.6 times, reaching 1.6 ± 0.12 times / day ($p < 0.001$).

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