Pediatr Gastroenterol Hepatol Nutr. 2022 May;25(3):276-282
https://doi.org/10.5223/pghn.2022.25.3.276
pISSN 2234-8646·eISSN 2234-8840

Pediatric Gastroenterology, Hepatology & Nutrition
pghn

Original Article

Check for updates

# Incidence and Associated Factors of Infantile Colic in Thai Infants

**Kamonnan Suklert and Nopaorn Phavichitr**

Department of Pediatrics, Phramongkutklao Hospital, Bangkok, Thailand

OPEN ACCESS

**Received:** May 20, 2021
**1st Revised:** Jul 13, 2021
**2nd Revised:** Sep 27, 2021
**Accepted:** Oct 21, 2021
**Published online:** May 9, 2022

**Correspondence to**
**Nopaorn Phavichitr**
Department of Pediatrics, Phramongkutklao Hospital, Ratchawithi Road, Bangkok 10400, Thailand.
Email: nopaorn@hotmail.com



**ORCID iDs**
Kamonnan Suklert
https://orcid.org/0000-0001-5543-0620
Nopaorn Phavichitr
https://orcid.org/0000-0002-3940-1456

**Conflict of Interest**
The authors have no financial conflicts of interest.

## ABSTRACT

**Purpose:** Infantile colic, a common functional gastrointestinal condition, causes distress and frustration in families. Its prevalence and incidence vary from community to community. The purpose of our study was to demonstrate the incidence of and factors associated with infantile colic in Thai infants.
**Methods:** We conducted a prospective analytic study to explore the incidence and factors associated with infantile colic in 386 Thai infants aged between one month and six months. Caregivers were interviewed using a questionnaire about infants' symptoms of colic based on the definition from the Rome IV criteria. Family background and potential precipitating factors of colic were also evaluated.
**Results:** The incidence of colic in infants younger than 6 months was 6.5%. All infants' colic started within 12 weeks of life and lasted approximately 6 weeks. Sex, gestational age, birth weight, delivery route, birth order, family factors, and parental factors were not correlated with the occurrence of colic. Infants who were exclusively breastfed for the first 2 months of life had a lower incidence of infantile colic than those who were mixed- or formula-fed (odds ratio=3.0; 95% confidence intervals=1.3 to 7.2).
**Conclusion:** The incidence of infantile colic in Thai infants in our study was 6.5%, which is similar to that in other reports. Being exclusively breastfed for the first two months was the only risk factor in our cohort.

**Keywords:** Colic; Incidence; Associated factor

## INTRODUCTION

Infantile colic (IC) is one of the most common functional gastrointestinal disorders in infants up to five months of age. The estimated prevalence of IC in the community is 5–19% [1,2]. Owing to the nature of unexplained crying, it causes enormous concern and stress in caregivers. The Rome IV committee defines the diagnostic criteria for IC as recurrent and prolonged inconsolable crying or fussing without a significant cause in healthy and well-thrived infants younger than five months [2]. Although IC is a self-limited and benign condition, the exact etiology remains unknown and is multifactorial, possibly involving alterations in the gastrointestinal tract, gut microbiota, hormones, neurological and psychosocial development, and cow's milk protein allergy [3]. Many therapies, including

pharmacological and behavioral interventions, have been reported; however, they are generally not scientific and show obscure results [3,4]. There is limited evidence that using hydrolyzed protein formulas in formula-fed infants or maternal diet restriction in breastfed infants decreases crying time, but most studies have limitations in methodology and further research is needed [4]. In addition, recent systematic reviews have found evidence of probiotic use, particularly *Lactobacillus reuteri* in the treatment of IC in breastfed infants [5,6].

Although IC is a self-resolving condition, persistent crying causes stress, frustration in the family, and unnecessary medical visits [7]. Parental reassurance remains the core management of IC. Most research data on IC are from developed countries, whereas there are very few data from developing countries [8]. There is a report of 20% colic incidence and an increased risk of IC in first-born babies in Iran [8]. In addition, an incidence of 16.3% and a higher risk of IC in non-breastfed infants have been reported in Brazil [9]. Different cultures and psychosocial factors can affect the incidence of IC; therefore, caregivers in different countries may respond differently to their infants. As data on the incidence of IC in Thai infants are scarce, our primary objective was to evaluate the incidence of IC in Thai infants. The secondary objective was to identify factors associated with inconsolable crying and compare family factors between colic and non-colic infants.

## MATERIALS AND METHODS

This study was a prospective analytic survey approved by the Royal Thai Army Medical Department Institutional Review Board (IRBRTA 893/2562). This study was conducted at the Department of Pediatrics, Phramongkutklao Hospital, Thailand, from July 2019 to October 2020. In our study, IC was defined according to the Rome IV criteria as recurrent and prolonged inconsolable crying or fussing without a significant cause in healthy and well-thrived infants younger than five months of age that lasts ≥ three hours/day for at least three days in a week [2]. Newborn infants delivered at our hospital were invited to participate in the study in postpartum wards. They were informed of the objectives of the study and provided their consent prior to data collection. A questionnaire based on the Rome IV criteria was used to assess IC by phone interview with the caregiver at the age of one, two, and four months. Infants who had colic required another interview at six months of age. Demographic data, family background, and potential precipitating factors of IC [2,3] (such as parental age, parental occupation, parental smoking, marital status, family income, number of caregivers, type of infant feeding, infant illness, and concomitant drug usage) were also explored in the questionnaire. Regarding economic status, we used an income of 30,000 THB per month as the appropriate income cut-off point, as per a report by the National Statistical Office of Thailand, which indicates that the family expenditure in Bangkok is around 32,052 THB per month [10]. The questionnaire was validated in 10 infants aged 1–2 months by face-to-face interviews with the parents at the pediatric outpatient clinic of Phramongkutklao Hospital before use, in accordance with the diagnosis. Infants with congenital anomalies or a history of gastrointestinal, hepatobiliary, cardiovascular, pulmonary, genitourinary, and/or neurological diseases were not eligible for enrollment in the study.

### Statistical analysis

Based on results from a previous study sharing a colic incidence of 16.3% [9], the calculated sample size for this study was 388 participants, which yielded a confidence level of 95%, 80% power with 4% acceptable error, and an expected 20% dropout. Descriptive data are

Pediatric Gastroenterology, Hepatology & Nutrition pghn

presented as mean, standard deviation, and percentage. Chi-square and Fisher's exact tests were used to test the differences in the proportion of the associated factors or potential precipitating factors for IC between the groups. Factors that had the potential to be risk factors for IC were tested using logistic regression analysis to determine the odds ratio (OR). The OR is also presented with a 95% confidence intervals (95% CI) and *p*-values. The accepted level of the alpha error was ≤ 0.05.

## RESULTS

A total of 424 newborns were enrolled in the study but only 386 infants completed the study. According to the Rome IV diagnostic criteria for IC for clinical research purposes, we found colic in 25 infants (6.5%). However, according to the diagnostic criteria for the clinical purpose of IC, the incidence of prolonged crying or fussing causing caregivers' concerns was reported to be slightly higher (31 infants, 8.0%). All infants started the first symptom of excessive inconsolable crying of IC within 12 weeks of life, with the peak of onset at the age of 4 weeks (11 of 25, 44%) (**Fig. 1**). We found that 76% and 88% of infants started prolonged crying within 6 and 8 weeks of life, respectively, and achieved resolutions of 76% and 92% within 12 and 16 weeks of life, respectively (**Fig. 2**). The mean crying was 6.1 weeks. At 24

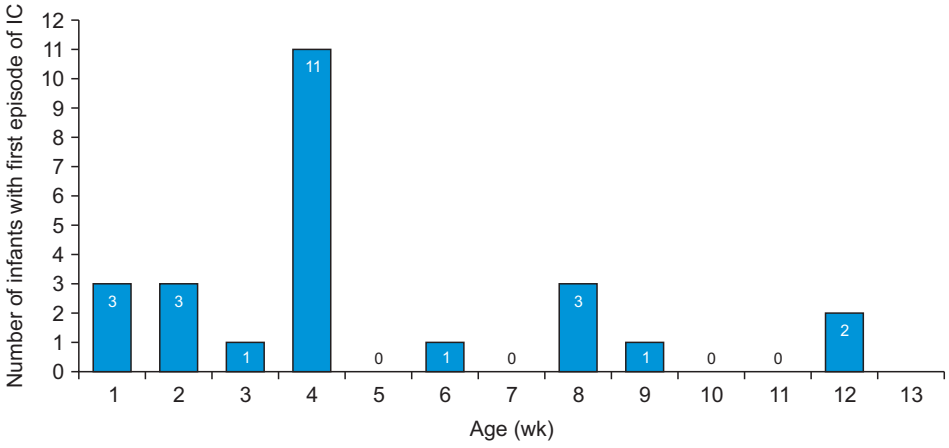


**Fig. 1.** Onset of infantile colic (IC) according to age of infants.

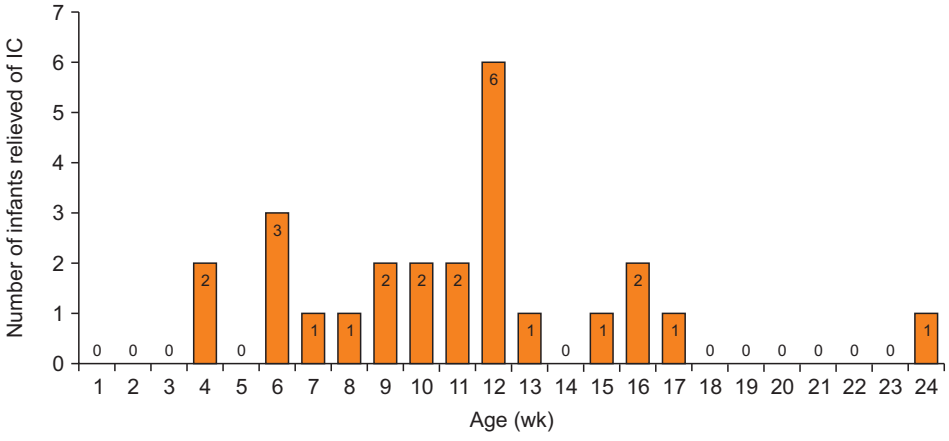


**Fig. 2.** Age of infants with resolution of infantile colic (IC).


https://doi.org/10.5223/pghn.2022.25.3.276

weeks of age, colic stopped in all the infants in the cohort. The demographic data of the comparison groups are presented in **Table 1**. Sex, gestational age, birth weight, birth order, route of delivery, parental age, parental smoking, parental income, level of parental education, marital status, and number of caregivers were comparable between the groups. Mothers who worked for the government or state enterprises tended to have more infants with IC, albeit not significantly, after multivariate analysis. Enrolled infants had exclusive breastfeeding at 1, 2, and 4 months of age (67.4%, 63.2%, and 57.5%, respectively). There was no difference in exclusive breastfeeding between the groups in the first month, but not in the second month of age. Infants who were mixed- or formula-fed had a higher incidence of IC than those who were exclusively breastfed for the first two months (adjusted OR=3.0, 95% CI=1.3 to 7.2, $p$=0.012).

Apart from excessive crying and fussing, infants with IC showed no difference in episodes of daily regurgitation and frequency of defecation compared with normal infants. In addition, infants with IC reported no other illnesses or use of concomitant drugs or special formulas. Infants in both groups thrived well. Other factors associated with the OR are shown in **Table 2**.

**Table 1.** Demographic characteristics in the comparison group

| Characteristic | Non-colic group (n=361) | Colic group (n=25) | $p$-value |
|---|---|---|---|
| Sex, male | 201 (55.7) | 11 (44.0) | 0.255 |
| Gestational age (wk) | 38.9±1.1 | 38.6±1.2 | 0.266 |
| Birth weight (g) | 3,087.7±640.6 | 3,090.3±347.1 | 0.659 |
| Route of delivery | | | 0.074 |
| Vaginal delivery | 237 (65.7) | 12 (48.0) | |
| Cesarean section | 124 (34.3) | 13 (52.0) | |
| Exclusive breastfeeding (mo) | | | |
| 0–1 | 246 (68.1) | 14 (56.0) | 0.210 |
| 0–2 | 234 (64.8) | 10 (40.0) | 0.013* |
| 0–4 | 212 (58.7) | 10 (40.0) | 0.075 |
| Birth order | | | 0.202 |
| First order | 228 (63.2) | 19 (76.0) | |
| Second order or more | 133 (36.8) | 6 (24.0) | |
| No. of caregivers | (n=355) | | 0.661 |
| One person | 158 (44.5) | 10 (40.0) | |
| Two persons or more | 197 (55.5) | 15 (60.0) | |
| Paternal age (y) | 31.2±6.1 | 31.9±7.0 | 0.884 |
| Maternal age (y) | 29.7±5.7 | 31.1±6.0 | 0.321 |
| Levels of paternal education | (n=348) | | 0.137 |
| Under college education | 206 (59.2) | 11 (44.0) | |
| College education or above | 142 (40.8) | 14 (56.0) | |
| Levels of maternal education | (n=354) | | 0.362 |
| Under college education | 175 (49.4) | 10 (40.0) | |
| College education or above | 179 (50.6) | 15 (60.0) | |
| Paternal occupation | (n=350) | | 0.090 |
| Non-government | 227 (64.9) | 12 (48.0) | |
| Government | 123 (35.1) | 13 (52.0) | |
| Maternal occupation | (n=354) | | 0.029* |
| Non-government | 279 (78.8) | 15 (60.0) | |
| Government | 75 (21.2) | 10 (40.0) | |
| Paternal smoking | 86/354 (24.3) | 6 (24.0) | 0.974 |
| Maternal smoking | 1/356 (0.3) | 0 (0.0) | 0.791 |
| Maternal marital status | (n=354) | | 0.805 |
| Married | 343 (96.9) | 24 (96.0) | |
| Divorced/separated | 11 (3.1) | 1 (4.0) | |
| Family income >30,000 THB/month† | 241/352 (68.3) | 18 (72.0) | 0.698 |

Values are presented as number (%) or mean±standard deviation.
*$p$≤0.05. †1 USD=32.60 THB.


https://doi.org/10.5223/pghn.2022.25.3.276

**Table 2.** Associated factors of infantile colic and odds ratio in the comparison group

| Factor | Non-colic group | Colic group (n=25) | Crude odds ratio (95% CI) | *p*-value | Adjusted odds ratio‡ (95% CI) | *p*-value |
|---|---|---|---|---|---|---|
| Cesarean delivery | 124/361 (34.3) | 13 (52.0) | 2.1 (0.9–4.7) | 0.080 | 1.8 (0.8–4.3) | 0.161 |
| Paternal smoking | 86/354 (24.3) | 6 (24.0) | 1.0 (0.4–2.5) | 0.967 | 1.0 (0.3–3.1) | 0.956 |
| Mixed- or formula feeding for the first 2 months | 127/361 (35.2) | 15 (60.0) | 2.8 (1.2–6.3) | 0.016* | 3.0 (1.3–7.2) | 0.012* |
| Paternal government employment | 123/350 (35.1) | 13 (52.0) | 2.0 (0.9–4.6) | 0.092 | 1.8 (0.7–4.7) | 0.243 |
| Maternal government employment | 75/354 (21.2) | 10 (40.0) | 2.5 (1.1–5.7) | 0.035* | 2.0 (0.7–5.3) | 0.182 |
| Family income >30,000 THB/month† | 241/353 (68.3) | 18 (72.0) | 1.2 (0.5–3.0) | 0.692 | 0.7 (0.2–2.2) | 0.566 |
| Being first child | 228/361 (63.1) | 19 (76.0) | 1.8 (0.7–4.7) | 0.202 | 1.8 (0.7–5.0) | 0.232 |
| Single caregiver | 158/355 (44.5) | 10 (40.0) | 1.2 (0.5–2.8) | 0.661 | 0.9 (0.4–2.0) | 0.731 |

Values are presented as number (%).
CI: confidence interval.
*$p \leq 0.05$. †1 USD=32.60 THB. ‡Adjusted for route of delivery, paternal smoking, type of feeding, parental occupation, family income, birth order, and number of caregivers.

## DISCUSSION

Existing reports have different methodologies to determine the prevalence or incidence of IC in the population, ranging from prospective, cross-sectional, to retrospective studies [1,11]. Our study was a prospective survey to explore the incidence of IC in infants from one month to six months of age.

The incidence of IC in our study was 6.5%, which is in the range of the estimated prevalence (5–19%) in previous studies [1]. However, due to the different definitions used (Wessel's, Rome III, or Rome IV criteria) and parental report data in other published studies, a wide range of the prevalence of IC in the community has been reported to be between 2 and 73% [11,12]. A worldwide survey estimated the prevalence of IC to be approximately 20% [11]. A cross-sectional, population-based study in the US using the Rome III criteria reported a prevalence of 6%, which is similar to our study [13]. Reports from developing countries, mostly using Wessel's criteria, showed a higher prevalence than in our study [8,9]. This variation may be influenced by many factors, such as criteria used to diagnose IC [2,12,14,15], caregivers' perceptions and concerns [2], and the lifestyle or culture of the community. In Thailand, most families are extended families with grandparents supporting young parents, which might be one factor influencing the perception of colic. Focusing on caregivers' distress or concern regarding prolonged crying, our study found a slightly higher incidence (8%) compared to 6.5% for the use of crying as one of the criteria. The majority of colic crying usually starts in the first 6 weeks of life, with the peak of crying at 6-8 weeks of age, and usually improves or resolves by 10–12 weeks of age [16,17]. In our study, the peak onset of IC occurred at 4 weeks of age, 76% occurred within 6 weeks, and 76% resolved within 12 weeks of age.

The exact pathogenesis of colic remains unclear, and may be multifactorial. It is a functional disorder; however, complete history taking and physical examination are essential to exclude other organic causes of infant crying and fussing. Theoretically, there is no clear association between colic and sex, gestational age, breastfeeding, or socioeconomic status [18]. Psychological stress during pregnancy [19], especially during the first pregnancy [20], has been reported to be associated with mild gastrointestinal disease and IC. Prenatal and postnatal maternal depression may correlate with the occurrence of difficult temperament and colic in infants [21]. Maternal stress and emotion were not explored in this study, but we found no correlation between IC and birth order, number of caregivers, family income, parental occupation, or marital status. Family background appeared to have no influence on

colic development in our study. Maternal smoking is hypothesized to be a risk factor for IC [22,23], but our data are discordant with this hypothesis. Another suggested risk factor for IC is alteration of the gut microbiota, causing intestinal inflammation and dysbiosis [24]. The mode of delivery and type of feeding strongly affect the development of a healthy gut microbiome, although there has been no evidence to support differences in colic prevalence in vaginal compared to cesarean delivery and breastfed infants compared to non-breastfed infants [25]. We did not find an association between IC and route of birth. In contrast, exclusive breastfeeding for the first two months seemed to be associated with less colic in our study. Infants who were not exclusively breastfed for two months had a significantly higher prevalence of colic. This discrepancy in the association between breastfeeding and other studies may be due to the multifactorial nature of the development of IC. In addition, maternal-infant bonding in breastfed infants may have created a bias regarding the reporting of infants' crying. Most of the IC in our study (92%) were resolved by the age of 4 months. However, this inconsolable crying still has an impact on family concerns, quality of life of parents and infants, and medical expenses [26]. A very large study with a larger sample size from different regions of the world may signify the associated or precipitating factors of IC and provide a better understanding of the pathogenesis and better care for these infants.

In conclusion, IC was found in Thai infants with an incidence of 6.5% in our prospective study. Family background, parental factors, socioeconomic status, mode of delivery, and birth order had no influence on the occurrence. According to our study, being exclusively breastfed for the first two months of life was a potential protective factor against colic.

## REFERENCES

1. Lucassen PL, Assendelft WJ, van Eijk JT, Gubbels JW, Douwes AC, van Geldrop WJ. Systematic review of the occurrence of infantile colic in the community. Arch Dis Child 2001;84:398-403.
PUBMED | CROSSREF
2. Benninga MA, Faure C, Hyman PE, St James Roberts I, Schechter NL, Nurko S. Childhood functional gastrointestinal disorders: neonate/toddler. Gastroenterology 2016;150:1443-55.e2.
PUBMED | CROSSREF
3. Mai T, Fatheree NY, Gleason W, Liu Y, Rhoads JM. Infantile colic: new insights into an old problem. Gastroenterol Clin North Am 2018;47:829-44.
PUBMED | CROSSREF
4. Hall B, Chesters J, Robinson A. Infantile colic: a systematic review of medical and conventional therapies. J Paediatr Child Health 2012;48:128-37.
PUBMED | CROSSREF
5. Ellwood J, Draper-Rodi J, Carnes D. Comparison of common interventions for the treatment of infantile colic: a systematic review of reviews and guidelines. BMJ Open 2020;10:e035405.
PUBMED | CROSSREF
6. Ong TG, Gordon M, Banks SS, Thomas MR, Akobeng AK. Probiotics to prevent infantile colic. Cochrane Database Syst Rev 2019.3:CD012473.
PUBMED | CROSSREF
7. Daelemans S, Peeters L, Hauser B, Vandenplas Y. Recent advances in understanding and managing infantile colic. F1000 Res 2018;7:F1000 Faculty Rev-1426.
PUBMED | CROSSREF
8. Talachian E, Bidari A, Rezaie MH. Incidence and risk factors for infantile colic in Iranian infants. World J Gastroenterol 2008;14:4662-6.
PUBMED | CROSSREF
9. Saavedra MA, da Costa JS, Garcias G, Horta BL, Tomasi E, Mendonça R. [Infantile colic incidence and associated risk factors: a cohort study]. J Pediatr (Rio J) 2003;79:115-22. Portuguese.
PUBMED | CROSSREF

10. National Statistical Office of Thailand. Family expenditure in Bangkok 2020 [Internet]. Bangkok: National Statistical Office of Thailand; [cited 2021 Sep 20]. Available from: http://statbbi.nso.go.th/staticreport/page/sector/th/08.aspx
11. Vandenplas Y, Abkari A, Bellaiche M, Benninga M, Chouraqui JP, Çokura F, et al. Prevalence and health outcomes of functional gastrointestinal symptoms in infants from birth to 12 months of age. J Pediatr Gastroenterol Nutr 2015;61:531-7. Erratum in: J Pediatr Gastroenterol Nutr 2016;62:516.
PUBMED | CROSSREF
12. Zeevenhooven J, Koppen IJ, Benninga MA. The New Rome IV criteria for functional gastrointestinal disorders in infants and toddlers. Pediatr Gastroenterol Hepatol Nutr 2017;20:1-13.
PUBMED | CROSSREF
13. van Tilburg MA, Hyman PE, Walker L, Rouster A, Palsson OS, Kim SM, et al. Prevalence of functional gastrointestinal disorders in infants and toddlers. J Pediatr 2015;166:684-9.
PUBMED | CROSSREF
14. Wessel MA, Cobb JC, Jackson EB, Harris GS Jr, Detwiler AC. Paroxysmal fussing in infancy, sometimes called colic. Pediatrics 1954;14:421-35.
PUBMED | CROSSREF
15. Hyman PE, Milla PJ, Benninga MA, Davidson GP, Fleisher DF, Taminiau J. Childhood functional gastrointestinal disorders: neonate/toddler. Gastroenterology 2006;130:1519-26.
PUBMED | CROSSREF
16. Lam TML, Chan PC, Goh LH. Approach to infantile colic in primary care. Singapore Med J 2019;60:12-6.
PUBMED | CROSSREF
17. Wolke D, Bilgin A, Samara M. Systematic review and meta-analysis: fussing and crying durations and prevalence of colic in infants. J Pediatr 2017;185:55-61.e4.
PUBMED | CROSSREF
18. Johnson JD, Cocker K, Chang E. Infantile colic: recognition and treatment. Am Fam Physician 2015.92:577-82.
PUBMED
19. Rautava P, Helenius H, Lehtonen L. Psychosocial predisposing factors for infantile colic. BMJ 1993;307:600-4.
PUBMED | CROSSREF
20. Phelan AL, DiBenedetto MR, Paul IM, Zhu J, Kjerulff KH. Psychosocial stress during first pregnancy predicts infant health outcomes in the first postnatal year. Matern Child Health J 2015;19:2587-97.
PUBMED | CROSSREF
21. Bang KS, Lee I, Kim S, Yi Y, Huh I, Jang SY, et al. Relation between mother's *taekyo*, prenatal and postpartum depression, and infant's temperament and colic: a longitudinal prospective approach. Int J Environ Res Public Health 2020;17:7691.
PUBMED | CROSSREF
22. Canivet CA, Ostergren PO, Jakobsson IL, Dejin-Karlsson E, Hagander BM. Infantile colic, maternal smoking and infant feeding at 5 weeks of age. Scand J Public Health 2008;36:284-91.
PUBMED | CROSSREF
23. Shenassa ED, Brown MJ. Maternal smoking and infantile gastrointestinal dysregulation: the case of colic. Pediatrics 2004;114:e497-505.
PUBMED | CROSSREF
24. Rhoads JM, Collins J, Fatheree NY, Hashmi SS, Taylor CM, Luo M, et al. Infant colic represents gut inflammation and dysbiosis. J Pediatr 2018;203:55-61.e3.
PUBMED | CROSSREF
25. Camilleri M, Park SY, Scarpato E, Staiano A. Exploring hypotheses and rationale for causes of infantile colic. Neurogastroenterol Motil 2017;29:10.1111/nmo.12943.
PUBMED | CROSSREF
26. Vandenplas Y, Hauser B, Salvatore S. Functional gastrointestinal disorders in infancy: impact on the health of the infant and family. Pediatr Gastroenterol Hepatol Nutr 2019;22:207-16.
PUBMED | CROSSREF