

Full Length Research Paper

Crying newborns: The colic and reflux situation in New Zealand as depicted by online questionnaire

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Infantile colic is prevalent among newborns and typically defined in terms of repeated bouts of inconsolable crying occurring several days of the week. There appears no universal cause for colic and none of the multifarious behavioural, dietary and pharmaceutical treatments are of benefit in all cases. This study collected data from 154 New Zealand parents with colicky and reflux infants by online questionnaire. Male and female infants were represented approximately equally in the sample, and respondents consisted of parents who breast fed and bottle fed, and considered themselves demand or routine baby feeders. Feeding frequency ranged from 5 to 14 sessions per day, and there was a weak, but significant, relationship between frequency of crying bouts and daily feeds. Almost 90% of newborns had started colicky behaviours by one month of age and although colic is often thought to settle naturally by 3 to 4 months, 24% of children had not resolved by 11 months. Behavioural interventions (example, burping; cranial massage; baby massage), natural products (example, herbal teas) and over the counter remedies (example, gripe water; colic powders) stopped colic completely in very few infants (< 3%), although most treatments improved the situation for some children. Prescription drugs (example, ranitidine; omeprazole) were perceived to be more efficient, with 23% of parents indicating that colicky behaviour had ceased, and 82% indicating these treatments were helpful. One note of concern is that over half of the parents that had given their child prescription medicines had increased the dosage over time. Respondents indicated that antenatal/pregnancy classes did not provide adequate education in topics such as winding babies, colic, reflux, and irregular sleeping patterns in newborns. The results of the survey reinforce a need for pre-natal education about the prevalence of these excessive crying behaviours in infants and which interventions could be attempted immediately.

Key words: Ante-natal education, colic, crying, gastro-oesophageal reflux, feeding, herbal remedies, wind.

INTRODUCTION

Various reports indicate that around 10 to 25% of newborns suffer from infantile colic at some stage, with 90% of cases occurring in the first month of life (Long, 2001; Roberts et al., 2004). Colicky behaviours appear

to peak at around one month to six weeks of age, and then decline in frequency and intensity, usually resolving naturally by 3 to 4 months of age (Garrison and Christakis, 2000; Lucassen et al., 2001; Totterdell, 2011;

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Sanghavi, 2005; Perry et al., 2011).

The crying of newborns is an important component of the development of the communication 'dialogue' between child and carer (Acebo and Thoman, 1995; Cecchini et al., 2007). Infantile colic involves crying behaviour that is persistent and excessive, generally being described as involving bouts of unexplained, intense and inconsolable crying in otherwise healthy infants (Wessell et al., 1954; Reijneveld et al., 2001).

The crying bouts usually occur multiple times a day, on several (or most) days of the week, and are often associated with other behaviours, for example irritability, reflux, indications of pain, and difficulty sleeping (Keller et al., 1990). In addition to the suffering experienced by the newborn, colic often results in a suite of negative emotions in the parents (and other family members), such as stress, despair and helplessness, in addition to the weariness which results from sleep deprivation (Kirkland, 1985; Sanghavi, 2005; Kurth et al., 2011).

The aetiology of infantile colic is often unclear, with suggested causal factors including a lack of development of the digestive system, gut inflammation, build-up of gas and over feeding (Woolridge and Fisher, 1988; Totterdell, 2001; Canivet et al., 2008; Iacovou et al., 2012). The situation can be further complicated by infants which exhibit the intensive crying associated with colic also showing behaviours associated with gastro-oesophageal reflux (GOR), such as spilling and regurgitating of milk, with either condition possibly causing the manifestation of the other (Van and Storms, 2010; Hassall, 2012; Hudson et al., 2012). Thus newborn diet is often an initial point of focus, with both adverse reactions to breast milk and to dairy-based formulae being associated with colic and reflux in some cases (Clifford et al., 2002; Leung and Lemay, 2004; Critch, 2011; Iacovou et al., 2012). Parents with colicky infants are faced with a wide range of treatments, from dietary modifications and behavioural interventions, and from natural or herbal remedies to potent prescription drugs (Lucassen et al., 1998; Dobson et al., 2012; Hall et al., 2012; Cowie, 2013). Studies into the treatment of excessive infant crying are numerous, but few treatments appear to work in all cases, and conclusions drawn from empirical investigations are often confounded by the studies being performed during the period when the infants were likely to improve naturally (Roberts et al., 2004; Sanghavi, 2005).

Many behavioural interventions, such as the use of a pacifier, swaddling, carrying, and decreased stimuli, can be adopted immediately but appear to only sometimes alleviate symptoms (Huhtala et al., 2000; Garrison and Christakis, 2000; Hyodynmaa and Tammela, 2005; Van et al., 2006; Dobson et al., 2012). Dietary modifications are some of the most commonly prescribed (and undertaken) interventions, as they are low risk and can be offered to mothers immediately. The replacement of dairy-based formulae with hydrolysed infant formula has been shown to be effective in some, but not all, cases.

Similarly, modifying the maternal diet to in order to avoid introducing allergens or specific 'elicitors' into breast milk, has also been demonstrated to reduce colicky behaviour (Garrison and Christakis, 2000; Critch, 2011; Iacovou et al., 2012).

Over the counter remedies, such as simethicone, various 'gripe water' tonics, and targeted preparations such as 'colic drops' and mixtures, are popular as they are easily acquired and obtained without need of a medical consultation (Lucassen et al., 1998; Roberts et al., 2004; Perry et al., 2011.) Various complementary and alternative medicines (CAM), for example chiropractic treatment (Alcantara et al., 2011; Miller et al., 2012), acupuncture (Cakmak, 2011), body and cranial massage (Huhtala et al., 2000; Arikan et al., 2008), probiotics (Sung et al., 2014) and herbal teas (Wiezman et al., 1993; Savino et al., 2005; Arikan et al., 2008), have also been reported to reduce colic, although rarely with any consistency (Lucassen et al., 1998; Roberts et al., 2004; Perry et al., 2011).

The necessity of using prescription medicines to treat colic and GOR in newborns is debated, with their use being more of a response to the anxiety and mental state of the parents as opposed to the prognosis of the newborn (Hassall, 2012; Hudson et al., 2012). Various reports indicate that increasing numbers of newborns are being prescribed strong antacid drugs (example, Prilosec), histamine antagonists (example, ranitidine) and proton pump inhibitors (PPIs; example, omeprazole) for symptoms associated with GOR and colic (Sanghavi, 2005; Van and Storms, 2010; Hassall, 2012). In 2013 omeprazole was the third most commonly dispensed medicine in New Zealand. Between 2006 and 2010 the number of prescriptions dispensed for newborns increased from 4650 to 8231. The largest occurred in the age zero to three months (111%) and four to six months (80%) cohorts. This increase despite a lack of evidence to support the prescribing of omeprazole to infants for symptoms such as irritability and regurgitation associated with uncomplicated reflux (BPAC 2011; 2014). Hassall (2012) suggested that this increase in the use of PPIs for colic and reflux may be related to an increase in the use of the term *acid reflux*, even though spilling of milk in infantile reflux is primarily due to over-filling of the stomach, and there is actually little evidence that acid plays a role in most cases. Indeed, a number of studies indicate the use of such drugs results in a wide range of adverse side effects, such as higher incidence of gastroenteritis, pneumonia and respiratory tract infections (Hassall, 2012; Hudson et al., 2012).

Apart from the work of Hudson et al. (2012), there appears to have been little previous research into colic, reflux and excessive crying in New Zealand. Kirkland (1982; 1985) summarized the findings of a postal survey of 450 New Zealand parents with excessively crying offspring, a study that was organized by New Zealand Woman's Weekly magazine in the early 1980s (J. Kirkland

pers. comm.). Kirkland described a situation where 75% of babies began excessive crying within three weeks of age and 25% were still crying at 9 months of age. Around 30% of mothers thought that the cause of the crying was likely to be related to wind, and 10% due to oversupply of milk (Kirkland, 1985).

The aim of the current investigation was to obtain more recent information on the experiences of New Zealand parents whose newborns showed colic, reflux or excessive crying by using an online questionnaire. Data were obtained on feeding behaviour, the extent of colicky behaviour, and the use and perceived benefit of a range of behavioural interventions, natural and 'over-the-counter' remedies and prescribed medicines.

METHODOLOGY

Survey

The questionnaire was active from 1st August to 1st December, 2012 and was accessible at the website www.naturalwinding.co.nz. The survey was advertised throughout New Zealand on radio stations, in newspapers and in parenting magazines (Example, Kiwi Parent, Little Treasures, Good, Kiwi Families and Family Times). Fliers advertising the survey were distributed to play centres and parenting groups. The survey was open to any parent whose child was displaying excessive crying and/or colicky behaviour patterns (with a list of these behaviours on the fore said website so parents could ascertain applicability) or diagnosed by a health professional (midwife, GP, paediatrician etc.). No parents were contacted directly to promote the survey; participation was purely voluntary and there was no remuneration for taking part. There were no exclusion criteria based on age of child, age of parent or time elapsed since colicky behaviour had occurred (potentially affecting accuracy of information recall). Each parent provided information based on just one child.

As a minimal-risk observational study, this investigation was not required to undergo a formal Health and Disability Ethics Committee review in New Zealand. However, the study was performed following the principles of the World Medical Association "Declaration of Helsinki", regarding informed consent, anonymity, beneficence and voluntary participation, and that withdrawal (in the sense that there was no obligation to answer all questions) could occur at any time. The survey asked a range of questions organized in broad subsections: background information; breast/bottle feeding; antenatal education/training in parenting; the occurrence and frequency of various colicky behaviours (example, frequency and duration of crying bouts; spilling of milk); use of behavioural interventions; use of over the counter (OTC) remedies; use of CAM and herbal or natural remedies; use of prescription medicines). The respondents were asked whether the interventions they had used had completely stopped the colicky behaviour and/or to rate the intervention using a score between ten (excellent) to zero (totally ineffective) on how effective they perceived that treatment to be. The score was applied to each group of remedies (natural, OTC, prescription); therefore each product was given an exclusive score only when that parent indicated they had used only that product and a combined score when the product was part of a wider range of remedies in the same category.

Statistical analysis

Data were collated and analysed using Microsoft Excel 2010 and Minitab v16. Associations between categorical variables were

examined using χ^2 tests. The effectiveness of 'cranial massage' and 'baby massage' were compared utilizing only those scores from respondents who had attempted both methods using a paired t-test. To compare major categories of chemical remedies (prescription; OTC and herbal) a 'within subject' analysis of variance was performed to compare scores between treatment groups whilst taking into account the differences in scoring schemes between individual parents. The relationship between the numbers of daily feeding sessions and bouts of crying was assessed using Pearson's correlation coefficient.

RESULTS

Participants

There were 154 respondents to the survey, ranging in age from 21 to 64 years. The number of children in each 'family' ranged from 1 to 5, with a mean of 1.8. In total, the parents had produced (or cared for) 315 children between them, of which 245 (78%) were described as having exhibited colic or reflux. Of the 154 children that were the actual subjects for the survey, 70 were female and 84 were male. With regard to antenatal instruction, 125 respondents (81%) had attended antenatal classes, but only 31 of these (25%) indicated that these classes had been particularly useful. Parents identified a number of areas that they thought more information was needed such as: sleep patterns in babies (10%), winding babies (10%) and settling (8%). The need for more information on colic/reflux was explicitly indicated by 17% of parents.

Feeding

The growth of newborns appeared fairly typical, with 89% having a weekly weight gain of between 110g and 250gm (although this information was poorly reported by the parents). More mothers considered themselves demand feeders (77%) than routine feeders (23%). Breast feeding was used by 92% of respondents, bottle feeding breast milk by 31% and the use of baby formula by 41% (23% of respondents utilized all three methods). Spilling of milk occurred with 82% of children, with 70% of mothers considering this normal behaviour. Of the 88 respondents who stated they switched feeding methods (that is, from breast to bottle or vice versa) the baby was thought to be more settled in 32% of cases.

The frequency of feeds ranged from 5 to 14 per day, with a mean of 8.7 times per day (Figure 1a). There was a weak, but statistically significant relationship between the number of breast feeds and number of crying bouts per day ($r_P = 0.224$, $n = 121$, $P = 0.014$). The average duration of breast feeds was approximately 30 min: 67% of mothers fed within the range of 20 to 60 min (Figure 1b). Total daily breast feeding times for each parent were estimated by multiplying feeding frequency by the average duration. For three mothers this total feeding was less than 60 min, which may indicate that some other feeding methods were also utilised (or represent an error in data reporting). The total feeding time data were skewed

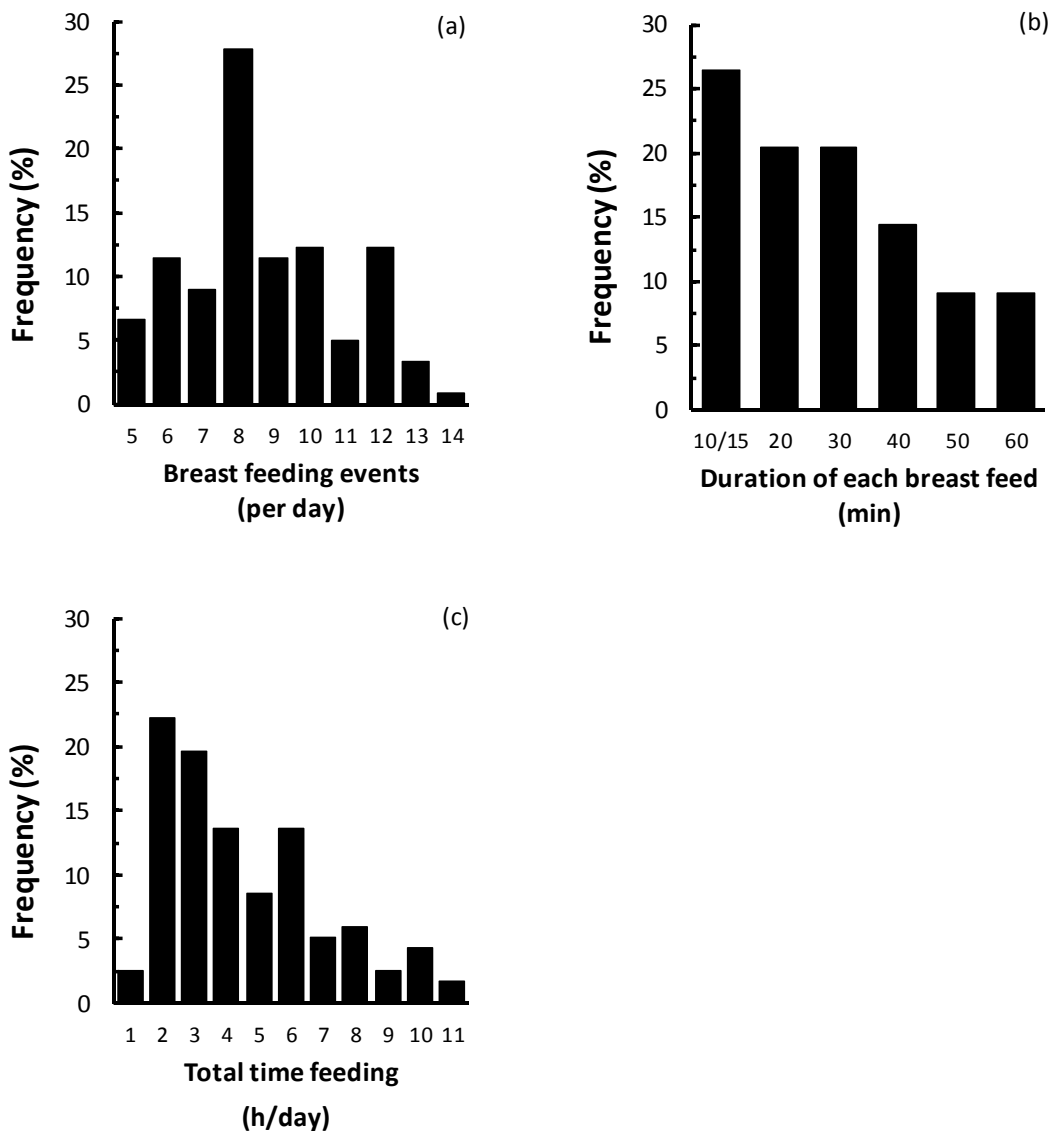


Figure 1. Frequency (%) charts illustrating patterns in (a) breast feeding events per day, (b) duration of each breast feeding session and (c) total breast feeding time per day. (Labels on x-axis represent upper limit of interval).

skewed, with 36% of parents feeding for 6 h or more per day, with some reportedly feeding up to 11 h (Figure 1c).

A number of issues were identified in the patterns of breastfeeding, such as 66% of parents allowing the baby to feed from both breasts at each feed and only 24% feeding their newborn at around the same time each day on the same breast. By feeding at different times each day and from a different breast, supply and demand can be compromised since it takes consistent demand to establish good milk supply. With a number of parents feeding like this it creates the possibility that some of the newborns may have actually been crying from hunger (Woolridge and Fisher, 1988; Murphy 2015). However, we believe this would be a very small proportion of the

newborns given that 70% of mothers increased feeding spells in the evening hours, with 31% of these offering another two to three feeds and 58% considering themselves as feeding ‘almost continuously’ during the evening.

Colicky behaviour

The parents indicated that 29% of the children began showing behaviours associated with colic within a week after birth, increasing to 89% in the first month and 100% by three months of age. Colicky behaviour had ceased in only 55% of the children by six months and 18% of children



Figure 2. Cumulative percentage of infants that ceased colicky and excessive crying behaviours with age (months) based on 154 New Zealand cases.

were still exhibiting excessive crying or reflux behaviour at 12 months of age (Figure 2). The frequency of crying bouts ranged from one to ten episodes per day, with a mean of 4.8 per day. 37.6% of newborns had three or fewer crying bouts per day, whereas 19.5% had eight or more. The average duration of crying bouts was estimated to be 80 min. In terms of the regularity of crying bouts, 83% of cases experienced crying bouts every day. When sleep finally occurred, only 9% of parents thought this was due to the baby being comfortable and tired. In contrast, 60% of parents thought their babies finally went to sleep due to exhaustion. By examining the combination of the number of crying bouts per day, and the average duration of crying bouts, a maximum of 95/154 newborns (62%) would meet the criteria for colic suggested by Wessel et al. (1954) of 'at least three hours crying, for at least three days a week'. Only 66% of the babies were actually diagnosed with reflux/colic by a medical practitioner, and, interestingly, there was no statistical association between meeting Wessel's criteria and being 'officially' diagnosed with colic/reflux ($\chi^2 = 0.88$ for 1 d.f., $P > 0.30$), suggesting that the diagnoses are inconsistent with Wessel criteria, or that some infants with severe crying are not being presented to medical professionals. Although fatigue (24% of respondents) and general discomfort (30%) were thought to be a common cause of crying bouts, the majority of parents (121/154) specifically indicated that symptoms associated with wind were one of the major causes of suffering (example, a build-up of wind; inability to bring up wind). Parents also believed that reflux or stomach acid (35%) was causing pain and crying. Other commonly suggested causes were: problems with the digestive system (19%); over supply of breast milk (17%); hunger from not feeding

properly (14%) and allergies (11%).

Behavioural curative methods

The most common basic behavioural methods used to try and calm a crying child were: pacing with the baby (78% respondents); bouncing the baby (75%); swaddling the baby (70%); and carrying the baby in a sling (68%). Approximately 30% of respondents attempted calming by giving the baby (boiled) water to drink, and 10% had offered the babies a sugar solution. Almost all (98%) of parents deliberately 'burped' their babies after feeding, with an average of 2.4 burps per session, but only a small proportion ($\approx 3\%$) indicated that this stopped the babies discomfort. Approximately two thirds of parents attempted to calm the baby by allowing the baby to suck a finger (62%) or use a pacifier (66%). Only 18% of parents believed they had been taught the correct use of a pacifier and some parents indicated that pacifiers could/would not be used as: the child rejected it (6.5%); the parents did not agree with their use (7.1%). 85% of parents said they would use a pacifier if there was scientific evidence indicating their merit. The same proportion (59%) of parents had attempted cranial massage as had attempted baby massage as a calming technique. The parents gave the cranial massage an average 'effect score' of 4.1/10, which was slightly higher than the score obtained for baby massage of 3.3/10 (paired t-test, $t = 2.33$, $P = 0.024$, $n = 56$).

Natural remedies

Half of the respondents had tried at least one natural remedy

remedy to ease colic symptoms, although only 2.7% of users indicated that these natural remedies made the excessive crying stop completely (Tables 1 and 4). These remedies were administered on average around 3 to 4 times day, but the average effect scores tended to be low (Table 2). The most commonly used product was 'Colic Calm' (a form of gripe water containing a mixture of herbs), followed by 'Rhugar' (a natural remedy made from rhubarb and ginger), then fennel and chamomile teas (Table 1). Chamomile tea was perceived to bring the greatest relief; with parents giving an average effect score of 6/10. Although most of their average effect scores were low, many of these products were scored highly (≥ 8) by some parents.

Over the counter (OTC) remedies

Overall, 82% of respondents had used OTC remedies, the most commonly used being Infacol (47%) which contains simethicone, followed by gripe water (40%) and Weleda Baby Colic Powder (21%) (Table 2). On average, these remedies were administered between 3 to 5 times a day, and obtained low average effect scores between 3/10 and 4/10, although the maximum and minimum scores for each product tended to be extreme (Table 3). Only 2.4% of users indicated these remedies had solved the problems associated with colic (Table 4).

Prescription drugs

The most commonly used prescription drugs were omeprazole, ranitidine and infant gaviscon (Table 3). The most common behavioural changes listed were: a reduction in crying, a reduction in spilling during feeding, babies appeared calmer and slept more. As a consequence, the effect scores for prescription drugs were relatively high compared to OTC and natural remedies, omeprazole having a mean score of 6.8/10 and ranitidine 7.1/10. Of the parents that had used these drugs, 82% indicated that they had proved 'helpful', with 23% indicating that their use had stopped colicky behaviour completely. Of concern was that over half (57%) of the parents said they had increased the dosage of prescription drugs over time. Although it was some-times difficult to extract this information from the given answers, for omeprazole, indications were that the average increase in dosage (relative to the initial dose) was 2.4 times, and for ranitidine 2.7 times. For both of these drugs, the maximum increase reported was 4 times the initial dose.

Statistical comparison of effects scores obtained by different product categories

The most commonly used remedies were the over the

counter products (81.8% of respondents), with the least common being the natural remedies (49.4%) (Table 4); 43 respondents had tried at least one of each category of remedy. The proportion of respondents that indicated that pharmaceutical remedies had solved the problems associated with colic was nearly 10 times higher for the prescription drugs (23.2%) than for the natural (2.7%) and OTC remedies (2.4%) (Table 4; $\chi^2 = 32.7$, d.f. = 2, $P < 0.001$). Similarly the average effect score for prescription drugs (6.4/10) was significantly higher than the effect scores for the OTC (3.6/10) and natural remedies (3.8/10) (Table 4; $F_{2,84} = 17.0$; $P < 0.001$).

DISCUSSION

The information on colicky and excessive crying behaviours provided by the respondents depicts a pattern fairly typical of that reported elsewhere, and there appears not to have been major changes from the situation described by Kirkland (1982) for New Zealand parents over 30 years ago. In the current study, colic started in just under 90% of newborns by one month of age with most ceasing by 12 months. Most parents indicated they thought newborn distress was related to wind (build-up of wind; inability to bring up wind) or reflux and stomach acid. Other commonly suggested causes were related to feeding or digestion, such as overfeeding on breast milk, hunger from improper feeding, or feeding allergies. From the share of cases, there appeared no obvious relationships between the occurrence of colic and gender of the newborns (Crowcroft and Strachan, 1997).

Similar to many other previous reports, given the prevalence of both bottle and breast fed infants, and routine and demand feeders, there appeared to be no association between general feeding strategy and the occurrence of excessive crying behaviour (Crowcroft and Strachan, 1997; Roberts et al., 2004; Critch, 2011). However, there was a positive relationship between the number of breast feeding sessions and bouts of crying per day: the newborns that had the most crying bouts had a slight tendency to be those that were fed most frequently. Many parents indicated total feeding times amounting to several hours per day with 70% of parents increasing feeding spells in the evenings. When the capacity of the newborn stomach is taken into consideration, along with the transit times for food to move through their digestive system, it appears that some of these newborns are being over fed (Murphy, 2015). Overfeeding is known to produce symptoms of colic and reflux (Woolridge and Fisher, 1988; Hassall, 2012), although in this instance we cannot ascertain whether feeding was the cause of the crying or a parental response to try and calm the baby. However, as the majority (77%) of parents were demand feeders, likely responding to crying as a cue for hunger, it may be speculated that a form of positive feedback loop may be occurring, involving overfeeding

Table 1. The use and perceived effectiveness (score from 10) of herbal and natural remedies for infantile colic in 154 New Zealand cases.

Remedy	Used by respondents (%)	Mean exclusive use score	Mean combined use score	Min. - Max. score	Mean usage per day
Colic Calm	16.9	3.1	3.8	1-8	3.7
Rhugar	11.7	3.5	3.7	1-7	4.2
Fennel tea	7.1	5.0	3.8	1-10	3.4
Chamomile tea	5.8	6.0	4.6	1-8	3.6
Mint tea	1.3	-	4.5	3-6	4.0
New Era	1.3	-	4.0	3-5	5.0
Ginger	0.6	3.0	3.0	3-3	6.0
Other	17.5	4.1	4.1	1-8	4.8

Table 2. The use and perceived effectiveness (score from 10) of over the counter remedies for infantile colic in 154 New Zealand cases.

Remedy	Used by respondents (%)	Mean exclusive use score	Mean combined use score	Min. - Max. score	Mean usage per day
Infacol drops	47.4	4.2	3.6	1-10	4.7
Gripe water	39.6	2.9	3.3	1-9	4.2
Weleda Baby Colic Powder	21.4	4.9	3.7	1-7	4.7
Colic drops	7.1	8.0	3.5	2-8	4.9
Wellington Hospital Colic Mix	5.8	4.0	3.9	1-8	5.2
Other	12.3	2.9	2.6	1-6	3.8

Table 3. The use and perceived effectiveness (score from 10) of prescription medicines for infantile colic in 154 New Zealand cases.

Medicine	Used by respondents (%)	Mean exclusive use score	Mean combined use score	Min. - Max. score	Mean usage per day
Omeprazole	39.6	6.8	6.7	1-10	2.2
Ranitidine	23.4	7.1	6.9	1-10	2.3
Gaviscon	11.0	3.2	4.5	1-10	4.0
Esomoprazole	0.6	-	-	-	-
Other	3.9	7.0	6.9	3-9	1.7

Table 4. Summary of overall product usage (% of parents) and perceived effectiveness (score from 10) for infantile colic/reflux as indicated by 154 New Zealand parents.

Number of products used	Proportion of respondents (%)			
	Prescription	OTC	Natural	All products
0	37.7	18.2	50.6	5.2
1	47.4	46.8	37.7	17.5
2	13.6	24.7	10.4	27.9
3	1.3	6.5	1.3	24.7
4	-	1.9	-	8.4
5	-	1.3	-	8.4
6	-	0.6	-	5.8
7	-	-	-	0.6
8	-	-	-	0.0
9	-	-	-	1.3
Colic ceased (% of users)	23.2	2.4	2.7	-
Mean effect score ($\times/10$)	6.4	3.6	3.8	-

overfeeding → crying → comfort feeding → crying, and so on. Cry responsiveness is a function of both infant behaviour and the 'dynamics of the mother-infant interactional system' (Acebo and Thoman, 1995): colicky behaviour could in some ways be seen to represent a malfunction of this parent-baby communication process.

Most of the respondents indicated levels of crying, spilling, sleeplessness and so on, in line with general definitions of colic. Statistically, there was a lack of association between medical diagnoses and the infants meeting Wessel criteria. Totterdell (2001) described a similar situation where many parents who noted prolonged crying in their infants did not seek (or feel they needed) professional help. However, these findings appear to differ with a number of other reports which suggest that colic or intensive crying is one of the most common reasons behind parents seeking medical help (Crowcroft and Strachan, 1997). In the UK, Sung et al. (2014) suggested that 'infant distress' is one of the 'most common presenting problems to primary, secondary, and tertiary healthcare sectors, costing the UK healthcare system millions of pounds annually'. Zwart et al. (2007) described an extreme example of this phenomenon where of 104 infants admitted to hospital with 'severe crying', a medical cause of the crying was identified in no cases, and almost all infants showed a rapid transition to 'normal crying' during the period of hospital admission. Thus, it appears that readiness to report colicky behaviour can be variable, and at least be partially dependent upon levels of stress, and feelings of helplessness, in the parents, and their inability to cope with inconsolable crying. Crowcroft and Strachan (1997) listed many social factors (such as the age of mother, socioeconomic factors, educational level) that might indirectly be related to parents' coping abilities and hence their inclination to seek advice or help with infant crying.

In this study parents indicated that the prescription drugs omeprazole and ranitidine were perceived to have worked well in alleviating crying; effect scores were high and over a quarter of parents indicated that colicky behaviour had ceased. Omeprazole is a proton pump inhibitor that reduces stomach acid in infants, whereas ranitidine is a histamine antagonist that inhibits stomach acid production. Thus, theoretically, these drugs alleviate colic by suppressing stomach acid. However, as Hudson et al. (2012) indicated, stomach acid is found to be the causal agent of excessive crying in only a small number of cases, and our results appear to contrast with some other empirical studies where there were no differences found between placebo and omeprazole treated groups of crying infants over time (Moore et al., 2003; Omari et al., 2007).

The perceived effectiveness of these prescription drugs may have been related to the finding that over half of the parents increased the dosage over time, sometimes up to four times the initial dose. Where doses are increased - and when body weight is taken into consideration - infants could be given quantities of these drugs equivalent or in excess of those recommended for adults. When even the validity of using these drugs for use with newborns is still debated the risk of side effects such as gastroenteritis and pneumonia would also likely be increased.

These findings add further impetus for the use (and potential misuse) of these drugs for treating ailments in newborns to be reviewed (Hassall, 2012; Hudson et al., 2012; BPAC, 2014).

Many reviews of colic treatments (Lucassen et al., 1998; Garrison and Christakis, 2000; Roberts et al., 2004; Cowie, 2013) indicate that herbal remedies may be a viable option, although many of these suggestions are largely based on the results of one or two empirical studies

(usually those of Weizman et al., 1993; Arikan et al., 2008; Perry et al., 2011).

In our study, the average effect scores for the natural remedies were low and very few parents indicated colicky behaviour disappeared altogether. However, high effect scores were given by some parents, suggesting these treatments can work in some cases. The organic nature and 'naturalness' of herbal remedies appeals to many parents (Garrison and Christakis, 2000) and their use is often advocated by midwives (Harding and Foureur, 2009). Chamomile and fennel appeared to be the most successful herbal remedies, agreeing with some previous findings (Savino et al., 2005; Arikan, 2008).

Most of the minor behavioural interventions (example, walking, swaddling, bouncing, front packs) were thought to be ineffective by respondents, contradicting some previous findings, but not others (Huhtala et al., 2000; Van et al., 2006). However, we feel that many of these interventions are so commonly undertaken by parents that they are likely to be part of normal parenting/nursing practice and would have been used early on to ease infant crying: if they had been successful it is unlikely the infant would have developed excessive crying behaviour in the first place.

Typically, the more involved behavioural interventions, such as cranial and infant massage, appeared to work well in some instances but not all. Many parents indicated that crying behaviours were associated with the build-up of wind and the inability to bring up wind. However, the levels of winding babies after feeding appeared to be low, most parents (90%) indicating that fewer than five burps were produced after each feed. With a lack of air being released, a build-up of trapped digestive gasses and air in the newborns stomach forms. Increasing the amount of air released by actively inducing something in the region of 10 to 15 burps after each feed, has proved effective in reducing colic and reflux in some instances (Murphy 2015).

LIMITATION

The use of questionnaires (along with oral interviews, diaries of behaviours and diet, etc.) is a common method of obtaining data on colic, interventions and long term outcomes (Crowcroft and Strachan, 1997; Clifford et al., 2002; Canivet et al., 2008; Talachian et al., 2008; Yalcin et al., 2010). The voluntary aspect to taking part in the survey could lead to an obvious sampling bias in terms of several social factors, such as exposure to advertising, willingness to respond, degree of motivation, free time, access to the internet, and so on. Also, the final sample size of 154 respondents is not substantial. Demographic data were not collected so that participants did not feel that the study might be designed to identify, or single out, any potentially vulnerable social group where crying babies appeared particularly prevalent. However, a number of socio-economic factors have been suggested

as influencing the occurrence of (and likelihood of seeking help for) colic, from educational standard and employment type, to being with a long term partner (Crowcroft and Strachan, 1997; Clifford et al., 2002; Canivet et al., 2004; Yalcin et al., 2010). Additional information on the parent's lifestyle (example, diet; alcohol intake; smoking) may have been informative and future research into the prevalence of colic in terms of New Zealand's various social groupings may be valuable in this respect.

The classification of the natural, OTC and prescription remedies was vague in some cases. For example, gripe water tonics can contain a variety of herbal extracts (such as dill and fennel) along with sucrose and bicarbonate of soda, and could be considered a form of herbal remedy. Similarly, Weleda colic treatments contain chamomile and fennel, as well as other herbs. Parents considered Gaviscon (and Infant Gaviscon) both as an OTC treatment and as a prescription medicine (most likely when suggested by a health professional), whereas ranitidine is now available over the counter in many places.

Conclusion

The results of our survey are in general agreement with those of many other reports on colic: there appears to be no overall common link between the occurrence of colic, gender and type of feeding strategy, and no universal cure. However, the data obtained on the quantity of feeding, at least for the breast feeders, may indicate a link between excessive feeding and the occurrence of colic/reflux. The results highlight that in New Zealand at least the prescribing of medicines such as omeprazole for colicky newborns is still widespread, and that many parents are using higher than recommended doses in attempts to stop excessive crying behaviours. Somewhat unfortunately, infants with colic appear to consist of a very heterogeneous group, with different sub sets responding differently to various interventions (Garrison and Christakis, 2000). These interventions could be attempted simultaneously to try and rapidly identify which treatment, or which combination of treatments, induces relief (Eriksson, 2008). Any care or management strategy should involve both infant and parental needs, with parents reassured to lessen feelings of inadequacy or unwarranted anxiety, and show understanding of the common link between persistent infant crying and a maternal state of tiredness and fatigue (Cakmak, 2011; Kurth et al., 2011). The care process could begin during prenatal education if parents were specifically informed of how to avoid and manage excessive crying, reflux and colicky behaviour, and that in most cases this does not signify a more serious ailment in the child (Keller et al., 1990; von Kries et al., 2006).

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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