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Original Article

The Effect of Pediatric Massage Therapy on Constipation in Formula-Fed Infants (6-12 months)

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ABSTRACT

Background: Constipation is a prevalent health problem in infants. It is a condition in which infants have difficulty defecating, bowel movements ≤ 3 times a week, and hard and large feces. In Indonesia, the prevalence of constipation in infants is 15.7%, and it needs to be treated appropriately. The effects of constipation are classified into two categories: short-term and long-term. Short-term effects can manifest as discomfort in infants, anorexia, and lack of weight gain. Non-pharmacological interventions, such as pediatric massage therapy, are effective management strategies for infant constipation.
Methods: This study employed a one-group pretest-posttest quasi-experimental design involving 38 constipation formula-fed infants aged 6-12 months. The pediatric massage therapy intervention three times a week was assessed before and after using the Bristol Stool Chart questionnaire.
Results: Based on the statistical analysis of 38 respondents (n = 38), a Z value of −5.42 was obtained with a p value (ρ) = 0.000. This result indicates that there is a highly significant statistical difference/relationship ($p < 0.05$), so the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted.
Conclusion: Pediatric massage therapy is an effective complementary therapy for managing constipation in formula-fed infants aged 6-12 months at the Puskesmas Sungai Besar, Ketapang Regency.

INTRODUCTION

Constipation is one of the most common gastrointestinal disorders in infants worldwide and remains a significant concern in pediatric health. Globally, functional constipation accounts for approximately 90–95% of constipation cases in children, while only a small proportion is attributable to organic causes (Koppen et al., 2018; Tabbers et al., 2014). Functional constipation is typically characterized by infrequent bowel movements (≤3 times per week), hard or large stools, painful

defecation, and stool withholding behavior. Epidemiological studies indicate that childhood constipation has become an increasingly recognized public health concern in both developed and developing countries (Rajindrajith et al., 2016). Although often considered benign, persistent constipation may negatively affect infant comfort, feeding patterns, and growth when not appropriately managed (Benninga et al., 2016; Koppen et al., 2018).

From a clinical perspective, organic causes of constipation in infants are relatively rare, representing approximately 5% of cases. The most common organic cause is Hirschsprung's disease, also known as congenital aganglionic megacolon, which is characterized by the absence of ganglion cells in the myenteric (Auerbach) and submucosal (Meissner) plexuses of the enteric nervous system. This absence results in impaired intestinal peristalsis and functional obstruction of the distal bowel (Gosain et al., 2017; Ambartsumyan & Smith, 2020). Due to the predominance of functional rather than organic causes, international clinical guidelines strongly recommend preventive and conservative management strategies as first-line therapy in infants (Tabbers et al., 2014; Koppen et al., 2018). Several studies also emphasize that early identification of risk factors is essential to prevent the progression of functional constipation into chronic bowel dysfunction (Pijpers et al., 2010).

At the national level, constipation in infants also represents a relevant public health issue in Indonesia. While comprehensive national epidemiological data remain limited, regional reports indicate that constipation affects a considerable proportion of infants, particularly during the transition to complementary feeding. Feeding patterns have been identified as key contributors to functional constipation, including type of milk consumed (breast milk versus formula) and the timing and composition of complementary foods (Mugie et al., 2011). Infant formula typically contains a higher proportion of casein protein compared to breast milk, which is whey-dominant. Casein forms firmer curds in the stomach and may slow gastrointestinal transit in some infants, potentially contributing to harder stool consistency. Dietary factors, including inadequate fiber intake and inappropriate feeding patterns, have also been associated with increased risk of constipation in children (Tabbers & Benninga, 2015). Reduced intestinal peristalsis leads to prolonged colonic transit time, increased water reabsorption, and subsequent formation of hard stools (Benninga et al., 2016).

At the local level, data from the Sungai Besar Community Health Centre indicate a high proportion of infants consuming complementary foods and formula feeding, with a notable number experiencing constipation. Variability in local prevalence compared with global estimates highlights the importance of contextual determinants such as dietary practices, caregiver knowledge, and access to health services. Community-level epidemiological assessments are essential for designing targeted interventions that are culturally and contextually appropriate (Koppen et al., 2018).

Constipation in infancy can produce both short-term and long-term consequences. Short-term effects include abdominal discomfort, irritability, decreased appetite, and inadequate weight gain. If left untreated, chronic constipation may lead to fecal impaction, anal fissures, stool withholding behavior, and persistent bowel dysfunction later in childhood (Benninga et al., 2016; Koppen et al., 2018). In addition, chronic constipation has been shown to negatively affect the quality of life of children and their families, highlighting the importance of early prevention and management (Youssef et al., 2005). Therefore, early identification and appropriate management are critical to prevent complications and promote optimal growth and development.

Management strategies for infant constipation include pharmacological and non-pharmacological approaches. Pharmacological treatments such as osmotic laxatives (e.g., polyethylene glycol) are effective and widely recommended; however, concerns regarding prolonged use, parental anxiety, and preference for natural approaches often lead caregivers to seek complementary therapies (Tabbers et al., 2014; Gordon et al., 2016). Non-pharmacological

interventions, including abdominal massage and pediatric massage therapy, have been increasingly studied as safe adjunctive treatments. Evidence suggests that abdominal massage may stimulate intestinal peristalsis, reduce colonic transit time, and increase bowel movement frequency in children with functional constipation (Liu et al., 2021; Malekiantaghi et al., 2025).

Physiologically, pediatric massage therapy is hypothesized to enhance gastrointestinal motility through modulation of the autonomic nervous system, particularly via stimulation of parasympathetic (vagal) activity. Increased vagal tone has been associated with improved digestive function and intestinal peristalsis (Field, 2019). Furthermore, the enteric nervous system relies on neurotransmitters such as serotonin (5-hydroxytryptamine), which plays a central role in regulating gut motility and defecation reflexes (Gershon & Tack, 2007). Although these mechanisms are biologically plausible, direct physiological measurements are rarely incorporated into community-based intervention studies, indicating a need for further mechanistic research.

Midwives play a crucial role in promotive and preventive infant health services, including monitoring growth, educating caregivers, and implementing complementary interventions. Integration of pediatric massage therapy into maternal and child health programs may represent a feasible, low-cost strategy, particularly in primary healthcare settings. However, most available studies remain limited to hospital-based or general populations, and there is a scarcity of empirical research examining the effectiveness of pediatric massage therapy specifically among infants aged 6–12 months in the Sungai Besar Community Health Centre working area.

This research gap underscores the importance of conducting a focused local study to evaluate the effectiveness of pediatric massage therapy as a non-pharmacological intervention for constipation in infants. Generating context-specific evidence is expected to support evidence-based midwifery practice and contribute to improved infant health outcomes at the community level.

METHODS

This study uses a quasi-experimental method with a one-group pretest-posttest design. This design involves a single group of subjects who are given an initial measurement (pretest) before the intervention, followed by a re-measurement (posttest) after the intervention is administered. The variables in this study consist of two variables, namely pediatric massage therapy as the independent variable and constipation in infants as the dependent variable.

This study has obtained ethical approval from the Health Research Ethics Committee of the Health Polytechnic of the Ministry of Health Pontianak with letter number 020/KEPK-PK.PKP/II/2025.

The population in this study consisted of infants aged 6–12 months with formula-fed infants who experienced constipation in the working area of Sungai Besar Health Centre, totaling 62 infants. The sampling technique in this study used consecutive sampling. Based on sample calculations plus a 10% potential dropout, a total of 38 infants aged 6-12 months with formula-fed infants who experienced constipation were obtained.

The researchers collected data using primary data obtained directly from respondents. In this study, primary data was obtained from the parents of infants experiencing constipation by having them fill out observation sheets before (pretest) and after (posttest) the administration of pediatric massage therapy. Data collection was carried out by distributing questionnaires based on the Bristol Stool Form Scale before and after the intervention was given. The research instrument used was an observation sheet referring to the Bristol Stool Form Scale, which is a scale used to classify stool form and consistency ranging from type 1 (very hard/separate like nuts, indicating severe constipation) to type 7 (liquid stool without form, indicating diarrhea). This scale was developed by researchers at

the University of Bristol, England, and consists of 7 types of stool. The intervention in the form of pediatric massage therapy was administered for 15 minutes each session, three times in one month. The massage techniques used refer to the IHCA (Infant Health Care Association) Institute standards. These techniques include abdominal massage with clockwise movements following the colon path to stimulate intestinal peristalsis, the "I Love You" (I-L-U stroke) technique on the abdominal area to aid the movement of gas and stool, the "walking fingers" movement (a finger-walking motion on the abdomen), as well as flexion-extension movements of both the baby's legs (bicycle movement) to help stimulate elimination. All procedures are performed with gentle pressure and adjusted to the baby's condition and comfort.

Normality testing was carried out using the Shapiro-Wilk test, as the sample size was less than 50 infants aged 6-12 months with FORMULA-FED INFANTS experiencing constipation. In addition to statistical significance, the magnitude of the intervention effect was evaluated using effect size (r). Based on the Wilcoxon signed-rank test results ($Z = -5.42$, $n = 38$), the calculated effect size was $r = 0.88$, indicating a large effect. This finding suggests that the intervention had a strong and meaningful impact, despite the relatively modest sample size. Subsequently, data analysis was conducted using the Wilcoxon test due to the non-normal distribution of the data. The average stool type before receiving pediatric massage therapy was 1.82 with a standard deviation of 0.393, a minimum value of 1 and a maximum value of 2. Meanwhile, the average stool type after receiving pediatric massage therapy was 3.47 with a standard deviation of 0.603, a minimum value of 2 and a maximum value of 4. The average frequency of bowel movements before receiving pediatric massage therapy was 1.00 with a standard deviation of 0.000 and the minimum and maximum values were 1. The average frequency of bowel movements after receiving pediatric massage therapy was 1.95 with a standard deviation of 0.226, a minimum value of 1 and a maximum value of 2.

RESULTS

The results of the study are presented in the following table:

Table 1. Characteristics of Respondents

Characteristics	Number (n= 38)	Percentage (%)
Sex		
Male	13	34.21%
Female	25	65.79%
Age		
6 months	5	13.16%
7 months	13	34.21%
8 months	6	15.79%
9 months	1	2.63%
10 months	1	2.63%
11 months	2	5.26%
12 months	10	26.32%
Daily Complementary Feeding (CF) Intake		
< 250 ml	0	0.00%
250 - 500 ml	38	100.00
> 500 ml	0	0.00%

Based on the table above, it is explained that out of 38 respondents, the majority were 7 months old, with 13 babies or 34.21%, and 65.79% of the respondents were female. Meanwhile, all babies consuming exclusive breast milk, totaling 38, consumed formula milk with a volume of 250 to 500 mL daily.

Table 2. Frequency distribution of stool types and bowel movement frequency of 6-12 month-old infants with constipation in the working area of Sungai Besar Health Centre, Ketapang Regency before and after receiving pediatric massage therapy

Description	Pre		Post	
	f	(%)	f	(%)
Bowel movement frequency				
≤ 3 x / weeks	38	100.00%	2	5.6%
> 3x / weeks	0	0.00%	36	94.74%
Jumlah	38	100.00%	38	100.00%
Stool type				
Type 1	7	18.42%	0	00.00%
Type 2	31	81.58%	2	5.26%
Type 3	0	00.00%	16	42.11%
Type 4	0	00.00%	20	52.63%
Type 5	0	00.00%	0	00.00%
Type 6	0	00.00%	0	00.00%
Type 7	0	00.00%	0	00.00%

Based on table 2 above, the results show that 38 infants (100%) had a bowel movement frequency of ≤ 3 times per week, with 7 infants (18.42%) having type 1 stool and 31 infants (81.58%) having type 2 stool before receiving paediatric massage therapy intervention. After the paediatric massage therapy intervention, the results showed that 36 infants (94.74%) had a bowel movement frequency of > 3 times per week, with 16 infants (42.11%) having type 3 stool, 20 infants (52.43%) having type 4 stool, and 2 infants (5.26%) having a bowel movement frequency of ≤ 3 times per week with type 2 stool.

The findings in Table 2 show an improvement in bowel movement frequency and stool consistency following the paediatric massage therapy intervention. Before the intervention, all infants (100%) had bowel movement frequencies of ≤3 times per week, with most presenting hard stool consistency (type 1 and 2). After the intervention, the majority of infants (94.74%) experienced bowel movements >3 times per week, along with softer stool types (type 3 and 4). Despite these encouraging findings, the relatively rapid changes observed over a short intervention period warrant careful interpretation.

Several potential sources of bias may partially explain the magnitude of improvement. First, reporting bias cannot be ruled out, as outcome data were obtained from parental reports, which may be influenced by subjective perceptions. Second, the Hawthorne effect may have occurred, whereby parents increased their attention to infant care and bowel habits during the study period, potentially contributing to improved outcomes. In addition, social desirability bias may have influenced parents to report favorable results in line with perceived expectations of the intervention.

Considering these factors, the observed improvement may reflect not only the effect of paediatric massage therapy but also increased caregiver awareness and engagement during the

intervention. Therefore, while paediatric massage therapy appears to be a promising complementary approach for managing constipation in infants, further studies using objective measurements, control groups, and longer follow-up periods are recommended to strengthen causal inference.

Table 3. Differences in stool types before and after pediatric massage therapy

Variable	n	*Z*	p- value
Before-after pediatric massage therapy	38	-5.423	0.000

Based on Table 3, with a value of ρ 0.000 (ρ < 0.05), it is concluded that there is a difference in stool type before and after being given paediatric massage therapy intervention in infants aged 6-12 months with formula-fed infants in the working area of Sungai Besar Health Centre, Ketapang Regency.

Table 4. Differences in bowel movement frequency before and after pediatric massage therapy

Variable	n	*Z*	*p-value*
Before-after pediatric massage therapy	38	-6.000	0.000

Based on table 4, the p-value is 0.000 or (p < 0.05), so it is concluded that there is a difference in the frequency of bowel movements before and after receiving paediatric massage therapy intervention in infants aged 6-12 months with formula-fed infants in the working area of Sungai Besar Health Centre, Ketapang Regency.

DISCUSSION

This study demonstrates that pediatric massage therapy was associated with improvements in constipation-related symptoms among formula-fed infants aged 6–12 months, including increased bowel movement frequency and improved stool consistency and defecation comfort after the intervention. These changes suggest a potential enhancement of gastrointestinal function; however, because the study used a quasi-experimental design without a concurrent control group, findings must be interpreted cautiously since causality cannot be firmly established.

Several potential confounding factors not fully controlled in this study may have contributed to the observed outcomes, including fluid intake, which affects stool hydration and bowel regularity; the introduction and progression of complementary feeding (MPASI) that commonly occurs between 6–12 months; and variations in infant physical activity levels, all of which can independently influence intestinal motility and bowel habits. Variations in these factors during the intervention period could partially explain improvements in bowel habits aside from pediatric massage therapy.

From a physiological perspective, pediatric massage therapy is hypothesized to influence gastrointestinal function through modulation of the autonomic nervous system. Specifically, gentle tactile stimulation may increase parasympathetic (vagal) activity, which has been associated with enhanced gastrointestinal peristalsis, improved coordination of smooth muscle contraction, and accelerated colonic transit in other pediatric populations (Diego, Field, & Hernandez-Reif, 2005). Although direct measurement of these mechanisms was not performed in this study, broader

massage research has demonstrated increased vagal tone and associated improvements in gastrointestinal motility following moderate-pressure infant massage (Diego et al., 2005; Field, 2019). Moreover, infant massage could influence local gastrointestinal reflexes and enteric neurotransmitter signaling—such as serotonin, which plays central roles in gut motility and defecation reflexes—but these biological mechanisms were inferred rather than directly measured in the present study.

Statistically, the Wilcoxon signed-rank test showed a significant difference in bowel movement frequency before and after the intervention ($\rho = 0.000$; $p < 0.05$). Prior to the intervention, all 38 infants had bowel movements ≤3 times per week, whereas after intervention 36 infants achieved >3 bowel movements per week. Although these findings are generally consistent with prior evidence indicating positive associations between infant massage and improvements in constipation outcomes, there are important similarities and differences across studies. For example, a recent meta-analysis of randomized controlled trials suggests that infantile massage increases defecation frequency and reduces constipation symptoms compared to drug therapy alone, though effects on stool form and difficulty of defecation are less consistent (Liu, Gang, Yunwei, & Lin, 2021). Similarly, another randomized controlled trial in older children found that abdominal massage improved overall constipation symptom scores but did not significantly change stool consistency (Malekiantaghi et al., 2025), highlighting variability in how massage impacts diverse populations and outcomes. Such differences may reflect variations in massage techniques, treatment duration, and participants' baseline characteristics, underscoring the need for standardized protocols in future studies.

An additional observation in the current study is that 2 infants did not achieve the >3 bowel movements per week threshold after intervention. This persistence of constipation in a minority of participants may relate to several factors, including age-related gastrointestinal maturation, duration or chronicity of constipation prior to the intervention, or variability in caregiver adherence to the massage protocol. Previous research suggests that younger or more developmentally immature infants may respond differently to tactile stimulation, and longer histories of constipation may require extended or adjunctive therapies before measurable improvement occurs.

From a clinical perspective, the improvements observed in this study suggest that pediatric massage therapy may serve as a promising, feasible, low-cost non-pharmacological complement to conventional constipation management in routine midwifery and pediatric practice. In midwifery care, infant massage can be integrated into caregiver education programs to support digestive comfort, especially where access to pediatric specialists is limited. However, implementation should be accompanied by guidance on adequate fluid intake, age-appropriate complementary feeding, and strategies to promote infant physical activity in order to optimize gastrointestinal outcomes. Clinicians should also recognize that individual responses may vary and monitor for cases where additional assessment or alternative interventions are required.

Despite these promising observations, this study has several limitations. The relatively small sample size ($n = 38$) may limit statistical power and generalizability. Outcome data relied on caregiver reports, which introduces potential reporting bias, and important confounders such as fluid intake, dietary changes, and activity levels were not quantified. Additionally, the single-center setting limits external validity. These limitations underscore the need for cautious interpretation and highlight the need for more rigorous controlled trials. A meta-analysis including multiple RCTs indicates that infant massage can increase bowel movement frequency and reduce constipation symptoms compared to drug therapy alone, but variations in technique and study quality warrant cautious interpretation of

mechanisms and effect sizes (Liu et al., 2021) and further reinforce the importance of well-designed comparative studies.

Future research should focus on larger, multi-center randomized controlled designs with longer follow-up periods and incorporate objective outcome measures such as standardized stool diaries, detailed dietary intake records, and physical activity monitoring. Investigations into biological mechanisms—such as direct measurement of autonomic nervous system activity, biomarkers of intestinal motility (e.g., motilin, serotonin), or neurophysiological markers of vagal activity—would strengthen understanding of pediatric massage therapy's independent effects within the broader context of infant development and feeding transitions.

CONCLUSION

The results of this study indicate a significant difference in bowel movement frequency among formula-fed infants aged 6–12 months before and after receiving pediatric massage therapy at the Sungai Besar Health Centre, Ketapang Regency. Prior to the intervention, all 38 infants had bowel movements ≤3 times per week, whereas after the massage therapy, 36 infants achieved >3 bowel movements per week. These findings suggest that pediatric massage may enhance gastrointestinal motility, although two infants continued to experience constipation, which could be influenced by factors such as age, duration of constipation prior to the intervention, or adherence to the massage protocol.

In addition, the study demonstrated a change in stool type after the intervention. Most infants initially had type 1 or 2 stools (hard or lumpy), while after the massage therapy, most had type 3 or 4 stools (soft and smooth), indicating improved stool consistency. Overall, these findings suggest that pediatric massage therapy was associated with improvements in constipation-related outcomes among formula-fed infants aged 6–12 months in this population. Clinically, the results support the integration of pediatric massage into caregiver education and routine infant care practices, particularly in primary healthcare settings where access to pediatric specialists is limited.

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