Infantile colic is defined as excessive crying in an otherwise healthy and thriving baby. The crying typically starts in the first few weeks of life and ends by 4–5 months of age. Colic is defined by the rule of three: crying that lasts at least 3 hours a day, for 3 days a week, and for at least 3 weeks in an otherwise healthy and well-fed infant.1

Clinical Presentation and Aetiology of Infantile Colic

The aetiology of infantile colic is not yet completely understood. Following are the various causes postulated for infantile colic:

Physiological Immaturity

Most of the physiological reasons proposed to be responsible for infantile colic are related to the gastrointestinal tract. Studies suggest that the increased intestinal permeability for macromolecules, such as human α-lactalbumin, is a sign of gut immaturity. The absorption of α-lactalbumin was found to be significantly higher in breastfed as well as formula-fed colicky infants, suggesting that the gut mucosa is affected in some manner in colicky infants. It is important to note that colic, which is considered to be gastrointestinal in origin, is not associated with any overt gut pathology. Some physiological differences between colicky and non-colicky infants have been reported, which are mainly related to hypococontractility of the gall bladder in colicky infants. Infantile colic has also been linked to immaturity of the central nervous system, although there is very little evidence to support this hypothesis.4

Lactose Intolerance

Some infants are unable to digest lactose because of the deficiency of the enzyme lactase in their intestine. Thus, a significant amount of undigested lactose may enter the infant colon, resulting in lactose intolerance. This undigested lactose acts as a substrate for the lactobacilli and bifidobacterial species to release hydrogen and lactic acid in the gut. The resultant hydrogen distends the colon and may result in pain, whereas the resultant lactic acid induces osmotic pressure that causes influx of water in the intestine and thereby gut enlargement. Therefore, carbohydrate malabsorption due to lactose intolerance may be one of the causes of colic in infants.2,4

Gut Hormones

A gut hormone called motilin affects gut function. It is hypothesised that motilin enhances gastric-emptying, which increases small-bowel peristalsis and decreases transit time, and may trigger colic in infants.1,2 Serotonin levels that peak in the evening cause intestinal cramps due to smooth muscle contraction. Melatonin has an opposite effect and causes smooth muscle contraction. Both serotonin and melatonin have a circadian rhythm. Serotonin’s circadian rhythm is present from birth, whereas melatonin’s circadian rhythm is evident only after 3 months of birth. The absence of melatonin’s circadian rhythm in the first 3 months for opposing serotonin’s rhythm may be a cause of colic in infants.2 Serum ghrelin levels were also found to be high in infants with colic. Ghrelin, the hunger hormone, may promote abnormal hyperperistalsis and increased appetite, which may lead to colic.2

Food Hypersensitivity

The role of diet as a cause of infantile colic still needs to be studied further to establish any association with infantile colic. Breastfed infants have incidences of colic similar to those of formula-fed infants. Eliminating allergens, such as cow’s milk protein, peanut, tree nut, soy, wheat,
fish, and so on, from the mother’s diet showed a significant reduction in crying and fussing time of the exclusively breastfed infants with colic.2

Psychosocial Factors

Maternal or parental anxiety or personality may be a cause of colic in infants. A frequently held view is that inexperienced and anxious parents, in particular mothers, may create an unfavourable environment, resulting in colic in infants.5 Poor mother–infant, father–infant, and dysfunctional interparental interactions may also be the cause of infantile colic.1,2

Gut Microbes

The gut of an infant is sterile at birth and colonisation occurs soon after birth. The type of colonising bacteria depends on the mode of delivery. Infants delivered by C-section lack faecal colonisation by Bifidobacteria and Lactobacillus just after delivery. The gut of infants born vaginally is colonised with Lactobacillus, Atopobium, Prevotella, and Sneathia species, which are absent in the gut of infants born via C-section delivery. Insufficiency of lactobacilli and high levels of coliforms in the immature gut can affect fermentation, which consequently leads to excessive intra-intestinal gas production, resulting in colic.2

The composition of gut microbiota has been associated with crying and fussing during early infancy. Infants with colic showed altered intestinal fatty-acid profile; decreased number of lactobacilli; increased anaerobic Gram-negative and coliform bacteria; and increased faecal calprotectin levels (calcium-binding protein produced by immune cells that is a marker of intestinal inflammation in faecal cells). The proportion of Bifidobacteria and Lactobacillus spp. was inversely associated with infant distress due to colic. These data suggest that the gut microflora has an important association with infantile colic, and altering the gut microbiota in a healthy way may resolve colic in infants.6 The clinical presentations of infantile colic are listed in Table 1.

Management of Infantile Colic

Infantile colic is a benign condition; educating parents about the self-limiting nature of colic and offering timely support are thus essential. Apart from this, behavioural modification therapies, dietary modification (probiotics), and medications have successfully been used in the management of infantile colic.7

Behavioural Modification Therapies

A behavioural modification therapy mainly involves counselling the parents about the normal crying pattern of the infants and training them on various infant-calming techniques, such as the 5s technique (includes swaddling, side/stomach, Shh-sound, Swinging the baby with tiny jiggly movements, and letting the baby suckle on a pacifier). Parental counselling has been found to be more effective than dietary modification techniques in colicky infants.8

Probiotics

Gut microbiota is a major determinant of intestinal health. Probiotics are live microorganisms that confer a health benefit when administered in adequate amounts. Various studies have shown the efficacy of certain probiotics in treating infantile colic.8

A systematic review reported data from three randomised controlled trials that included 209 exclusively breastfed infants. All the three clinical trials utilised Lactobacillus reuteri (55730 or DSM 17938) with identical daily doses. These results suggested that after 7 days of initiation of treatment, the probiotic group showed a significant decrease in crying time. Probiotics decreased crying time by almost an hour. A progressive, statistically significant overall response rate was noted starting at 7 days and was
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maximum at 21 days in the probiotic group. The benefit of addition of *L. reuteri* in the treatment group continued even after stopping it. The overall response rate of *L. reuteri* group was more pronounced than the placebo group. Another systematic review with trials using reduction in fussing and crying time as endpoint suggested two- to three-fold greater chances of 50% reduction in the crying or fussing time in infants receiving probiotics as compared with control subjects. A study by Savino et al. administered *L. reuteri* DSM 17938 at a dose of 108 colony-forming units per day to 50 exclusively breastfed infants with colic. The results showed that the treatment was safe, well tolerated, and improved the symptoms of infantile colic.

*L. reuteri* DSM 17938 is recognised by the Food and Drug Administration as ‘Generally Recognized as Safe (GRAS)’. Daily administration of *L. reuteri* 17989 early in life lowered the reported incidence of inconsolable crying (symptom of infantile colic), regurgitation, and functional constipation at the end of 3 months of life and beyond.

**Medications**

Some of the agents, such as dicyclomine hydrochloride, cimetropium bromide, simethicone, sucrose, and herbal medications, have been used in the management of colic. However, a recent Cochrane review suggested that no recommendations can be made on the pain-relieving efficacy of these agents for the treatment of colic. Use of gripe water is one of the common methods followed in India for the management of colic. However, gripe water has no proven health benefits.

**Conclusion**

Infantile colic is a self-limiting and benign process in which the infant has episodes of inconsolable crying. It peaks at around 6 weeks of age and resolves by 3–6 months. The exact cause of infantile colic is not clear; however, various reasons for infantile colic have been postulated. The composition of gut microbiota is strongly associated with fussing and crying time of infantile colic. Administration of probiotics, especially *L. reuteri*, alters the gut microbiota and has been shown to be effective in treating infantile colic.

**References**