

**Research Article**

# The Effect of Field Massage on Bilirubin Levels in Neonates with Hyperbilirubinemia

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**Abstract.** Hyperbilirubinemia is one of the most common clinical phenomena. It is found in 80% of premature infants and 60% of term infants in the first week of life. Most hyperbilirubinemia does not require special therapy, but because of the potential toxic effects, all neonates should be monitored to detect the possibility of severe hyperbilirubinemia. Based on data from the Directorate of Family Health, in 2019, out of 29,322 under-5 deaths, 69% of deaths occurred in the neonatal period. One of the causes of mortality in neonates is bilirubin encephalopathy/kernicterus. Bilirubin encephalopathy is the most severe complication of neonatal jaundice. In addition to encephalopathy, other risks include sequelae in the form of cerebral palsy, high-pitched deafness, paralysis and dental dysplasia, which greatly affect the quality of life. Several studies have been conducted to find alternative supporting therapies that can be used to effectively reduce bilirubin levels in addition to providing phototherapy, one of which is the provision of field massages. Field massage is thought to increase the excretion of bilirubin in infants during phototherapy. The purpose of this literature review was to determine the effect of field massage on reducing bilirubin levels in neonates with hyperbilirubinemia. This was a traditional narrative literature review which grouped similar extracted data according to the results measured to answer the objectives. According to the results, giving field massages two times a day for three days for 15 minutes each time was able to significantly reduce bilirubin levels.

**Keywords:** field massage, hyperbilirubinemia, neonates

## 1. Introduction

Hyperbilirubinemia is one of the most common clinical phenomena found in 80% of premature infants and 60% of term infants in the first week of life[1]. Infants with hyperbilirubinemia appear jaundiced due to the accumulation of the yellow pigment bilirubin in the sclera and skin. This condition is known as neonatal jaundice. Excessive increase in bilirubin can be potentially toxic and cause death. Based on data reported to the Directorate of Family Health through [komdat.kesga.kemkes.go.id](http://komdat.kesga.kemkes.go.id), in 2019, out of 29,322 under-five deaths, 69% (20,244 deaths) of them occurred in the neonate. Of all 2 reported neonatal deaths, 80% (16,156 deaths) occurred in the first six-day period of life. One of the causes of mortality in neonates is bilirubin encephalopathy (better known

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as kernicterus). Premature babies have a higher risk of developing kernicterus than term babies [2]. Bilirubin encephalopathy is the most severe complication of neonatal jaundice. In addition to having a high mortality rate, it can also cause sequelae in the form of cerebral palsy, high tone deafness, paralysis and dental dysplasia which greatly affect the quality of life. Various methods have been used to manage newborns with hyperbilirubinemia, one of the standard methods that is often used is phototherapy. However, there are some adverse side effects of phototherapy, including: diarrhoea, skin rash, dehydration, hyperthermia, retinal disorders and bronze baby syndrome. Phototherapy can also increase the risk of melanoma in the future and increase the psychological stress of the mother and baby [3]. The field massage method is massage in infants or neonates that focuses on providing stimulation to the chest and abdomen area. Field massage is an alternative to supporting therapy that is thought to increase the excretion of bilirubin in infants during phototherapy. Novianti et al (2018) stated that field massage as adjuvant therapy can reduce serum bilirubin levels effectively[4]. The research added that massage with the field method can reduce excessive bilirubin levels in neonates<sup>(3)</sup>. This is because the stimulation can stimulate metabolism so that toxins in the body can be easily decomposed and excreted through feces and urine, increasing the work of the digestive organs and the swallowing process in neonates so that there is an increase in metabolism in the body. The dose or movement of stimulation used refers to the research of M Ahmadpour-Kacho, he explains that the difference between massage with the field method and massage in general is in the area given the stimulation. The massage field provides more stimulation to the face, stomach and chest area. It aims to activate the vagus nerve to increase metabolism so that the function of the digestive organs can work better[3].

## 2. Research methods

The type of literature review used in this study is a traditional literature review (narrative) by grouping similar extracted data according to the results measured to answer the objectives. Literature review is an activity to explore literature that has been published or stated in the previous literature on a topic or aspect that has been determined to be studied. The criteria for the journal to be reviewed are research journals on neonates patients with hyperbilirubinemia with a journal publication time span of 2016-2021. The analytical method used uses journal content analysis, then coding is carried out on the contents of the journal being reviewed, after coding is done then summarized and compared between one literature with another.

TABLE 1: characteristics of respondents by gender

No	Gender	Result	Prosentase
1	Male	187	51.1 %
2	Female	179	48.9 %
	Result	366	100 %

TABLE 2: Characteristics of Respondents by Type of Childbirth

No	Journal	Type Of Delivery	Normal Action
1	Korkmaz (2020)	21	29
2	Eghbalian (2017)	62	72
3	Abdelhamid Zaki, N. (2019)	33	27
4	Kenari (2020)	50	40
5	Novianti (2017)	14	18
	Summary	180 (49.1%)	186 (50.9%)

### 3. Results and Discussion

#### a. Research result

Based on table I it can be concluded that the results of male respondents were 187 (51.1%), and female respondents were 179 (48.9%).

Table II shows that the type of delivery *Action* is as many as 186 respondents (50.9%), and the type of Normal Delivery is 180 respondents (49.1%)

Table III shows that from 5 journals that have been reviewed, the average massage is 2.2 times, the average massage duration is 15 minutes and the massage duration is 3.4 days.

Based on table IV above, the mean defecation is 4.62 times per day for the treatment group and 3.07 times per day for the control group, which means that field massage is effective in increasing the frequency of defecation in infants.

TABLE 3: Average Massage Frequency, Massage Duration, and Treatment Duration

No	Journal	Frequency (n/day)	Massage Duration (minute)	Treatment Time (Days)
1	Korkmaz (2020)	2	15	2
2	Eghbalian (2017)	2	15	4
3	Abdelhamid (2019)	2	15	5
4	Kenari (2020)	3	15	3
5	Novianti (2017)	2	15	3
	Average	2,2	15 minute	3,4 days

TABLE 4: Differences in the mean frequency of defecation for each group

No	Juornal	Defecation Frequency (Mean)	
		Control Group	Intervention group
1	Korkmaz (2020)	5 x/days ( range 2.57–9)	8 x/days (range 6.48-11.86)
2	Eghbalian (2017)	3.62 x/days	5.41 xdays
3	Abdelhamid Zaki, N. (2019)	1.97 x/days	2.72 x/days
4	Kenari (2020)	-	-
5	Novianti (2017)	1.56 x/days	2.44 x/days
	Average	3.03 x/days	4.62 x/days

TABLE 5: Decreased Bilirubin Levels among Groups

Journal	Bilirubin Level						P Value
	Control		Intervensi				
	Pre	Post	Pre and post difference	Pre	post	Pre and Post difference	
Korkmaz (2020)	18.64±1.42	11.04± 1.57	7.6	17.91± 1.55	9.02±1.27	8.89	P<0.001
Eghbalian (2017)	18.33	9.36	8.97	18.44	6.94	11.5	p< 0.001
Abdelhamid Zaki (2019)	12.63±4	7.4±3.43	5.23	11.26±2.27	2.5±1.48	8.76	p< 0.001
Kenari (2020)	17±1.38	6.97±0.47	10.03	17.01±1.46	5.56±0.48	11.45	p<0.001
Novianti (2017)	14,69	10,05	4.64	15,26	8,09	7,17	P<0.001
	Average Pre-Post	difference	7.29	Average Pre-Post	difference	9.55	

Table V shows that all journals have significant results (p<0.001), which means that field massage is effective in reducing bilirubin levels. The mean value of the difference before and after treatment in the control and treatment groups were 7.29 mg/dL and 9.55 mg/dL, respectively.

Based on table VI, it is known that field massage is effective in reducing the length of stay in hospital, the average decrease in length of treatment is 19.72 hours.

a. Discussion

TABLE 6: Length of hospital stay and duration of phototherapy

No	Journal	Length of hospital stay Control group	Intervention group	Decreased Treatment time	P Value
1	Abdelhamid Zaki (2019)	75.46± 15.52	50.13± 15.53	25.33	<0.001**
2	Kenari (2020)	95.57±8.28	*81.47±3.56	14.1	<0.001
	Average reduction in treatment time			19.72	

## 1. Gender

Based on table I, it is known that male has a greater risk of hyperbilirubinemia than female new-borns. This can be seen from the percentage of respondents who are male is as much as 51.1% of the total respondents. Quoted from The American Academy of Pediatrics (AAP) it is stated that male is a risk factor for hyperbilirubinemia. This is in line with the research conducted by Karbandi et al (2016), Moghadam et al (2015), Abdelhamid Zaki, N. (2019), Kenari (2020), Novianti (2017) and Boskabadi (2020) that most of the samples with hyperbilirubinemia were found in male<sup>(2,3,4,5,6,7)</sup>. There are several things that predispose boys to have a higher risk of hyperbilirubinemia compared to girls, including:

a. The Y chromosome possessed by males can increase the rate of destruction of red blood cells and inhibit the maturation of metabolic enzymes bilirubin. In baby boys bilirubin is produced more quickly than in baby girls, this is because baby boys have protein Y in the liver which plays a role in the uptake of bilirubin to liver cells. Males have tendency to suffer from hyperbilirubinemia. (Tazami et al (2013)

b. The prevalence of Gilbert's syndrome (genetic disorder of bilirubin conjugation) is reported to exist more than double in men than in women (Watchko, JF. 2006).

c. G6PD deficiency is the most common enzyme disorder in humans, which is gender-linked (x-linked) which generally only manifests in males (Wibowo, 2007). G6PD deficiency is widespread and often unrecognized, and is more common in populations around the Mediterranean, Middle East, Arabian Peninsula, Southeast Asia, and Africa. Its spread due to immigration, and interbreeding has turned G6PD deficiency into a global problem:[5]

Based on the results of the research conducted by the review and corroborated by other studies and existing theories, it can be concluded that male is one of the risk factors for hyperbilirubinemia.

## 2. Gestational Age

Based on the journal that was reviewed, it was found that all respondents have gestational age at term (100%). Hyperbilirubinemia is one of the most common clinical phenomena found in 80% of premature infants and 60% of term infants in the first week of life[1]. The increased production of bilirubin in new-borns is due to the shorter life span of infant erythrocytes than adults, increased heme degradation, increased cytochrome turnover, and increased reabsorption of bilirubin from the intestine.

Research conducted by Kamal et al (2011) on 124 cases of hyperbilirubinemia showed that 24 cases were physiological cases, 84 cases were due to lack of breast milk (Breast

feeding Jaundice), 5 cases were due to breastfeeding problems (Breast Milk Jaundice), 5 cases were due to premature birth, and 6 cases due to pathological processes. (Kamal 2011) Based on the results of Kamal's 2011 research, it can be concluded that the most common cause of hyperbilirubinemia in term neonates is inadequate breastfeeding (lack of milk). Lack of breast milk intake can cause hyperbilirubinemia due to increased enterohepatic circulation. The American Academy of Pediatrics (AAP) also stated that one of the risk factors for hyperbilirubinemia is the lack of breast milk[5].

Moreover from The American Academy of Pediatrics (2004): one of the risk factors for hyperbilirubinemia is prematurity caused by immature liver cells (immature), slow bilirubin uptake and conjugation and increased enterohepatic circulation. This causes preterm infants to experience hyperbilirubinemia more often than term infants. Premature babies have a 2-fold higher risk than term babies and bilirubin concentrations increase on days 5 to 7 after birth. Hyperbilirubinemia in premature babies occurs on days 2-5 and severe hyperbilirubinemia is more clearly seen in small babies (birth weight 2500 grams or gestational age) [5]

Based on the results of the research conducted by the review and corroborated by other studies and existing theories, it can be concluded that gestational age is a risk factor for hyperbilirubinemia, found in 80% of premature infants and 60% of term infants in the first week of life. The most common is increased enterohepatic circulation due to insufficient breast milk intake.

### 3. Characteristics of Respondents by Type of Delivery

Based on Table II about the characteristics of respondents based on the type of birth, it was found that the respondents who gave birth by using the Action methods (SC/forceps/vacuum) were 186 (50.9%), and who gave birth vaginally amounted to 180 respondents (49.1%). Hyperbilirubinemia can occur in every delivery process, both normal delivery and surgical deliveries. Babies who are born normally or by action do not cry immediately, it can cause hemodynamic abnormalities so that respiratory depression and causes hypoxia throughout the body which results in respiratory/metabolic acidosis which can interfere with bilirubin metabolism[4] A cross-sectional study conducted stated that the total bilirubin value was higher in infants with vaginal delivery compared to caesarean section with p of 0.02 where vaginal delivery with vacuum and oxytocin induction was suspected as a risk factor for hyperbilirubinemia. Babies born by vacuum extraction and forceps extraction have a tendency for closed bleeding in the head, such as caput sudcadenaum and cepalhematoma which are risk factors[6]. Based on the results of the research conducted by the review and corroborated by other studies and existing theories, it can be concluded that the type of delivery is one of the risk

factors for hyperbilirubinemia, where the type of delivery with action (SC/Vacuum) has a higher risk for hyperbilirubinemia.

#### 4. Frequency and Duration of Massage

The results of research in 5 reviewed journals stated that massage using field massage with a frequency of 2 times a day for 15 minutes performed 3-5 days can reduce bilirubin levels in neonates with hyperbilirubinemia[4], field massage intervention which is carried out 2 times a day for 15 minutes for 3 (three) days is effective in reducing serum bilirubin levels in hyperbilirubinemic infants undergoing phototherapy. Giving massage 3-5 days is proven to significantly reduce bilirubin levels, this is in accordance with research conducted Kenari (2020) with the title "Comparing the effect of kangaroo mother care and Field massage on serum bilirubin level of term neonates with hyperbilirubinemia under phototherapy in the neonatal ward" that giving Field massage for 3 days gave a significant decrease in bilirubin: before treatment  $17.01 \pm 1.46$  to  $5.56 \pm 0.48$  after treatment[7]. The results of a study conducted by Eghbalian (2017) with the title "The lowering of bilirubin levels in patients with neonatal jaundice using massage therapy: A randomized, double-blind clinical trial" stated that there were significant differences in bilirubin levels and frequency of defecation in the two groups on the day of the 3rd and 4th week with  $p < 0.05$ [8]. The average time of massage in this study is also in line with the results of the research of Lin et. al (2015) and Ahmadipour (2020), which stated that giving massage within 3-4 days can give significant results, where there is a significant difference ( $p = 0.03$ ) between the group given infant massage compared to the control group<sup>(1,9)</sup>. In addition to being proven effective in reducing bilirubin levels in term neonates with hyperbilirubinemia, massage using field massage technique has also been shown to have an effect on reducing bilirubin levels in premature infants and in healthy neonates to prevent hyperbilirubinemia. Concluded that by massaging healthy neonates for 3 times for 15-20 minutes for 4 days can prevent pathological hyperbilirubinemia in healthy neonates[9]. Found that the results of massage carried out 2 times for 20 minutes carried out from the first postnatal day to the fourth day resulted in an increase in defecation and a significant difference in bilirubin levels between the control and treatment groups[2]. Based on the results of research that The review was carried out and strengthened by other studies and existing theories, so it can be concluded that massage with field massage with a frequency of 2 times a day for 15 minutes for 3 days can help reduce bilirubin levels in neonates with hyperbilirubinemia undergoing phototherapy. In addition, field massage is also effective to help prevent hyperbilirubinemia in healthy infants and premature infants.

#### 5. Increased frequency of defecation (BAB)

The results of research in 5 journals that were reviewed showed that there was an increase in the frequency of defecation (BAB) and a decrease in bilirubin levels after massage. Research conducted by Nora Abdelhamid Zaki and Amina Mohamed Thabet (2019) entitled "Effect of Field massage on Bilirubin Level and Stool Passage Frequency among Neonates with Hyperbilirubinemia under Phototherapy", stated that there was an increase in the frequency of bowel movements in the massage group compared to the control group, the average of each group was 2.72 times per day and 1.97 times per day times per day[10]. The more often massage stimulation is carried out for neonates, the more effects will be obtained related to digestive and metabolic processes, thereby increasing defecation. The increase in the frequency of defecation (BAB) in the treatment group was due to the excretion of conjugated bilirubin and bilirubin that has been broken down by phototherapy rays, most of which were excreted through feces (85%), through urine only (1%), and the remaining 14% returned into the urine enterohepatic circulation)[4]. Massage in neonates can also stimulate the release of meconium and can increase bowel movements and is expected to increase bilirubin excretion. An increase in stool frequency reduces the reabsorption of conjugated bilirubin secreted in the intestine and thus prevents an increase in bilirubin[11].

Based on the results of the research conducted by the review and strengthened by other studies and existing theories, it can be concluded that massage with a field massage with a frequency of 2 times a day for 15 minutes carried out for 3 days can help increase the frequency of defecation as much as 2-8 times a day in neonates with hyperbilirubinemia.

#### 6. Decreased Bilirubin Levels

Based on table III concerning Bilirubin Levels Before and After, the average decrease in bilirubin levels in the treatment group was 9.55 mg/dL and in the control group was 7.29 mg/dL, the decrease in bilirubin levels between the two groups showed a significant difference  $p < 0, 05$ . This shows that giving field massage to neonates with hyperbilirubinemia has been shown to have an effect on reducing bilirubin levels.

In line with research conducted by Abdelhamid, Eghbalian (2017) suggested that being given field massage therapy 2 times a day for 15 minutes for 4 days was proven to reduce bilirubin levels from 18.44 mg/dL to 6.94 mg/dL[8]. The results of research conducted by Kenari (2020) and Novianti (2017) also showed a significant decrease in bilirubin levels ( $p < 0.001$ ) in the treatment group with a decrease of 7.17-11.5 mg/dL after massage with field massage<sup>(4,7)</sup>. Field massage as adjuvant therapy can increase the excretion of bilirubin that has been broken down through phototherapy mechanisms. Bilirubin converted by phototherapy (lumirubin) should be excreted rapidly through



feces and urine. However, in new-borns, the intestinal activity to excrete meconium is not yet optimally functioned due to suboptimal nutrient intake and immature digestive processes. So that lumirubin is not easily hydrolyzed and reduced by intestinal bacteria to be excreted through feces and urine, even the isomers of bilirubin and lumirubin are very easy to use.

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