

Original Article



Incidence and Associated Factors of Infantile Colic in Thai Infants

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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 \geq 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

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

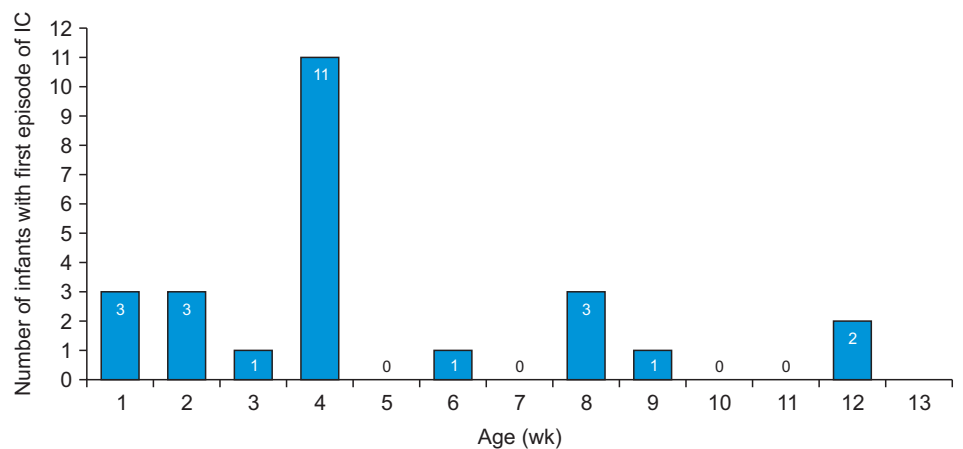


Fig. 1. Onset of infantile colic (IC) according to age of infants.

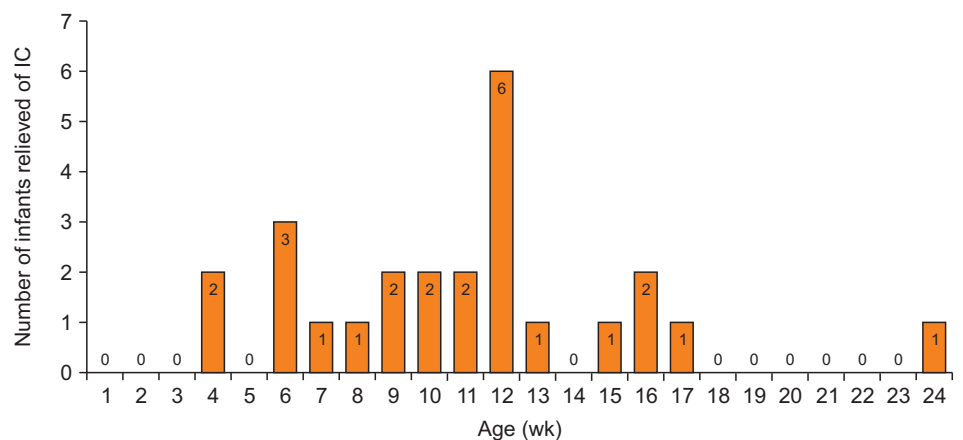


Fig. 2. Age of infants with resolution of infantile colic (IC).

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.

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.

* $p < 0.05$. [†]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.

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