

Review Article

Efficacy of Lactobacillus Reuteri in Improving Gut Barrier Function & Management of Infantile Colic

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Abstract: Infantile colic is a frustrating impasse that affects up to 20% of infants. Nevertheless, its pathogenesis is currently unknown, some hypotheses are food hypersensitivity or allergy, gut dysmotility, inflammation, and visceral pain. Probiotics use in treatment and prevention of infantile colic is a moderately new topic. Moreover, Probiotics strains exhibit a wide range of health benefits by modifying the intestinal microbiota and immunity. Lactobacillus reuteri is one of the utmost widely studied probiotic strains. It endorses gut health by stimulation of mucosal gut barrier functions, production of antimicrobial substances (such as reuterin and lactic acid) and influencing acquired and innate immune responses. Reuterin produced by L. reuteri is a potent anti-microbial compound capable of inhibiting a wide spectrum of pathogenic microorganisms. L. reuteri creates biofilms that stimulate tumor necrosis factor production by lipopolysaccharide (LPS)-activated monocytoic cells, apart from antimicrobial metabolite production. Interestingly, as a potential therapy for childhood, L. reuteri administration has emerged functional gastrointestinal disturbances as these disturbances are associated with gut microbiota perturbations in early life. The review précises the beneficial aspects of the probiotic L. reuteri strain in clinical practice with a special focus on its role in improving gut health and immunity including managing Infantile colic in infants and toddlers.

Keywords: Lactobacillus Reuteri, Infantile Colic, Functional Gastrointestinal

1. Introduction

Infantile colic (IC) is a frequent issue in the first few months of life that causes the baby to cry excessively. [1, 2]. IC is

defined by prolonged sobbing for at least three hours a day, three days a week, over a period of roughly three weeks, causing weariness, tension, worry, and sadness in the parents [3, 4]. IC symptoms are most severe at 6 weeks of age and

resolve by 12 weeks [5].

Previous research has shown that IC follows a diurnal cycle of pain beginning in the evening [6] and that the occurrence of colic follows an equivalent pattern across male and female newborns [7]. How IC develops in the first place is not known. Multiple factors contribute to this syndrome, as is explained in [8]. Possible causes of IC include sensitivities to milk proteins, an overabundance of intestinal gas, and a hormonal imbalance in the intestines. Colic has been linked to factors such as microbial dysbiosis, maternal smoking, hormonal shifts, and gastrointestinal inflammation (GII) in recent research [9-11]. Postpartum depression, parental anxiety, stressful pregnancies, unhappiness in the sexual connection, bad experiences after delivery, ineffective parenting, and disruption of the gut-brain axis have all been linked to IC in some research [7]. The estimated IC prevalence throughout the world is 20% [12]. One in six households will seek medical help for their child's weeping [13] because of this issue. As of yet, there are no FDA-approved drugs to treat this condition; simethicone, for example, failed to exhibit superior qualities compared to a

placebo [14, 15]. Although Dicyclomine hydrochloride has showed promise in certain trials for treating IC, its usage is limited because of the risk of adverse effects in newborns [16].

Other potential treatments, such as cimetropium bromide or herbal medicines, are described by very low-quality research and are thus not recommended. But their management of IC is not universally accepted [17] owing to a lack of compelling evidence. Probiotic supplementation has shown promise as a potential therapy for IC. In proper doses, probiotics—which are living, non-pathogenic types of bacteria—have a favorable impact on the host. Substances known as prebiotics are essential in the regulation of the gut microbiota since they stimulate the development of probiotic bacteria. An example of a synbiotic is a mix of prebiotic fiber with a probiotic yeast [18, 19]. *Bifidobacterium*, *Lactobacillus*, *Bacillus*, *Pediococcus*, and even certain yeasts have been identified as promising candidates for use as probiotics. Collectively, these strains bolster the host immune system in ways that are beneficial for maintaining gut microbial balance and anti-inflammatory responses [20, 21].

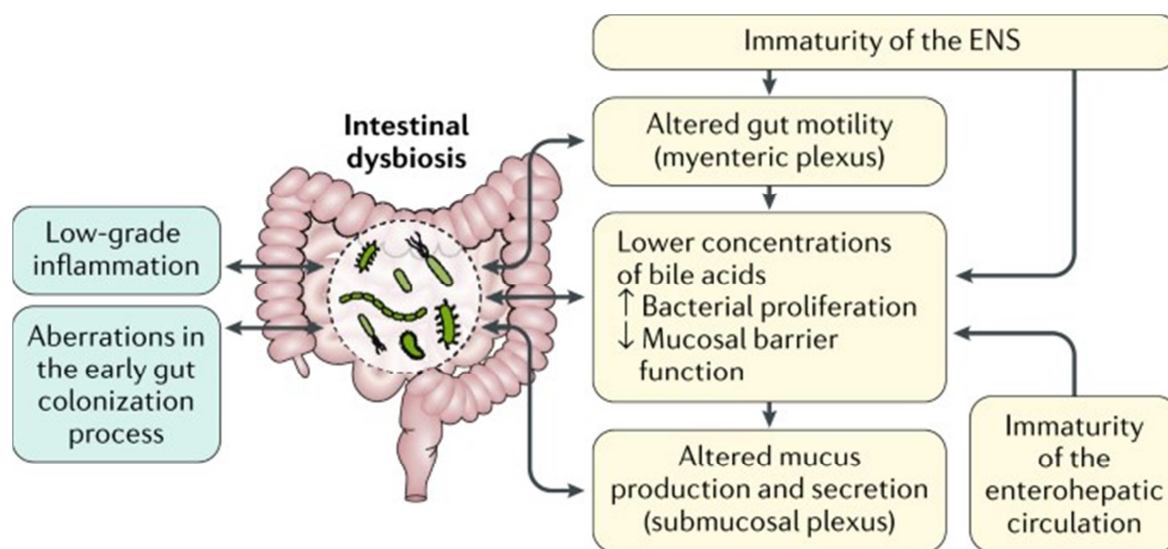


Figure 1. Mechanism of Infantile Colic.

Source: Infantile Colic- Mechanism and management, Published 14 May 2018
Link: <https://www.nature.com/articles/s41575-018-0008-7>

Moreover, our review may inform researchers of new strategies for the management and treatment of IC as well as new clues for understanding its pathogenesis. This review and meta-analysis aimed to evaluate the efficacy and possible mechanisms of probiotics for managing IC.

2. Literature Review

2.1. Proposed Aetiological Factors for Infant Colic

There is ongoing discussion as to whether newborn colic is only one end of the weeping continuum or a symptom of deeper physiological or psychological issues. Physiological variables in the newborn or psychological concerns between the mother and child may exacerbate normal weeping in

infants, leading to the condition known as "infant colic" [13]. Some of the proposed psychosocial hypotheses include a child with a challenging temperament, an infant who lacks the maturity to regulate their responses to internal and external stimuli, insufficient mother-infant connection, and maternal worry [13]. Visceral discomfort, intestinal dysmotility, and gastric hyperpressurization are also postulated as causes [14, 15]. No research, however, has been able to show whether or not they are actual causes of newborn colic. Although gastrointestinal (GI) reflux was formerly thought to be a leading source of newborn discomfort, numerous recent clinical investigations have shown that this is unlikely to be the case [16, 17]. One of the greatest factors linked to weeping has been shown to be food allergy [18-22]. It is believed that the underlying mechanism is gut inflammation caused by an

allergy to cow's milk protein. One research found that faecal calprotectin, an inflammatory marker in the gut, was greater in babies with colic than in those without [23], while another

investigation could not support this conclusion [24]. Infants with cow's milk protein allergy may also have an altered gut flora [25, 26].

Figure 1: Causes and symptoms of infantile colic

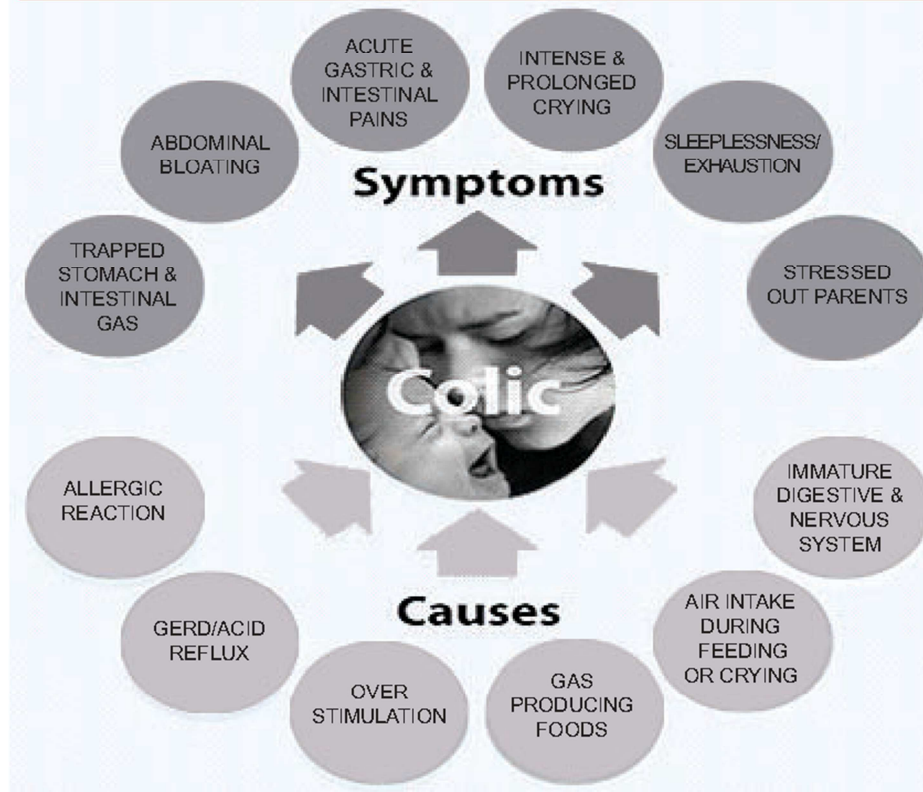


Figure 2. Causes and symptoms of infantile Colic.

Source: The causes and Treatment of Newborn, Infant and Baby Colic by T. A. Lowrence B.Sc., CIRM, CPM
Link: <https://www.coliccalm.co.nz/colic/what-are-the-symptoms/>

The pathophysiological role played by gut bacteria in the worsening of baby crying has been the subject of several studies. Many studies have shown that children with and without colic have distinct gut bacteria, and this exciting new idea is attracting a lot of attention from scientists. Colic infants were found to have higher concentrations of *Escherichia coli* (E coli) and lower concentrations of *Lactobacillus* species than healthy infants in one study [27], and in two other studies [28, 29], higher concentrations of *Escherichia coli* (E coli) and lower concentrations of *Lactobacillus* species were found in infants with colic compared to controls. Another research found that particular *Lactobacillus* strains were more common in babies with colic compared to controls [30], while a more recent investigation revealed that certain *Bifidobacterium* and *Lactobacillus* species were protective against crying [31]. These results imply that the microbiota are likely to be different in babies with colic, while it is unclear whether these variations in the microbiota are the cause or outcome of the colic disease. Infant screaming may be caused by changes in the stomach's mechanics, such as gas generation and bloating and/or gut dysmotility [32, 33]. Infantile colic probably has

several causes.

2.2. Infant Colic Treatments Available Now

Interventions for newborn colic have been the subject of four systematic studies, all of which have shown them to be beneficial [34-37]. If a baby has a food allergy, the best treatment is to switch them to a hypoallergenic or extensively hydrolyzed whey or casein-based formula and have their moms try elimination diets if they're nursing. It is not known which infants benefit from hypoallergenic diets and which do not, therefore remove cow's milk from nursing moms is not always successful. Increased parental response, decreased stimulation, and the use of sucrose are other viable options. Focused parental counseling, greater carrying, the use of vehicle trips stimulators, soy milk, and fiber-enriched meals are among methods that have been shown to be ineffective. There is no evidence that proton-pump inhibitors help with gastroesophageal reflux disease [17]. Anti-foaming agents like simethicone, which are used to treat gastrointestinal gas and bloating, don't work either [38, 39]. Effective

anticholinergic medications such dicyclomine, however, are linked to serious side effects in newborns [2, 35]. While there is some evidence that offering family support might alleviate stress for caregivers, that evidence is less compelling when it comes to whether or not it would reduce weeping [34]. Therefore, there are currently no effective and realistic solutions that can be quickly applied to aid families with babies who suffer from colic.

2.3. Role of *L. reuteri* in Gut Health

Utilizing probiotics as a treatment for newborn colic is a novel and encouraging technique. Many dietary items, including baby formulas, include probiotics, which are living bacteria thought to provide health advantages [40]. Probiotics

colonize the intestine, limit the adherence of other bacteria via competitive inhibition, increase mucus layers, enhance mucosal barriers, and reduce intestinal inflammation [41-43]. The microbiota in an infant's digestive tract may be altered by probiotics, and the variety of that microbiota can be increased [34-40]. Recent research [32] shown that some strains of *Lactobacillus* might halt the formation of gas-producing coliforms isolated from newborns with colic. Probiotics and prebiotics may affect neonates' GI motility by influencing gastric emptying [33]. Probiotics, according to research conducted on rats, may alter pain perception by the stomach and can reduce gut contractile activity [41-43]. Another theory is that probiotics alleviate newborn discomfort by decreasing inflammation in the stomach.

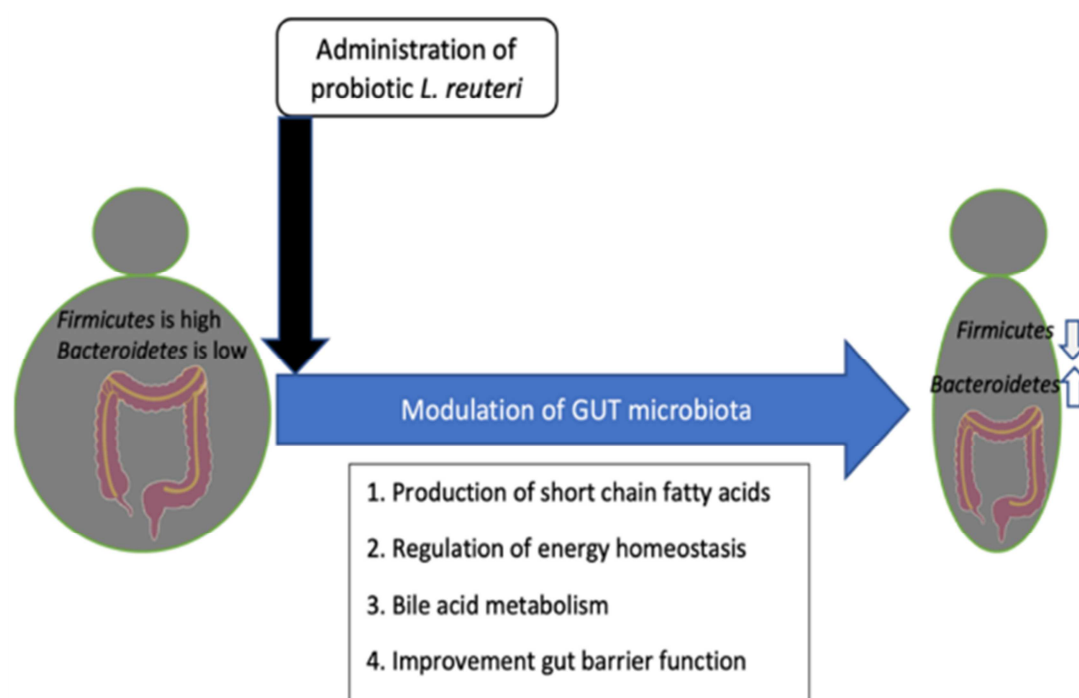


Figure 3. Role of *L. reuteri* in Gut Health.

Source: *Limosilactobacillus reuteri* in Health and Disease: by Jumana et. El; MDPI Journal/Microorganism 2022, 10 (3), 522
Link: <https://doi-org/10.3390/microorganism 10030522>

Therapeutic benefits of probiotics in treating newborn colic have been investigated in four randomized controlled studies. To alleviate newborn colic, Savino et al. [10] reported in 2006 that *Lactobacillus reuteri* (*L. reuteri*) strain ATCC 55730 was much more effective than simethicone ($n=83$). Similar encouraging findings were seen in a placebo-controlled research with the same number of participants ($n=50$) conducted in 2010 using *L. reuteri* strain DSM17938 as the intervention [6]. In all investigations, the moms of the newborns were also following a cow's milk-free diet. The therapeutic benefits of probiotics on newborn colic have been studied in two earlier studies ($n=9$, $n=62$) [5, 6], however the results showed no meaningful impact on crying time.

One baby in two will show symptoms of a functional gastrointestinal disease (FGID) between the ages of 0 and 6 months. Infantile colic, regurgitation, functional diarrhea, and functional constipation are all examples of functional gastrointestinal disorders (FGIDs), and their frequency is high yet wildly variable among regions [8]. In that it allows for the colonization of the gut with good bacteria, *L. reuteri* is helpful to the health of the host. This is because certain strains of *L. reuteri* are able to survive in environments with a low pH and bile salts. Because of their ability to create exopolysaccharides (EPS), which are crucial for biofilm formation, these strains are able to bind to mucin and intestinal epithelia. *L. reuteri*'s probiotic benefits are increased by the creation of biofilms, which aid the bacteria in adhering to epithelial surfaces.

2.4. Use of Probiotics and the Potential Role of *Lactobacillus Reuteri* in Infant Colic

Utilizing probiotics as a treatment for newborn colic is a novel and encouraging technique. Many dietary items, including baby formulas, include probiotics, which are living bacteria thought to provide health advantages [40]. Probiotics colonize the intestine, limit the adherence of other bacteria via competitive inhibition, increase mucus layers, enhance mucosal barriers, and reduce intestinal inflammation [41-43]. The microbiota in an infant's digestive tract may be altered by

probiotics, and the variety of that microbiota can be increased [44-45]. Recent research [32] shown that some strains of *Lactobacillus* might halt the formation of gas-producing coliforms isolated from newborns with colic. Probiotics and prebiotics may affect neonates' GI motility by influencing gastric emptying [33]. Probiotics, according to research conducted on rats, may alter pain perception by the stomach and can reduce gut contractile activity [43-48]. Another theory is that probiotics alleviate newborn discomfort by decreasing inflammation in the stomach.

Gut Colonization of *L.reuteri*

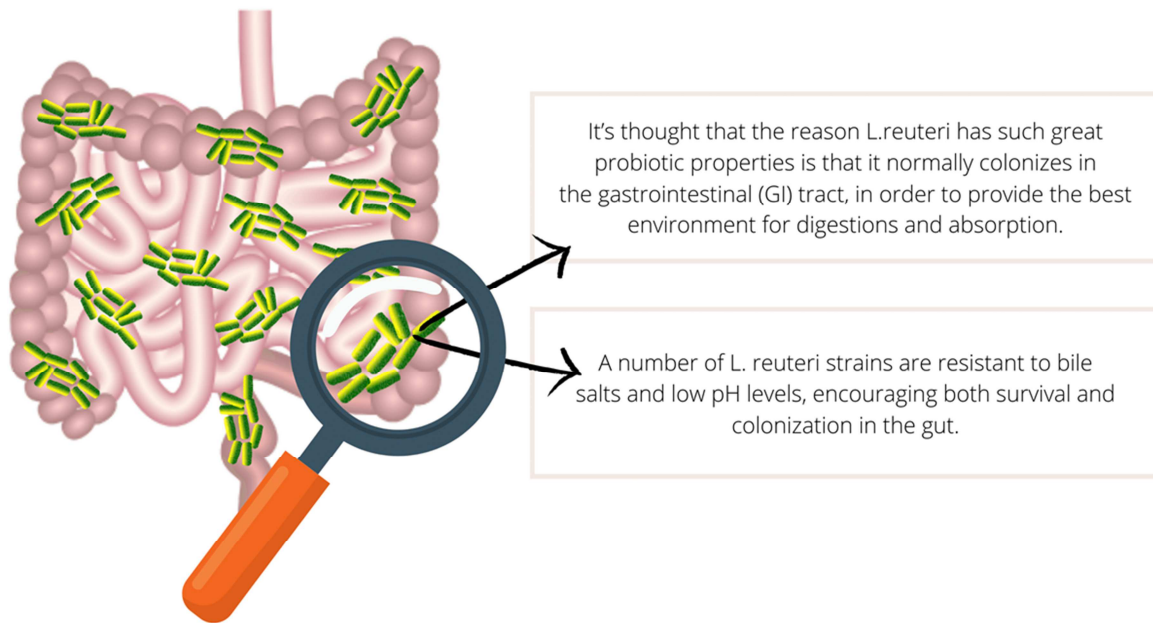


Figure 4. Flow chart of *Lactobacillus reuteri* gut colonization in infants.

Source: Parna Thriv LIVE A VITAL LIFE: The Vital Role *Lactobacillus Reuteri* Plays in Your Babies Health

Link: <https://pranathrive.com/lactobacillus-reuteri/>

Because of the conflicting findings in the aforementioned trials, the usefulness of probiotics (including *L. reuteri*) for the treatment of baby colic is still up for debate. Since the research populations in both the Savino et al. trials were limited to breastfed babies whose mothers were on a cow's milk-free diet, it is possible that the results may not be generalizable to the general population. Further research is needed to address methodological problems raised by prior studies. In the 2007

trial by Savino et al., for instance, simethicone was used as a comparison group rather than a placebo, thus there was no way to hide dosing or timing discrepancies between the therapies. Although probiotic bacteria are known to have species-specific effects, the other studies lacked the statistical power to identify differences and utilized mixtures of probiotics, both of which may have contributed to the divergent outcomes.

Table 1. Clinical trials of probiotic strains.

Study	Type of study	Probiotic strain (dose)	Duration of treatment	Population and type of feeding	Age	Results
Kianifar et al. [28]	A randomized controlled trial	<i>Lactobacillus casei</i> , <i>Lactobacillus rhamnosus</i> , <i>Streptococcus thermophilus</i> , <i>Bifidobacterium breve</i> , <i>Lactobacillus acidophilus</i> , <i>Bifidobacterium infantis</i> , <i>Lactobacillus bulgaricus</i> and fructooligosaccharide (10^8 CFU/day)	30 Days	BF infants	15-120 Days	Significant improvement of colic symptoms in the probiotics group
Mi et al. [29]	A placebo-controlled observational	<i>Lactobacillus reuteri</i> DSM 17938 (10^8 CFU)	21 Days	42 BF infants	Less than 4 months	100% Treatment success in the

Study	Type of study	Probiotic strain (dose)	Duration of treatment	Population and type of feeding	Age	Results
	randomized study					probiotic group, significant reduction of mean crying time, maternal depression and significant increment of maternal satisfaction Probiotics treatment significantly reduced crying time partly due to the increased expression of CC-chemokine receptor Meanwhile, there was no significant difference in the experimental groups in term of IL-10. There was not a significant difference in crying time, fecal calprotectin levels, or <i>Escherichia coli</i> load probiotic group cried 49 minutes more than the placebo group Significantly shorter crying time in the infants received probiotics.
Savino et al. [30]	Randomized clinical trial	<i>Lactobacillus reuteri</i> DSM17938 (1×10^8 CFU/day)	28 Days	50 BF infants	<50 Days	
Sung et al. [32]	Double-blind, placebocontrolled randomized trial.	<i>Lactobacillus reuteri</i> DSM 17938 (1×10^8 CFU/day)	30 Days	167 BF or FF infants	<3 Months	
Savino et al. [26]	A double-blind, placebo-controlled randomized trial	<i>Lactobacillus reuteri</i> DSM 17938 (1×10^8 CFU/day)	30 Days	87 BF infants	<12 Weeks	
Baldassarre et al. [35]	A double-blind, randomized, placebo-controlled clinical trial	<i>Lactobacillus paracasei</i> DSM 24733, <i>Lactobacillus plantarum</i> DSM 24730, <i>Lactobacillus acidophilus</i> DSM 24735, <i>Lactobacillus delbrueckii</i> subsp. <i>bulgaricus</i> DSM 24734, <i>Bifidobacterium longum</i> DSM 24736, <i>Bifidobacterium breve</i> DSM 24732, <i>Bifidobacterium infantis</i> DSM 24737, and <i>Streptococcus thermophilus</i> DSM 24731 (5×10^9 CFU/day)	21 days	62 BF Infants	30-90 Days	Significant reduction of crying time in comparison with the placebo as well as higher responders to treatment was observed in the probiotic group.

2.5. Role of *L. reuteri* in Immunomodulation

The immune system has been shown to be affected by *L. reuteri*. Pro-inflammatory cytokine production may be suppressed and regulatory T-cell growth and activity can be boosted by certain strains of *L. reuteri* [5]. Anti-inflammatory Treg cells have been demonstrated to be induced by *L. reuteri* in many investigations.

The ability of *L. reuteri* to induce Tregs is very varietal specific. Although stimulation of Treg cells is essential for the anti-inflammatory activity of *L. reuteri*, this is not always the case. *L. reuteri*'s ability to dampen Th1/Th2 responses in Treg-deficient mice is a case in point. Strains of *L. reuteri* have been shown to inhibit the generation of inflammatory cytokines [5]. When given the opportunity, *L. reuteri* ATCC 55730 will colonize the human gastrointestinal tract after being given to the

patient in a live form to be taken orally as a supplement.

This is linked to an increase in duodenal B-lymphocytes, a decrease in stomach mucosal histiocytes, and a substantial boost in CD4(+) T cells (T helper cells) [24].

In addition, it has been hypothesized that some strains of *L. reuteri* may exhibit immunoregulatory effects in the human intestine by preventing the production of tumor necrosis factor alpha (TNF) and the subsequent damage to the intestine that is triggered by lipopolysaccharide (LPS). In newborn rats with LPS-induced inflammation of the small intestine and ileum, *L. reuteri*'s anti-inflammatory effect decreases the levels of pro-inflammatory cytokines (interleukin-8 [IL-8], IL-1, interferon, TNF) in the intestinal mucosa. In an experimental model of necrotizing enterocolitis, *L. reuteri* DSM 17938 was shown to inhibit a Tolllike receptor-4 signaling pathway, preventing the release of cytokines [4].

Table 2. Anti-inflammatory properties of *L. reuteri* and other probiotics with efficacy proven in clinical trials.

Single strain	Anti-inflammatory marker	Dose (duration)	Probiotic combination	Anti-inflammatory marker	Dose (duration)
Lactobacillus reuteri DSM 17938*	Increased CC-chemokine receptor 7 [30], increased FOXP3 mRNA levels [26] and reduced fecal calprotectin[89]	10 ⁸ CFU/day (21 and 28 days)	Lactobacillus rhamnosus 19070-2 and Lactobacillus reuteri 12246*	Reduced intestinal permeability	(125×10 ⁶ CFU/day) (28 days)
Lactobacillus reuteri (American Type Culture Collection (AT CC) strain 55730)	-	10 ⁸ CFU/day (28 days)	Bifidobacterium lactis Bb 12 and Streptococcus thermophilus*	Reduced fecal calprotectin as well as increased fecal IgA due to Bifidobacterium lactis Bb 1291) and also maintenance of mucosal barrier and reduced intestinal permeability by Streptococcus thermophilus [92]	107 and 106 CFU/g 240 mL of solution per day (mean ±SD, 210±127)
Lactobacillus acidophilus HA122	-	1×10 ⁹ twice a day (28 days)	Bifidobacterium breve B632 and BR03*	reduced TNF-α levels	5 mL/10 ⁸ (90 days)
-	-	-	Pediococcus pentosaceus CECT 8330 and Bifidobacterium longum CECT 7894*	Increased IL-10 production	10 ⁹ CFU per day (14 days)
-	-	-	Lactobacillus paracasei DSM 24733, Lactobacillus plantarum DSM 24730, Lactobacillus acidophilus DSM 24735, Lactobacillus delbrueckii subsp. bulgaricus DSM 24734, Bifidobacterium longum DSM 24736, Bifidobacterium breve DSM 24732, Bifidobacterium infantis DSM 24737, and Streptococcus thermophilus DSM 24731*	Normalization of intestinal integrity along with the reduced mucosal secretion of TNF-alpha and IFNgamma in the animal models of Crohn's disease	5×10 ⁹ CFU/day (21 days)

2.6. Effectiveness of *L. reuteri* in Management of Pediatric Disorders

2.6.1. Diarrhea

About 2.5 million children die each year from diarrhea, making it the sixth highest cause of mortality among children globally [14]. Several studies have shown that there are methodological difficulties in determining the precise advantages of *L. reuteri* supplementation in children with diarrhea. Diarrhea and hospital stays were shorter in the group given *L. reuteri* compared to those who received a placebo or no therapy at all [15]. Dinleyici et al. performed a randomized controlled study (RCT) to examine the impact of administering *L. reuteri* on the duration of diarrhea and length of hospital stay in children with acute diarrhea. The RCT included 127 children aged 3-60 months. The usage of probiotics was not associated with any unwanted consequences. More so, the *L. reuteri* group had considerably shorter bouts of diarrhea than the control group. After 24, 48, and 72 hours, those who took *L. reuteri* had a considerably decreased daily stool volume. *L. reuteri* patients spent less time in the hospital on average than those in the control group [16].

There was a significant decrease in the frequency of

recurrence of watery diarrhea and a shorter duration of symptoms in a research when *L. reuteri* was administered as an additional treatment compared to placebo.

2.6.2. Constipation

There is a worldwide incidence of 9.5% for childhood constipation, making it a major health issue. Constipation affects around 90% of kids, and there's usually no obvious medical explanation [18, 19]. In young children, functional constipation may manifest in a variety of ways, including uncomfortable stools that are difficult to pass and, in rare cases, fecal incontinence [19].

Methane production by methanogenic gut flora, which is high in constipation patients, has recently been shown to delay colonic transit [4]. Thus, administering *L. reuteri* decreases methane generation and speeds up gastrointestinal transit [20]. The beneficial effects of *L. reuteri* on chronic constipation are due, in part, to the fact that it stimulates the production of short-chain fatty acids (SCFA), decreases the level of gut intraluminal pH, increases colonic peristalsis, and modulates the frequency and velocity of colonic myoelectric cells [9].

According to the available data, *L. reuteri* did not change the consistency of stools in people with chronic constipation,

even if it helped enhance bowel movements [10].

A study by Indrio *et al.* found that *L. reuteri* helped reduce constipation in infants during the first three months of life [21]. The administration of lactobacilli may restore the natural composition of the gut microbiota after it has been disturbed by early life experiences, reducing visceral sensitivity and mucosal permeability [9]. Further clinical trials are needed to understand the processes by which *L. reuteri* modifies intestinal motility and relieves constipation in children, as has been recommended for by a number of researchers.

2.6.3. Regurgitation

Regurgitation is one of the most prevalent medical problems in infants. In newborns between the ages of 3 and 4 months, it affects almost half of them [22]. Supine posture, watery meals, and a weak gastroesophageal junction have all been cited as possible causes. Infant reflux is quite common, and therapy often consists of a few simple changes, including feeding the baby more slowly and having them sit upright after meals [23].

In babies with functional regurgitation, *L. reuteri* administration decreases the average daily number of episodes and increases stomach emptying [15]. Comparing the effects on stomach emptying rate and regurgitation frequency of partly hydrolyzed formula, 100% whey protein formula, a formula incorporating starch, and *L. reuteri* DSM 17938 was the focus of a double-blind RCT.

The number of regurgitations that occurred on a daily basis fell dramatically in the *L. reuteri* group compared to the control group. Additionally, the percentage change in stomach emptying rate was significantly larger in the *L. reuteri* DSM 17938 group compared to the placebo group [22]. Treatment with the probiotic *L. reuteri* has been shown in large multicenter, double-blind RCTs to enhance stomach motility in babies with gastroesophageal reflux, leading to fewer bouts of regurgitation [10, 22].

3. Discussion

The majority of research on probiotic strains pertaining to the treatment of digestive disorders in children has focused on *L. reuteri* [11, 25, 26]. The safety and effectiveness of *L. reuteri* in treating infantile colic in children aged 6 to 36 months was investigated. In the research, there were no reports of harm from its use [27]. D-lactic acid synthesis in healthy newborns who were given an *L. reuteri*-containing formula was tested in a randomized, double-blind, controlled safety experiment by Papagaroufalos *et al.* After two weeks, the findings showed that D-lactic acid levels did not rise after consuming a formula containing *L. reuteri* [28].

Evidence level 1 has been established for the use of *L. reuteri* DSM 17938 in the treatment of infantile colic by the World Gastroenterology Organization (WGO) and Latin American Experts. Moreover, there is data indicating that *L. reuteri* DSM 17938 efficiently lowers newborn colic in breastfed babies. Nonetheless, for babies who are formula-fed, no such suggestion exists [4]. Use of the probiotic *L. reuteri* DSM

17938 in breast-fed babies with colic has been recommended by the American Academy of Family Physicians with a level B recommendation [4]. Evidence from many research suggests that *L. reuteri* DSM 17938 may have a role in the treatment or prevention of a variety of clinical disorders.

Anti-inflammatory effects of probiotics were demonstrated by significant downregulation of TNF-, IL-6, toll-like receptor-4 (TLR-4), and NF-B and significant up-regulation of IL-10 in LPS-induced ileitis in rats, and this study looked at two strains of probiotics, *L. reuteri* DSM 17938 and ATCC PTA 4659. Previous discussion has shown that probiotics are anti-inflammatory and immunomodulatory agents (TNF-, IL-6, TLR-4, and NF-B are all indicators of the inflammatory condition, and IL-10 is a powerful anti-inflammatory cytokine) [7]. In mice with colitis, *L. reuteri* and other probiotics significantly decreased production of the inflammatory cytokine TNF- [78], which in turn decreased production of the anti-inflammatory IL-8 [9].

Similar results were seen in another investigation, which found that IL-10 null mice had much less *L. Sp.* Restoring healthy concentrations of this probiotic decreases colonic mucosal adherent, which in turn reduces colitis symptoms [8]. An unbalanced gut microbiome has been linked to a variety of pathogenic situations, including colic.

4. Conclusion

Infant colic is common, distressing, impacts adversely on maternal mental health, and is a risk factor for shaken baby syndrome. An effective, practical and acceptable intervention for infant colic would represent a major clinical and public health advance.

According to a number of studies, the probiotic strain *L. reuteri* has positive benefits on Infant colic. So, it's safe to say that *L. reuteri* is an essential component of a healthy gut microbiota. This probiotic has been shown to be safe, effective, and well tolerated in a number of clinical studies for use in the prevention and treatment of a wide range of gastrointestinal illnesses and the promotion of immunological modulation. In addition, *L. reuteri* supplementation has been shown to have no effect on the incidence of colic or other gastrointestinal diseases, according to the results of many experiments and published publications. Although *L. reuteri* has been shown to improve gut microbiota activities and interactions with other organ systems, further clinical research is needed to assess the short- and long-term effects of *L. reuteri* supplementation. Due to the strain specificity of *L. reuteri*'s probiotic effects, it may be beneficial to mix several strains of *L. reuteri* to increase their efficacy. The expansion of the use of this probiotic microbe in the treatment and prevention of illness will be fueled by the findings of future studies.

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