


A pilot study of parents' experiences of reflexology treatment for infants with colic in Finland

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Scand J Caring Sci; 2020; 34; 861–870

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Background: Many infants under 4 months suffer from infantile colic. Infants with colic cry a lot, appear to be in pain, and it is difficult to sooth them. Colic is a painful condition for the infant and very stressful to parents. Parents in Finland get advice to try reflexology treatment for their infant, but there are no studies in Finland to support this advice.

Aim: The aim of the pilot study was to treat infants with reflexology and find out parents' experiences of the effects of the treatment on colic symptoms and parental stress.

Method: A total of 33 parents of 35 infants diagnosed with colic participated to the pilot study. Three certified reflexologists with health care education background and extensive experience in infant reflexology were trained to give the reflexology treatment in a standardised manner. They treated each infant 3–4 times. The whole body reflexology treatment session consisted of gentle pressure treatment of soles and feet, hands, head,

face, ears, back, neck and whole stomach area. One treatment session lasted about 20–30 minutes, and treatments were delivered within 8–12 days. The data were collected from the parents with semi-structured questionnaires.

Results: The series of the treatments helped reduce the suffering of all the babies with infant colic. The colic symptoms disappeared on 43% of infants and decreased on the remaining 57%. The parents reported having pleasant experiences with the treatment, regardless whether the colic symptoms disappeared or continued. Parents stated that the treatment reduced the most typical colic symptoms; infants' body tension, colic crying and restless movements, poor sleep quality and irregular bowel movements.

Conclusions: Reflexology treatment seems to be a safe and effective way to treat infants with colic when conducted by a health care professional with reflexology training and experience.

Keywords: infant, colic, reflexology treatment, parent, stress.

Submitted 31 May 2019, Accepted 13 October 2019

Introduction

Almost, every fifth infant under 4 months suffers from infantile colic. According to Wessel et al. (1) infantile colic is a condition where: an infant between 2 weeks and 4 months of age is crying for at least 3 hours a day, at least 3 times a week, for at least for 3 weeks. When there is no medical explanation for the condition, it is diagnosed as infantile colic. It is a painful condition with no known cure. Its cause is unknown, but it is thought to be a sign of immaturity, and the condition of the

macrobiotic flora of the infant's gut and probiotics might offer some help for the condition (2).

Infantile colic symptoms are very stressful to the parents and put a strain on the marital relationship (1,4,5). Colic is also linked to increased risk of maternal postpartum depressive symptoms (6,7) and decreased maternal self-efficacy (7). Parents are tired and worried about the inconsolable crying and do not know how to help their baby. Colic puts a shadow to their whole life (1,8), and they need help from their family, friends and health care professionals to cope with this period of symptoms (5,9).

There are a few studies that describe ways to try help infants with colic symptoms. Two studies (2,10) describe the use of probiotics. One study (2) found that the use of *Lactobacillus Reuteri* is a safe way to ease symptoms of colic, but more studies are needed to support use. The

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other study (10) evaluated the effect of probiotics in 84 infants with colic, but found no significant difference between study and control groups in colic symptoms, and the infants in the control group slept more than the infants in the study group. Dietary management of colic has been described in a systematic review (11).

Another review (12) concluded that manual therapies (e.g. osteopathy and chiropractic treatment) can help to relieve the tensions of the infant's body and help the infant to relax, cry less and sleep better. However, there is still little evidence of the effectiveness of osteopathy, infant massage and acupuncture as treatments for infantile colic (13).

A randomized controlled trial (RCT) (14) of mother–infant pairs ($n = 100$) was conducted in Iran. The intervention group mothers were taught to massage their infant with colic once in the morning and once at night for a week. Control group mothers were advised to rock their infant when the colic symptoms started. They concluded that massage decreased crying and increased sleep significantly better than rocking. Also, acupuncture treatment has been studied (15). In Sweden, researchers compared in a multicentre, randomised, controlled, single-blind, three-armed trial two styles of acupuncture with no acupuncture, as an adjunct to standard care for treating colic (16). The effect of each type of acupuncture was similar and superior to standard care alone in reducing crying. However, a systematic review (17) does not recommend acupuncture for infant colic because it may be painful, and there is still little evidence to support the treatment.

Reflexology is a nonpharmacological, complementary therapy for treating various symptoms or conditions. This therapy uses pressure and stimulation on various reflex zones, for example in feet and hands, to cause reactions in other parts of the body. This stimulation can lead to positive reactions in the correlating body part, by improving the blood and energy flow and causing a sense of relaxation and pain relief (18,19). The effect of reflexology treatment might be explained by peripheral vasodilation following the removal of local toxin accumulation (18). Reflexology has a long history, and nowadays, there are several ways to administer reflexology; some therapists treat only feet and some the whole body, making it difficult to compare and evaluate the outcomes of studies of reflexology (19).

Infant reflexologists argue that pregnancy and birth might cause stress to the infants' nerve vagus, which is connected to various organs and intestines. Pregnancy and also birth injuries can put a strain on this nerve. This can lead to stomach problems in infant and infants' difficulties in turning their head to one side, causing problems in feeding. However, there is still little research evidence on this. A review article (20) from Field and Diego 2008 states that simulation or massage of pressure

receptors of the infant can increase vagus nerve activity. This in turn stimulates gastric functions, weight gain and socio-emotional development of the infant.

There are very few studies on the use of reflexology for children. The use of combination of drug-free treatments including reflexology to treat tension headaches in school children (21) has been found effective. One study (22) dealt with constipation and motor functions of children with cerebral palsy (CP) and found a positive effect on constipation but not in the motor functions. On the other hand (23), the effects of reflexology on children with functional constipation were not statistically significantly different between the study and control groups. Another study (24) found an improvement in the spasticity of children with CP.

Even fewer studies have assessed the use of reflexology in children under the age of 1 year. One study (25) investigated the effects of reflexology treatment on infantile colic and a second (26) on pain related to vaccinations. In this RCT study, (26) 60 infants were allocated to either the reflexology intervention group or to the control group, 30 infants each. Reflexology before vaccination reduced pain levels (FLACC pain score) experienced after vaccination, and the reflexology group also had lower heart rates, higher oxygen saturation and shorter crying period than the controls. Another study (27) examined the effects of reflexology on the physiological functions and pain of infants ($n = 30$) in an intensive care unit in Iran. There was no control group. Infants received foot reflexology treatment. Before and after the treatment, oxygen saturation, heart rate and pain scores were measured. The Neonatal Infant Pain Scale (NIPS) was used to measure pain. Results showed that reflexology treatment helped reduce infants' NIPS scores and improved oxygen saturation.

The most recent study (25) describes positive results of treating infants with colic ($n = 64$) with reflexology treatment of the feet. The study group infants ($n = 33$) received treatment first by the researcher and then by their mother 2 days a week for 3 weeks. Mothers received reflexology education and an infant colic booklet and oil. Mothers were also on a special diet. The control group infants did not receive reflexology. The intensity of the colic symptoms measured by the Infant colic scale (ICS) was similar in both groups before the intervention but significantly lower in the study group at the end of the intervention.

In Finland, social media discussion groups on colic offer reflexology treatment as one of the means to reduce colic symptoms, and public health nurses advice parents of infants with colic to try reflexology treatment as a last resort. However, this has been unofficial advice since there have been no previous studies in Finland that would support the practice. WHO (28) recommends that more research is needed of traditional and

complementary therapies, their effectiveness, safety and user experiences.

Aim

The aim of this pilot study was to describe:

- 1 Parental experiences of reflexology treatment for their infants with colic.
- 2 How parents evaluate the effects of the reflexology treatment on colic symptoms like crying and sleeping difficulties
- 3 How parents evaluate the effects of the reflexology treatment on parental stress.

Methods

This was a descriptive intervention study without a control group conducted in Lohja municipality in southern Finland. The data were collected during 2.1.2018–31.12.2018.

In 2018, a total of 357 infants were born to 326 mothers in Lohja. Information about the study was given to all parents in the local hospital and maternity and child health clinics. All parents of otherwise healthy infants who were diagnosed with colic were invited to participate. Public health nurses used Wessels criteria to make the colic diagnoses in infants attending the Lohja maternity and child health clinics and gave the parents the lead reflexologist's contact information. Informed consent was sought from all parents who decided to participate in the study. Only otherwise healthy children with no medical conditions were included to the study. Infants who had already received reflexology treatments or who had medical problems were excluded. Altogether 35 Lohja parents with 37 infants diagnosed with colic by public health nurses, participated in the intervention. Later, one infant was excluded because her mother had difficulties answering all follow-up questionnaires and another because of infant's acute health problems. In the end, 35 infants were included in the study.

The intervention consisted of 3–4 reflexology sessions delivered within 8–12 days. Each reflexology session consisted of gentle reflexology pressure treatment of soles and feet, hands, head, face, ears, back, neck and whole stomach area. The duration of one treatment session was about 20–30 minutes. However, 1 hour was reserved for each treatment session, to avoid feelings of being hurried and to allow enough time for discussion between the reflexologist and the parents. Also, time was needed for completing the symptoms diary, answering parents' questions, as well as for breastfeeding and consoling the baby. Parents were present during the treatments sessions. After the third or fourth (final) treatment session, parents were given advice and a leaflet to further continue the gentle treatment of the baby's feet at home.

Three certified reflexologists with health care education background (nurse, public health nurse and practical nurse) and with extensive experience in infant reflexology were trained to give the treatment in a standardised manner. Before each treatment, the reflexologist completed a symptoms diary with the parents. This included parents' observations of the infants' symptoms (cry, skin, body tensions, as well as sleeping and feeding behaviours).

The three reflexologists treated each infant 3–4 times (32 infants 3 times and 3 infants with an additional 4th time when requested by the parents) in Lohja hospital or the municipal child health clinic. The data were collected using semi-structured questionnaires distributed to participating parents ($N = 33$). The parents received an electronic questionnaire before the first treatment (questionnaire 1), 3 days after each treatment (questionnaire 2) and a week after the last treatment (questionnaire 3). The questionnaires included socio-demographic data of the family and infant, infant's colic symptoms, experience of the treatment and the therapist's behaviour, as well as infant's reaction to the treatment, parental postpartum stressors, parenting stressors and coping.

When available, we used previously used and validated scales. Parental stress was measured by assessing two components: perceived stressors and coping with stressors. The adapted Park et al. (29) postpartum stressor measure was used to measure postpartum stress, with participants rating items (e.g. related to health/well-being of baby) from 'Very stressful' to 'Not at all stressful'. For parenting stressors (adapted from Berry and Jones (30) Parenting Stress Scale), parents were asked about the stress related to their parenting experiences (e.g. 'Caring for my baby sometimes takes more time and energy than I have to give') and rate their level of agreement from 'Strong agreement' to 'Strong disagreement' on a 5-point scale.

Support from people who are important to the participants was measured by assessing who the main source of support was, and the quality of the support received: 'Who is your main support' with a multiple choice response format (partner/father/mother/siblings/spouse's mother or father/other family member/close friend/peer-supporter/I do not receive support from anybody). Some open ended questions of parents' experiences of the colic and treatment were also asked, and their results are being reported elsewhere.

Analysis

Data were analysed using SAS 9.4 statistical software (SAS Institute Inc., Cary, North Carolina, USA). Data were presented by frequencies, percentages, means (M), standard deviations (SD) and ranges (min, max). This pilot study was conducted without a control group because of limited resources.

After the series (3 or 4 times) of reflexology treatments sessions, parents were asked whether the baby still had colic symptoms. Based on the answers, two groups were formed: 'No colic' and 'Colic'. The differences in numerical variables between these groups were tested by t-test or Wilcoxon signed-rank test, according to the normality of distributions. In case of categorical variables chi-square, exact chi-square or Fisher's test were used, when appropriate. Changes between before and after treatment were studied using paired t-test. p-values < 0.05 were considered as statistically significant. Results with p-value between 0.05 and 0.1 were also treated as statistically symptomatic.

Ethics

The study followed the ethical guidelines (31) of The Helsinki Declaration (The World Medical Association 1964) and the Code of Conduct for Research Ethics and Research Licensing Practices of Ethical Committees. The study was approved by the HUS Ethics Committee (HUS/2314/2017). The ethical guidelines of good scientific practice issued by the National Advisory Board on Social and Health Research (32) were followed at all stages of the research process. Parents were notified of the study in hospital and local maternity and child health clinics.

Public health nurses diagnosed the colic by using Wessel's criteria. Parents volunteered to participate in the study. The reflexologists were also health care professionals, so they were able to observe the infants condition during the treatments in a safe manner. Parents were informed about infants' normal reactions to treatment, and parents were present during treatment. They were told that they may choose to interrupt treatment at any time. Data were kept confidential, and individual families cannot be identified in the reported material. The implementation of the research did require the use of personal data of infants and parents, and a scientific research report of the study was prepared. This information was kept separate from the data.

Results

The mothers of the infants were on the average 30-years old (range 21–40), and 97% were married or cohabiting. Most of the mothers (54%) had a university degree, 29% vocational degree, 3% high school and 14% primary school certificate. Most of the infants were their mothers' first child (49%) and 31% second child. (Table 1). The infants were on average 6.11 weeks (range 2–10) old when they enrolled to the study.

For half of the infants, their colic symptoms had disappeared by the time the parents answered the third and last survey questionnaire (a week after the last treatment). The group was named 'No colic' group. The

Table 1 Infants' characteristics (N = 35)

Infants' characteristics	n	%
Infants' birth order		
First child	17	49
Second	11	31
Third	5	14
Fourth	2	6
Siblings had colic (n = 18)		
Yes	5	28
No	10	55
I cannot say	3	17
Mode of delivery		
Vaginal	27	77
Planned caesarean	1	3
Unplanned caesarean	7	20
Skin contact within 5 minutes		
Yes	26	74
No	9	26
Nutrition type		
Only formula	5	14
Only breast milk	24	69
Breast milk and formula	6	17
Baby gets vitamin D drops		
Yes	25	71
No	10	29
Baby with reflux medication		
Yes	2	6
No	33	94
Baby uses lactic acid bacterial preparation		
Yes	23	66
No	12	34
Baby uses Herbal Remedy		
Yes	19	54
No	16	46
Regurgitation		
Never	1	3
Rarely	17	49
Often	8	23
In connection with each feed	9	26

infants who still had symptoms (57%) although they were less severe, were classified as 'Colic' group. There was no statistically significant difference between the mother and infant characteristics (Table 1) and the continuation of colic symptoms.

Before treatment, 30 of the infants were breastfed. Before reflexology treatment, there was no difference in how easy or difficult the mothers experienced breastfeeding. After treatment, mothers in 'No colic' group found breastfeeding easier (M = 4.50, SD = 0.29) than mothers in the 'Colic' (M = 3.62, SD = 0.28) group (p = 0.043). There was no statistically significant difference between the type of nutrition and the continuation of colic.

On the average, the infants were 2.8 weeks old when the colic symptoms started (1–7 weeks) and 6.9 weeks (2–12 weeks) old when the treatment started (Table 2).

Table 2 Age of the infant and colic

Age of the infant and colic	All (N = 35)		'No colic' (n = 15)		'Colic' (n = 20)		p*
	Mean (SD)	Min-max	Mean (SD)	Min-max	Mean (SD)	Min-max	
When colic symptoms begun	2.80 (1.51)	1-7	3.33 (1.99)	1-7	2.40 (0.88)	1-4	0.107
Enrolment to the study	6.11 (2.01)	2-10	6.87 (2.20)	2-10	5.55 (1.70)	2-8	0.054
At the start of therapy	6.89 (2.22)	2-12	7.67 (2.53)	2-12	6.30 (1.81)	3-9	0.071

*Difference between 'No colic' and 'Colic' groups.

The 15 infants (43%) whose colic symptoms had disappeared by the end of the final (third or fourth) therapy ('No colic' group) were slightly older (M = 6.87, 2–10 weeks) when they enrolled to the study (p = 0.054,) and their therapy begun (M = 7.67 weeks, 2–12) later (p = 0.071) than the 20 infants whose colic symptoms continued ('Colic' group). This difference was not statistically significant.

Feedback from the parents

The overall feedback from the parents on reflexology treatment was positive. All study participants reported willingness to continue the treatments throughout the pilot study. The parents agreed that the reflexology treatment relaxed the infant (M = 4.5, SD = 0.74), was pleasant (M = 4.4, SD = 0.98), disagreed that it was painful (M = 1.60, SD = 1.06), or scary (M = 1.14, SD = 0.53) or caused anxiety (M = 1.11, SD = 0.53). They disagreed with the statement that the treatment had no effect on the infant (M = 1.51, SD = 0.95). On a scale of 1–5, five

being strongly agree, the parents agreed that the reflexologist was friendly (M = 4.74, SD = 0.95), professional (M = 4.77, SD = 0.73), unhurried (M = 4.80, SD = 0.72), the baby was in safe hands with the reflexologist (M = 4.80, SD = 0.72), and the reflexologist knew the limits of her knowledge in taking care of the baby (M = 4.51, SD = 0.92). There was no statistical difference in these answers from parents of infants with 'No colic' after the treatments ended or of infants still having symptoms of colic. The therapy was equally well liked by both groups.

The colic symptoms of 15 infants disappeared after the series of reflexology treatment (3–4 times) intervention. The 20 infants whose colic symptoms continued after the reflexology intervention cried significantly less (p = 0.0024) after the last (i.e. fourth) therapy (M = 2.80 vs. 4.25 hours/day) than before the intervention. (Table 3). Also, their daily sleeping time was increased from 13.84 hours before intervention to 14.66 hours after intervention (p = 0.071). We also assessed the treatment outcome after intervention as a whole (Table 4). As a whole, parents in both groups ('No colic' and 'Colic')

Table 3 Colic symptoms, cry and sleep

Occurrence of colic symptoms	Before reflexology (Questionnaire 1)		After last reflexology therapy (Questionnaire 3)		Significance of change from Questionnaire 1 to Questionnaire 3 p
	Mean (SD)	Min-max	Mean (SD)	Min-max	
How many hours a day on the average does the baby cry?					
All babies (N = 35)	3.79 (1.69)	1.00-8.00	-	-	
'No colic' group Q3 (n = 15)	3.17 (1.99)	1.00-6.00	-	-	
'Colic' group (n = 20)	4.25 (1.90)	1.00-8.00	2.80 (1.40)	1.00-5.00	0.0024
p*	0.059				
How many times a week do colic symptoms occur?					
All babies (N = 35)	5.57 (1.34)	3.00-7.00	-	-	
'No colic' group Q3 (n = 15)	5.60 (1.31)	3.50-7.00	-	-	
'Colic' group (n = 20)	5.55 (1.39)	3.00-7.00	5.05 (2.09)	1.50-7.00	0.343
p*	0.915				
How many hours a day the baby sleeps?					
All babies (N = 35)	14.32 (3.24)	8.50-20.00	-	-	
'No colic' group Q3 (n = 15)	14.96 (3.26)	8.50-19.00	-	-	
'Colic' group (Q1 n = 19) (Q3 n = 18)	13.84 (3.23)	9.00-20.00	14.66 (2.25)	11.00-19.00	0.071
p*	0.334				

*Difference between 'No colic' and 'Colic' in Q1.

Table 4 Treatment outcome in the 'No colic' (n = 15) or 'Colic' (n = 20) groups

The treatment	Completely disagree (1) n (%)	Somewhat disagree (2) n (%)	Not agree nor disagree (3) n (%)	Somewhat agree (4) n (%)	Fully agree (5) n (%)	Mean (SD)	Min-max	Difference between 'No colic' and 'Colic' p
Reduced colic crying								
'No colic'	0 (0)	0 (0)	1 (7)	3 (20)	11 (73)	4.67 (0.62)	3-5	0.017
'Colic'	1 (3)	3 (9)	1 (3)	9 (26)	6 (17)	3.80 (1.20)	1-5	
All	1 (3)	3 (9)	2 (6)	12 (34)	17 (49)	4.17 (1.07)	1-5	
Improved baby's sleep quality								
'No colic'	1 (7)	0 (0)	1 (7)	4 (27)	9 (60)	4.33 (1.11)	1-5	0.108
'Colic'	2 (10)	1 (5)	5 (25)	5 (25)	7 (35)	3.70 (1.30)	1-5	
All	3 (9)	1 (3)	6 (17)	9 (26)	16 (46)	3.97 (1.25)	1-5	
Reduced restless movements								
'No colic'	0 (0)	1 (7)	0 (0)	5 (33)	9 (60)	4.47 (0.83)	2-5	0.116
'Colic'	1 (5)	1 (5)	6 (30)	4 (20)	8 (40)	3.85 (1.18)	1-5	
All	1 (3)	2 (6)	6 (17)	11 (26)	17 (49)	4.11 (1.08)	1-5	
Reduced body tension								
'No colic'	0 (0)	0 (0)	2 (13)	3 (20)	10 (67)	4.53 (0.74)	3-5	0.445
'Colic'	1 (5)	0 (0)	1 (5)	8 (40)	10 (50)	4.30 (0.98)	1-5	
All	1 (3)	0 (0)	3 (9)	11 (31)	17 (57)	4.40 (0.88)	1-5	
Reduced the baby's regurgitation								
'No colic'	2 (13)	2 (13)	4 (27)	4 (27)	3 (20)	3.27 (1.33)	1-5	0.353
'Colic'	4 (20)	3 (15)	7 (35)	4 (20)	2 (10)	2.85 (1.27)	1-5	
All	6 (17)	5 (14)	11 (31)	8 (23)	5 (14)	3.03 (1.29)	1-5	
Reduced the baby's flatulence								
'No colic'	2 (13)	1 (7)	2 (13)	5 (33)	5 (33)	3.67 (1.40)	1-5	0.064
'Colic'	8 (40)	0 (0)	4 (20)	6 (30)	2 (8)	2.70 (1.53)	1-5	
All	10 (29)	1 (3)	6 (17)	11 (31)	7 (20)	3.11 (1.53)	1-5	
Facilitated baby's bowel movements								
'No colic'	0 (0)	0 (0)	2 (13)	4 (27)	9 (60)	4.47 (0.74)	3-5	0.012
'Colic'	4 (20)	0 (0)	3 (15)	10 (50)	2 (15)	3.40 (1.35)	1-5	
All	4 (11)	0 (0)	5 (14)	14 (40)	12 (35)	3.86 (1.24)	1-5	
Did not affect the baby's symptoms in any way								
'No colic'	14 (93)	1 (3)	0 (0)	0 (0)	0 (0)	1.07 (0.26)	1-2	0.269
'Colic'	16 (80)	2 (10)	0 (5)	0 (5)	0 (0)	1.35 (0.81)	1-4	
All	30 (86)	3 (9)	1 (3)	1 (3)	0 (0)	1.23 (0.65)	1-4	

highly agreed that the treatment reduced infants' body tensions ($M = 4.40$, $SD = 0.88$), colic crying ($M = 4.17$, $SD = 1.07$) and restless movements ($M = 4.11$, $SD = 1.08$), sleep quality ($M = 3.97$, $SD = 1.25$) and bowel movements ($M = 3.86$, $SD = 3.86$). Parents reported that they did not experience the intervention having any effect on baby's regurgitation ($M = 3.03$, $SD = 1.29$). All parents strongly disagreed that the treatment would not have had any effect on the infants' symptoms ($M = 1.23$, $SD = 0.65$). However, there was a statistically significant difference between the 'No colic' and 'Colic' groups on whether the treatment reduced colic cry ($p = 0.017$), helped bowel movements ($p = 0.012$) and reduced baby's flatulence. The difference was symptomatic ($p = 0.064$), with parents of the 'No colic' group agreeing more strongly to these statements than parents in the 'Colic' group.

Postpartum stressors (Table 5) as a whole were on average higher before the reflexology treatment intervention ($M = 2.15$, $SD = 0.51$) than after the intervention ($M =$

1.85 , $SD = 0.64$), $p = 0.0001$. Before the intervention parents found it very stressful to take care of and sooth an infant who cried with colic ($M = 2.69$, $SD = 0.93$). They were stressed about the infants' illness ($M = 2.97$, $SD = 0.95$), health and well-being ($M = 2.66$, $SD = 0.84$), sleeping ($M = 2.51$, $SD = 0.98$) and not sleeping ($M = 2.66$, $SD = 1.08$) and their own lack of sleep ($M = 2.66$, $SD = 0.97$).

There was a statistically significant difference in positive direction before and after treatment in stress levels in relation to how the parents felt about baby's health and well-being ($p = 0.0001$), baby's illness ($p < 0.0001$), soothing a crying baby ($p = 0.034$), things related to baby's sleeping ($p = 0.001$), or matters related to baby staying awake ($p = 0.0002$). Also, parents felt less stress about the lack of their own sleep ($p < 0.0001$) or their spouse's lack of sleep ($p = 0.0016$). However, when we compared the 'No colic' and 'Colic' groups, we realised that as a whole ($p = 0.0002$) and in many stressors, the reduction only happened in the 'No colic' group. Only

Table 5 Postpartum stressors and change of stress within the study

Postpartum stressors and experienced stress	Before therapy (Q 1) Mean (SD)*	After therapy (Q 3) Mean (SD)*	Significance of change between Questionnaires 1 and 3**		
			All babies (N = 35) p	'No Colic' (n = 15) p	'Colic' (n = 20) p
How stressful it is that the baby has colic problems	2.91 (0.82)	3.14 (0.91)	0.147	0.023	0.789
How stressful to treat your baby when your baby is symptomatic/crying in his/her colic	3.00 (0.84)	3.26 (0.98)	0.095	0.262	0.235
How stressful is the following at the moment					
Baby's health and well-being	2.66 (0.84)	2.00 (0.94)	0.0001	<0.0001	0.104
Baby's illness	2.97 (0.95)	1.91 (0.92)	<0.0001	0.0002	0.0009
Soothing a crying baby	2.69 (0.93)	2.26 (1.04)	0.034	0.0005	0.760
Things related to baby sleeping	2.51 (0.98)	1.94 (1.00)	0.001	0.004	0.090
Matters related to baby staying awake/control	2.66 (1.08)	1.86 (1.00)	0.0002	0.006	0.014
Baby growth and development	1.51 (0.61)	1.40 (0.50)	0.254	0.019	0.716
Parenthood	1.71 (0.75)	1.77 (0.91)	0.600	1.0	0.541
Breastfeeding	2.11 (1.32)	1.89 (1.30)	0.058	0.054	0.949
Relationship with spouse/couples relationship	1.91 (0.95)	1.60 (0.60)	0.062	0.072	0.453
Financies-economic matters	2.20 (1.16)	2.11 (0.16)	0.373	0.104	0.666
Work related matters	1.83 (1.04)	2.03 (1.44)	0.344	0.607	0.408
Home affairs/housework	1.97 (0.82)	1.83 (0.79)	0.257	0.055	1.0
Taking care of your own well-being and health	1.80 (0.72)	1.71 (0.89)	0.499	0.271	1.0
Taking care of the spouse's well-being and health	1.40 (0.65)	1.54 (0.74)	0.169	0.433	0.267
Lack of your own sleep	2.66 (0.97)	2.09 (0.92)	<0.0001	0.001	0.010
Spouse's lack of sleep	2.03 (0.94)	1.77 (0.94)	0.0016	0.019	0.042
Isolation/feeling of loneliness	1.89 (0.96)	1.66 (1.08)	0.283	0.744	0.021
The amount of stress as a whole	2.15 (0.51)	1.85 (0.64)	0.0001	0.0002	0.065

*All scales 1-4: 1 = not at all stressful, 4 = very stressful.

**All significant changes mean decrease in stress.

stress about baby's illness, matters related to baby staying awake, lack of own sleep or spouses sleep were reduced in both 'No colic' and 'Colic' groups, with one exception. Mothers in the 'Colic' group felt less isolated and lonely after the treatments than before treatments ($p = 0.021$), but there was no similar change in the 'No colic' group.

We asked the mothers to name the persons who helped them to take care of the infant with colic. Most named their spouse, mother, father, siblings, and other relatives and close friends. The mean for the number of supporting persons before intervention was 2.71 (SD = 1.73) in the 'No colic' group and 2.65 (SD = 1.31) in the 'Colic' group. After treatments, the number of supporting persons was decreased in the 'No colic' group ($M = 2.21$, SD = 1.67) and increased in the 'Colic' group ($M = 3.32$, SD = 1.67) where maternal grandmother's importance as a supporting person increased significantly ($p = 0.005$).

Parenting feeling and stressors

There was a significant change of the parenting stressors (Table 6) from before intervention to after intervention. After the reflexology intervention, the stress symptoms of

the parents in the 'No colic' and 'Colic' groups were relieved and parents agreed they loved spending time with the infant ('No colic' $p < 0.0001$ and 'Colic' group $p = 0.0001$). Before the treatments, most parents agreed that 'because of the baby, my life has little time and flexibility'. This changed significantly to the better after intervention, for both 'No colic' ($p < 0.0001$) and 'Colic' ($p = 0.0003$) groups. After intervention, mothers in both groups found it easier to 'balance the different responsibilities between my baby', and the change for the better was statistically significant in both groups, 'No colic' ($p = 0.043$) and 'Colic' ($p = 0.0093$). However, only the 'No colic' group reported a significant increase in the satisfaction of being a parent ($p = 0.041$) and a decrease in the agreement of 'baby taking more time and energy than I would have' ($p = 0.001$).

Discussion

The major finding of this study is that the reflexology treatment helped reduce the suffering of all the babies with infant colic. The colic symptoms disappeared for 43% and decreased for 57% of the infants. The finding

Table 6 Parenting stressors and feelings

Parenting stressors and parenting feelings	Before Reflexology (Q1)* Mean (SD)	After Last Reflexology Therapy (Q3)* Mean (SD)	Significance of change from Q1 to Q3 p
I am satisfied with being a parent			
'No Colic'	4.47 (0.52)	4.73 (0.46)	0.041
'Colic'	4.40 (0.50)	4.35 (0.93)	0.834
Baby care takes more time and energy than I would have			
'No Colic'	2.47 (1.13)	1.53 (0.74)	0.001
'Colic'	2.60 (1.27)	2.35 (0.99)	0.204
Because of the baby, my life has little time and flexibility			
'No Colic'	4.87 (0.35)	2.53 (1.51)	<0.0001
'Colic'	4.50 (0.51)	2.89 (1.41)	0.0003
It is difficult for me to balance the different responsibilities between my baby			
'No Colic'	3.00 (1.65)	2.07 (1.44)	0.043
'Colic'	3.10 (1.59)	2.15 (1.09)	0.0093
I love spending time with the baby			
'No Colic'	2.73 (1.39)	4.87 (0.35)	<0.0001
'Colic'	2.50 (1.50)	4.40 (0.99)	0.0001
I worry about doing enough for my baby			
'No Colic'	2.80 (1.57)	2.73 (1.39)	0.850
'Colic'	3.15 (1.69)	3.30 (1.30)	0.603

*Scale 1 = completely disagree, 2 = somewhat disagree, 3 = not agree nor disagree, 4 = somewhat agree, 5 = fully agree.

supports the Finnish parental grapevine folk wisdom of trying reflexology treatment for an infant with colic if nothing else has worked. In addition, all the parents reported having pleasant experiences with the treatment, regardless whether the colic symptoms disappeared or continued. The parents agreed that the treatment relaxed the infant, was pleasant and not painful or scary, nor did it cause anxiety to the parents. The parents also agreed that the reflexologist behaved in a friendly, unhurried and professional manner, and they understood the limits of reflexologist's knowledge.

According to the parents' opinion, the treatment reduced the most typical colic symptoms; infants' body tensions, colic crying and restless movements, poor sleep quality and irregular bowel movements. These results are similar to a previous (25) study by Icke and Genc, (25) that showed how foot reflexology treatment significantly decreased colic symptoms. However, in their study, foot reflexology consisted of one treatment session by a reflexologist and thereafter continuation by infant's mother. Also, it is not known how each mother administered the reflexology treatment. In addition, in our study, the reflexology treatment was administered to the whole body of the infant, not just the feet.

Parental stress was relieved during the intervention in both groups. Being part of the intervention, sharing concerns of the infant with the therapist, and being able to do something to help the suffering infant can perhaps relieve stress, even though colic symptoms continued.

While parental stress symptoms decreased in both groups, parental satisfaction increased only in the 'No colic' group, indicating that the disappearance of the infant colic symptoms can have a major role in improving the well-being of the parents. In two Swedish (3,8) studies, parents reported suffering and feelings of powerlessness when the colic symptoms continued. Understandably, it is hard to be satisfied as a parent when you are unable to console your own infant.

Breastfeeding was more pleasant and easier for mothers of infants whose colic symptoms disappeared and more difficult when the symptoms continued. Colic has an impact on breastfeeding, since it is very difficult for the crying infant to settle down to feed. This can be very distressing to the breastfeeding mother, who may think that crying is linked to their breast milk. As a result (33), mothers seek help and advice from friends and family and try various types of elimination diets (no caffeine, broccoli, cabbage, garlic and onions, spicy foods, gluten, beans, etc.) to help their infant.

The results indicate that the collaboration within the family may be improved when the symptoms of the infant's colic continue, but are properly recognised and treated. The mothers whose infant's colic continued were able to get more support from their relatives, most commonly from their spouse and their own mother. It might be easier to ask for help from family members because parents do not want to go out of the house with the crying baby and get judged (3,4,33). Mothers of babies

whose colic symptoms continued reported feeling less isolated and lonely after the reflexology intervention, perhaps because they were able to share their concerns about their infant with the therapist, and be reassured.

Finally, these results and the results of some previous studies (14–17,25) using nonpharmacological, manipulative therapies, such as acupuncture, massage and reflexology indicate that these kind of therapies show potential in treating infantile colic symptoms. However, more and larger scale studies are needed to get more knowledge of why and how they work.

Reliability

The pilot study sample was small, and there was no control group. This should be kept in mind when assessing the reliability of the results. On the other hand, data were collected before and after treatment to compare the change. This was a follow-up study, and all the parents completed the intervention fully, and there was no missing data in the questionnaires. The intervention was implemented in health care facilities by an experienced child reflexologist, and the agreed treatment protocol was followed carefully in detail and in a similar manner during every treatment session. The reflexologists were health care professionals allowing them to notice if the infant would have had some other health problem or illness and refer the child to the medical care. A statistician helped to formulate the questionnaires and complete the statistical analyses. To improve the reliability, we asked several different questions about the treatment outcome and regardless of how we asked, the parents answered that the therapy was pleasant and had a positive effect on the infants' colic symptoms.

Conclusions

This pilot study suggests that reflexology treatment seems to be a safe and effective way to treat infants with infant colic when conducted by health care professionals with the training and experience of reflexology treatment. Parents reported that the reflexology treatment was a pleas-

ant experience for them and their infants. Infants' colic symptoms either disappeared or were reduced. The parental stress was also reduced during the intervention. To confirm the results, a RCT study with a larger sample size and a comparison group would provide more robust evidence of the effectiveness of the method.

Acknowledgements

We are thankful for reflexologist Riitta Silander from Sentire Oy for her work in the development of the reflexology treatment intervention and data collection. We give thanks to Associate professor Riitta Meretoja from HUS for her collaboration and continuous support throughout the study. We give thanks to special education teacher Irene Äyräväinen from The Finnish Association for Natural Health FNH for her support to the project and starting the collaboration with the City of Lohja. Finally, we are thankful for Child and Nature Foundation for their financial support for this study.

Author contributions

LH and PP designed the study. LH collected the data, PP did the statistical analysis, and LH reported the results. LH and MA wrote the introduction and PP was responsible for writing the statistical analysis chapter. All authors collaborated in the discussion. LH drafted the manuscript and MM, PP, MA took responsibility for commenting and critically revising all the manuscript versions. All authors contributed to, read and approved the final version of the manuscript.

Ethical approval

The study was approved by the HUS Ethics Committee, reference number HUS/2314/2017.

Funding

This research was funded by the Lapsi ja Luonto säätiö (Child and Nature Foundation) in Finland.

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