Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/8c3ttq08

COMPARISON OF LACTOSE CONTAINING WITH LACTOSE FREE MILK IN THE MANAGEMENT OF ACUTE WATERY DIARRHEA - CHILDREN LESS THAN 2 YEARS OF AGE

Sbah Munir[1], Afsheen Batool Raza[2*], Madiha Tahir[3]

[1,2*,3]Department of Paediatric Medicine, Children's Hospital and the Institute of Child Health, Lahore, Pakistan

[*]**Corresponding Author:** Afsheen Batool Raza,
*Email: dr.afsheenrazapaeds@gmail.com

ABSTRACT

Background: For infants under two, acute watery diarrhea (AWD) continues to be a major source of illness and mortality, especially in underdeveloped nations. Effective dietary control is necessary because illness can cause severe dehydration and nutritional deficiencies. The main carbohydrate in milk, lactose, can make diarrheal episodes worse for kids who have lactose intolerance.

Objective: To compare the mean duration of diarrhea resolution and weight change of lactose free versus lactose containing milk in the management of acute watery diarrhea in children.

Methods: It is a Randomized Controlled trial. The research was conducted from April 15, 2023, to April 21, 2024, at pediatric medicine Unit of The Children's Hospital and UCHS Lahore. The children were randomly assigned to two groups using a lottery system. Group A received a lactose-free formula, but Group B received lactose-containing milk. Diarrhea resolution duration was assessed. Three days later, the children's weight was measured with a weighing machine, and any variations in weight were recorded.

Results: In Group A, there were 27 (54%) males and 23 (46%) females, whereas Group B had 23 (46%) males and 27 (54%) females. The mean time of diarrhea resolution and mean weight difference between Group A and Group B were significantly different, as evidenced by the significant p-value.

Conclusion: Lactose-free formula was shown to be more effective in the dietary control of acute watery diarrhea (AWD), with a shorter duration of diarrhea than lactose-containing formula.

Keywords: Acute watery diarrhea, Lactose free formula, Weight.

INTRODUCTION

Diarrheal illnesses continue to be a major cause of childhood mortality and a major contributor to morbidity in children under two.[1] When taking into account the annual occurrence of episodes as well as the hospitalization rates, the effects of these illnesses are most noticeable during infancy. Given the annual occurrences and hospitalization rates, the burden of these illnesses is greater throughout infancy.[2] Because they injure hundreds of millions of young children and result in child fatalities annually, these are significant global issues.[3] Both the short-term and long-term effects should be included in any attempt to gauge how severe diarrhea is in children.[4] Previous studies reported a high mortality rate, highlighting difficulties in care and poor responses to dietary

treatment, especially in individuals with uncertain diagnoses. However, enhanced care and earlier intervention have led to a reduction in fatality rates.[5] Lactose is the main carbohydrate found primarily in mammalian milk.[6] It serves as the main dietary sugar for practically all infants and is the predominant sugar in breast milk and conventional infant formulas.[7] A lack of lactase, an enzyme necessary for lactose breakdown, which is mostly found in the villi tips of the jejunum, results in lactose malabsorption.[8] Lactose is consequently not completely broken down and absorbed in the small intestine. During acute diarrheal illness, lactose intolerance can develop in newborns and young children, but its clinical significance is typically limited, especially in more severe instances. While intestinal damage is uncommon, older children and teenagers frequently exhibit symptoms of lactose intolerance.[9,10] Lactose intolerance can cause symptoms like bloating, diarrhea, flatulence, stomach pain, distention, and cramps.[11,12] The purpose of this study is to assess the efficacy of lactose-free and lactose-containing milk in treating acute watery diarrhea (AWD) in children. Previous research suggests that lactose-free milk may assist children with AWD; however, the influence on weight and overall health remains unknown. Given the limitations of previous research, such as small sample sizes and a lack of local evidence in the literature, this study is needed to establish local evidence and determine the possible positive impact of lactose-free milk in our area. By doing so, we hope to gather local evidence that will inform the usage of lactose-free milk in managing diarrhea in children and maybe aiding in weight loss, so improving their overall health.

Operational Definitions

Acute Watery Diarrhea is defined as having three or more loose stools of grade III or above in a 24-hour period, with an illness lasting no longer than 14 days. Duration of diarrhea resolution means the number of days between the delivery of therapy and trial milk and the remission of diarrhea, defined as stool consistency below grade III, was assessed. Change in weight is defined as the assessment was based on the change in grams between the baseline weight at the time of presentation and the weight assessed 3 days later using a weighing machine. The change was computed as follows:

Change = Weight on Day 3 - Weight at Presentation. Hypothesis was there is a difference in the average length of diarrhea resolution and weight change between children treated with lactose-free milk versus those treated with lactose-containing milk for acute watery diarrhea (AWD).

PATIENTS AND METHODS

The Pediatric Medicine Unit of The Children's Hospital and the UCHS Lahore conducted a Randomized Controlled Trial from April 15, 2023 to April 15, 2024. The study included children of either gender aged 1 month to 24 months who presented with acute watery diarrhea (AWD) lasting shorter than 14 days, according to the operational definition. Malnourished patients (>-2SD according to WHO criteria) and those who had already been on antibiotics before to hospitalization were excluded. A sample size of 100 cases, 50 in each group, was determined based on a 95% confidence level, 90% power of test, and the duration of diarrhea resolution as 3.17±1.04 days with lactose-free milk and 5.25±1.58 days with lactulose-containing milk for AWD management. A non-probability consecutive sampling procedure was used, and 100 youngsters who met the inclusion requirements were picked. Following parental agreement, demographic information such as name, age, sex, initial weight, and date of admission were recorded. The children were then randomly assigned to two groups using a lottery method: Group A received lactose-free formula and Group B received lactose-containing milk. Both groups received standard care, which included antibiotics and rehydration, as per hospital practice. Following early rehydration and stabilization, the youngsters were given the appropriate milk. The children were then watched in the wards. The length of diarrhea resolution was examined using the operational definition. After three days, the child's weight was assessed with a weighing machine, and any weight changes were recorded in accordance with the operational definitions. All acquired data was documented on a proforma. The

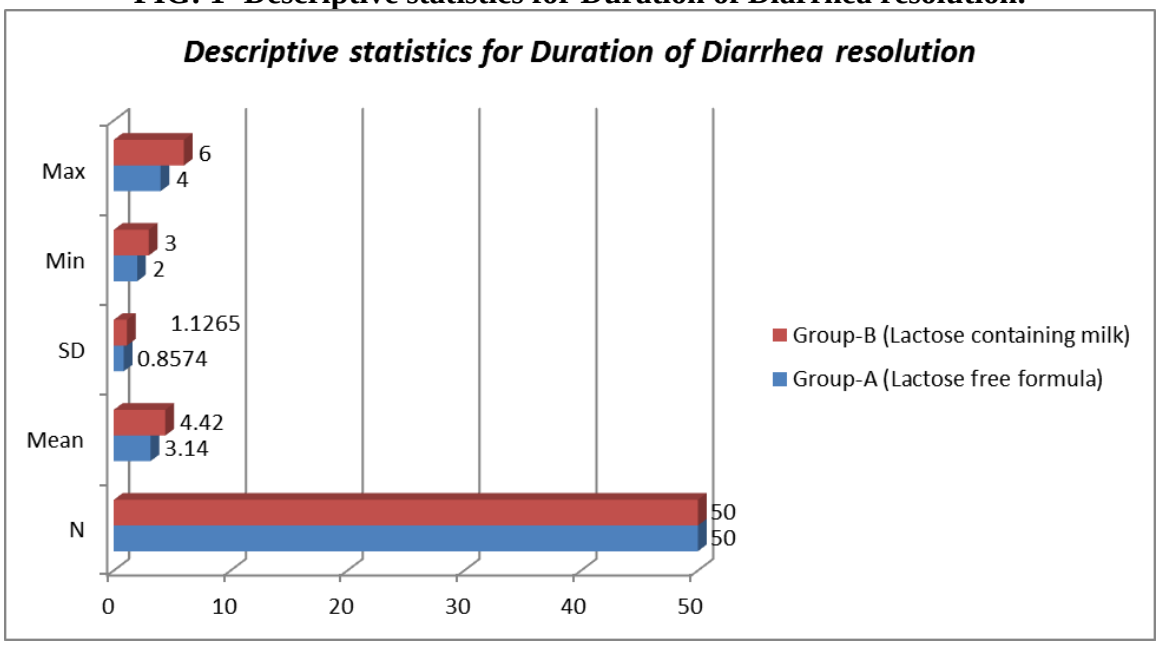
collected data was then input and analyzed with SPSS version 20. Qualitative variables such as gender were estimated using frequency and percentage, whereas quantitative data such as age, length of diarrhea resolution, and weight change were determined using mean and standard deviation. The independent sample t-test was used to compare both groups, with a significance level of p-value ≤0.05. Additionally, data was stratified by age and gender. After stratification, the independent sample t-test was repeated, with a p-value of ≤0.05 indicating significance.

RESULTS

Children in Group A had an average age of 12.52±6.33 months, ranging from 2 months to 24 months. Group B had a mean age of 12.46±7.37 months, ranging from 2 months to 24 months. Group A contained 27 (54%) males and 23 (46%) females, whilst Group B had 23 (46%) males and 27 (54%) females. Notably, there was a significant difference in the mean values of diarrhea resolution length between Group A and Group B, as evidenced by a p-value of 0.000 **(Fig: 1)**. There were no significant differences in mean weight between Group A and Group B at baseline or after 7 days of treatment, as demonstrated by non-significant p-values of 0.61 and 0.19, respectively **(Fig: 2)**. However, there was a significant difference in the mean weight difference between Group A and Group B, with a p-value of 0.000 **(Fig: 3).**

Significant differences were seen in the mean values of weight difference across all age categories (1-6, 7-12, 13-18, and 19-24 months) within both Group A and Group B, with p-values <0.05 **(Table: 1)**. Furthermore, substantial variations in mean diarrhea resolution length were seen between males and females in both Group A and Group B, with p-values of 0.000 for both genders. Significant differences were identified in the mean weight difference between males and females in both Group A and Group B, with p-values <0.05 **(Table: 2).**

FIG: 1- Descriptive statistics for Duration of Diarrhea resolution.



P-Value is 0.000
t-test is -6.39
Group-A: Lactose free formula
Group-B: Lactose containing milk
P-Value is 0.61 for initial weight and 0.19 for weight at day 7.

FIG: 2- Descriptive statistics for initial weight & at Day 7.

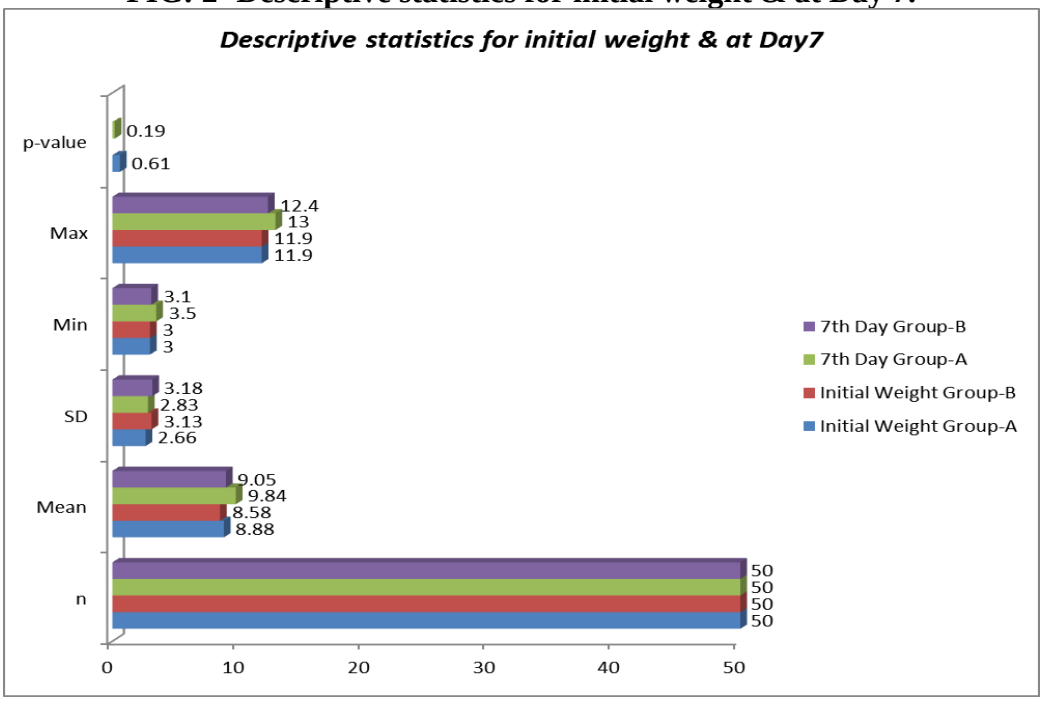


FIG: 3- Descriptive statistics for difference in weight in treatment groups.

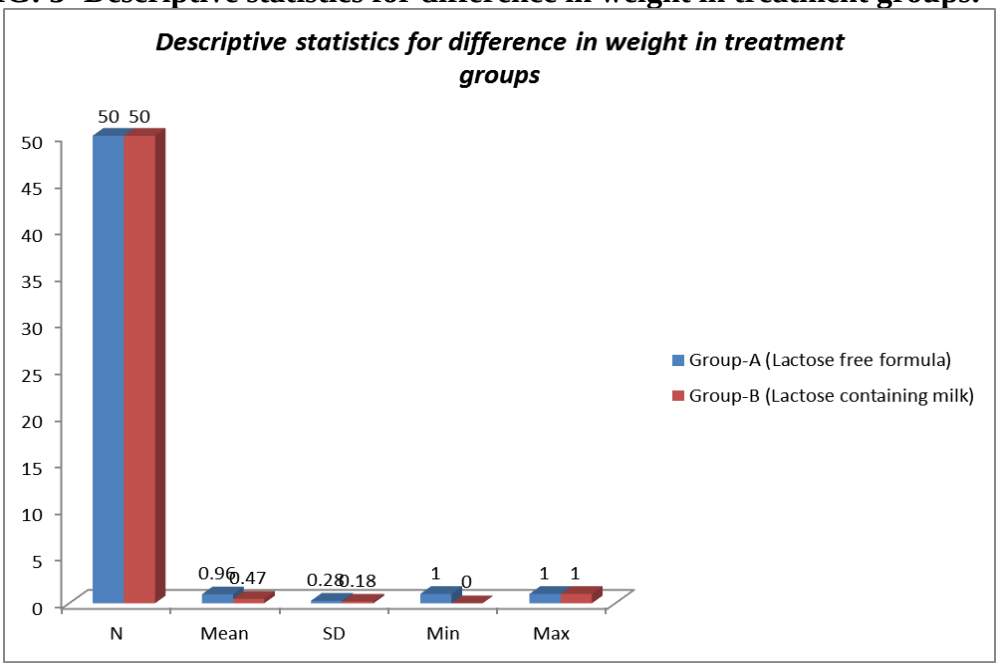


Table-1: Descriptive statistics for resolution of diarrhea duration & weight difference in treatment groups stratified for age

	Duration of diarrhea resolution		*p-value*	*Weight difference*		*p-value*
	Group-A	***Group-B***		***Group-A***	***Group-B***	
1-6	2.90±087	4.80±0.94	***0.000***	0.66±0.18	0.40±0.22	***0.007***
7-12	3.53±0.74	3.87±0.99	***0.360***	0.89±0.25	0.47±0.16	***0.000***
13-18	3.00±0.92	4.73±1.03	***0.000***	1.11±0.23	0.50±0.13	***0.000***
19-24	3.00±0.81	3.91±1.31	***0.069***	1.15±0.12	0.50±0.18	***0.000***

Group-A: Lactose free formula
Group-B: Lactose containing milk

Table-2: Descriptive statistics for resolution of diarrhea duration & weight difference in treatment groups stratified for gender

	Duration of diarrhea resolution		***p-value***	***Weight difference***		***p-value***
	Group-A	***Group-B***		***Group-A***	***Group-B***	
Male	3.17±0.90	4.47±1.08	***0.000***	0.89±0.28	0.50±0.17	***0.000***
Female	3.09±0.81	4.37±1.18	***0.000***	1.05±0.25	0.44±0.17	***0.000***

Group-A: Lactose free formula ***Group-B:*** Lactose containing milk

DISCUSSION

Acute watery diarrhea in children younger than two years old requires careful evaluation of dietary strategies, especially when comparing lactose-containing to lactose-free milk. A lactose-free diet combined with traditional therapy can improve clinical results and reduce negative effects. However, to avert probable malnutrition and developmental problems, care must be taken to ensure enough nutritional intake.[13] Acute gastroenteritis is a substantial cause of morbidity and mortality among children, accounting for around 15% of all childhood fatalities worldwide. Illnesses associated with gastroenteritis continue to be a significant public health issue in developing countries. Studies indicate that lactose-free milk, especially in industrialized countries, may help reduce the length of hospital stay in children with diarrhea.The study examined the management of acute watery diarrhea in infants under two years old by comparing the effects of lactose-containing and lactose-free milk (LFM). The results showed that 89% of infants with LFM stopped having diarrhea within three days, compared to 67% with lactose-containing milk. This represented a considerable improvement in recovery rates. This implies that LFM would be a better course of action for young infants with severe diarrhea. [14]When compared to milk that contains lactose, lactose-free milk has been demonstrated to shorten the duration of diarrhea and enhance recovery in children younger than two years old. This is especially important because intestinal inflammation can lead to lactose intolerance during episodes of diarrhea. Furthermore, lactose-free choices are frequently preferred by parents during such periods, underscoring the need for interventions that balance symptom management with meeting children's nutritional needs.[15] In this study, children given lactose-free formula experienced acute diarrhea on average for 1.7±0.8 days, which was considerably lower than the mean length of 2.7±0.8 days for infants given lactose-containing formula ($p<0.001$). This demonstrates how lactose-free formula can be used to treat young children's diarrhea. The results validate the clinical practice preference for lactose-free choices when infants arrive with acute diarrhea. [16]In children under five, diarrhea is still a major source of morbidity, especially in developing countries, and managing it can be made more difficult by secondary lactose intolerance. Our research highlights the significance of lactose-free formula in dietary management by demonstrating its effective improvement in diarrhea resolution when compared to lactose-containing choices.[17] In a separate investigation[18], Group-1 exhibited an average duration of diarrhoea resolution of 4.52±1.16 days, whereas Group-2 demonstrated an average duration of 3.16±0.94 days. A significance level of 0.001 was calculated for this disparity, indicating a significant difference between the two groups. On the other hand, the average time taken to resolve gastroenteritis was found to be 3.14±0.85 days in Group A and 4.42±1.12 days in Group B, according to our research. Our results showed a shorter resolution time for the same group, while the linked study found a longer one for the lactose-free formula group. Reevaluating the previously asserted comparability is necessary to adequately reflect the observed discrepancies in trial outcomes.This study demonstrates how lactose-free milk powder can effectively reduce the symptoms of diarrhea in children younger than two. The notable decrease in recuperation duration implies that lactose-free preparations have the potential to efficiently reestablish intestinal integrity and enhance intestinal barrier performance. According to these results, lactose-free diets may be helpful in treating acute watery diarrhea, especially in young children whose symptoms may worsen when given regular milk. This supports the need for specialized nutritional therapies in the treatment of pediatric diarrhea.[19] Simakachorn et al. discovered in a separate study that the median

time required for diarrhea to resolve was substantially reduced by 20.5 hours when using lactulose-free milk as opposed to lactulose-containing milk (77.0 hours vs. 97.5 hours; P = 0.002). An increase in percent weight gain and a significant reduction in defecation frequency were associated with the use of lactulose-free milk.[20]The substantial rise in sugar levels linked to lactose-free formulations was highlighted by the finding that the mean difference in added sugar content between lactose-free and 100% lactose formulas was 2.88 g per 100 g of formula (MD 2.88 g, 95% CI 1.67 to 4.09).[21] This finding implies that the consumption of lactose-free milk resulted in an average reduction of diarrhea duration of around 18 hours. Additionally, an earlier resolution of diarrhea was associated with lactose-free products (RR 0.52, 95% CI 0.39 to 0.68).[22] Consistent with previous research [23,24], our findings support the efficacy of lactose-free milk in the treatment of AWD by accelerating the resolution of diarrhea. The current study discovered that in breastfed infants getting zinc supplementation, the incidence or duration of diarrhea was not significantly impacted by lactose-restricted diets. In contrast, research currently available indicates that undiluted non-human milk can be an effective treatment for many infants suffering from acute watery diarrhea. The results emphasize the importance of early feeding and oral rehydration solutions (ORS), suggesting that these measures may have a greater impact than the use of lactose-free formulations. Furthermore, confounding variables that are essential for assessing dietary interventions—like the severity of the diarrhea and patient age—were not taken into consideration in earlier analyses. These findings highlight the need for more investigation to elucidate the effects of dietetic treatment and lactose-free formulas in breastfed infants with severe diarrhea. [25] Children were randomized into two groups in a recent study to assess the effectiveness of adjunct therapy for diarrhea: one group received probiotics, while the other received zinc supplements. Group B received zinc sulfate pills, while group A received a probiotic sachet comprising Lactic acid bacteria and Saccharomyces. The participants' ages were distributed similarly. The zinc group experienced a shorter length of diarrhea than the probiotic group, according to the results. Furthermore, individuals who received zinc recovered more quickly. Overall, the results indicate that probiotics were not as effective as zinc supplementation in treating diarrhea, however both treatments had some effect on the frequency and consistency of stools.[26]

CONCLUSION

Lactose-free formula was shown to be more effective in the dietary control of acute watery diarrhea (AWD), with a shorter duration of diarrhea than lactose-containing formula.

REFERENCES

1. Thystrup C, Majowicz SE, Kitila DB, Desta BN, Fayemi OE, Ayolabi CI, et al. Etiology-specific incidence and mortality of diarrheal diseases in the African region: a systematic review and meta-analysis. BMC Public Health. 2024;24(1):1864.
2. Nguyen RN, Bui NQ, Thai DN. Efficacy of lactose-free milk in treating acute gastroenteritis in Vietnamese children: a randomized controlled trial. Cureus. 2024;16(5).
3. Veerlapati R, Prasad KNV. Study on lactose intolerance in children with acute diarrhoea. JMSCR. 2019;7(10):502-8.
4. Yousuf M, et al. Clinical assessment and demographic insights of lactose intolerance among diarrheal children at Hyderabad, Pakistan: lactose intolerance among diarrheal children. Pakistan BioMed J. 2024;7(2):40-4. doi:10.54393/pbmj.v7i02.1030.
5. Das JK, Padhani ZA, Bhutta ZA. Persistent diarrhea in children in developing countries. In: de Almeida JPM, Shakoor TKRK, Stenson AMG, editors. Textbook of pediatric gastroenterology, hepatology and nutrition: a comprehensive guide to practice. Cham: Springer; 2022. p. 231-40. doi:10.1007/978-3-030-80068-0_17.
6. Urashima T, et al. Evolution of milk oligosaccharides: origin and selectivity of the ratio of milk oligosaccharides to lactose among mammals. Biochim Biophys Acta Gen Subj. 2022;1866(1):130012.

7. Cheng L, Akkerman R, Kong C, Walvoort MT, de Vos P. More than sugar in the milk: human milk oligosaccharides as essential bioactive molecules in breast milk and current insight in beneficial effects. Crit Rev Food Sci Nutr. 2021;61(7):1184-200.
8. Hammer HF, Högenauer C. Lactose intolerance and malabsorption: clinical manifestations, diagnosis, and management. Waltham (MA): UpToDate; 2022.
9. del Carmen Tocaa M, Fernández A, Orsic M, Tabacco O, Vinderola G. Lactose intolerance: myths and facts. An update. Arch Argent Pediatr. 2022;120(1):59-66.
10. Al-Beltagi M, Saeed NK, Bediwy AS, Elbeltagi R. Cow's milk-induced gastrointestinal disorders: from infancy to adulthood. World J Clin Pediatr. 2022;11(6):437.
11. Hammer HF, Högenauer C. Lactose intolerance and malabsorption: clinical manifestations, diagnosis, and management. Waltham (MA): UpToDate; 2022.
12. Akram M, Hussain S, Salim MW, Pervaiz F, Karim SA, Khan HI. Comparison of outcome of lactose-free formula milk with yogurt in children with acute diarrhea. Pak J Med Health Sci. 2023;17(5):281.
13. Aierken K, Xu Z, Ma J, Kawuli G. The efficacy of low/lactose-free milk powder in the treatment of lactose intolerance in infants: a protocol for systematic review and meta-analysis. Medicine. 2024;103(31).
14. Al-Dulaimy WZ, Al-Sabeea MK, Al-Ani RK. Lactose free-milk for young children with acute diarrhea, western of Iraq. Al-Anbar Med J. 2021;17(2):68-71.
15. Noreen A, Jalal A, Qudsia, Jabeen R, Qamar S. Comparison of lactose-free with lactose-containing formula milk in the management of acute watery diarrhea in infants. Pak J Med Health Sci. 2016;10(4):1337-9.
16. Arshad M, et al. Comparative study of lactose and lactose-free milk for acute diarrheal management in children up to 1 year of age. Prof Med J. 2020;27(08):1631-5.
17. Nitayakul P, Jeephet K, Ngeonmak T. Efficacy of lactose-free formula as a 24-hour management approach for acute diarrhea among children. J Southeast Asian Med Res. 2023;7.
18. Mahfuz M, Alam MA, Islam SB, Naila NN, Chisti MJ, Alam NH, et al. Treatment outcome of children with persistent diarrhea admitted to an urban hospital, Dhaka during 2012–2013. BMC Pediatr. 2017;17(1):142.
19. Liu M, et al. Lactose-free milk powder can effectively relieve diarrhea symptoms in weaning SD rats and children. Food Sci Hum Wellness. 2024;13(3):1494-502.
20. Liu M, Han S, Li B, Chen C, Yao L, Kwon JI, et al. Lactose-free milk powder can effectively relieve diarrhea symptoms in weaning SD rats and children. Food Sci Hum Wellness. 2024;13(3):1494-502
21. Mokhtari P, Schmidt KA, Babaei M, Goran MI. Altered nutrient composition of lactose-reduced infant formula. Nutrients. 2024;16(2):276.
22. Nitayakul P, Jeephet K, Ngeonmak T. Efficacy of lactose-free formula as a 24-hour management approach for acute diarrhea among children. J Southeast Asian Med Res. 2023;7.
23. Aierken K, Xu Z, Ma J, Kawuli G. The efficacy of low/lactose-free milk powder in the treatment of lactose intolerance in infants: a protocol for systematic review and meta-analysis. Medicine. 2024;103(31).
24. Andri A. Comparison of the incidence of acute watery diarrhea in children aged 0-12 years with exclusive breastfeeding and infant formula milk. J Med Hutama. 2023;5(1):3672-9.
25. Mehrabani S, Esmaeili M, Moslemi L, Tarahomi R. Effects of lactose-restricted regimen in breastfeeding children with acute diarrhea. Int J Prev Med. 2020;11(1):75.
26. Mehrabani S, Esmaeili M, Moslemi L, Tarahomi R. Effects of lactose-restricted regimen in breastfeeding children with acute diarrhea. Int J Prev Med. 2020;11(1):75.