

The Effect of Implementing Massage on Direct Bilirubin Levels and Intestinal Defecation in Neonates with Physiological Jaundice Undergoing Phototherapy

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Abstract

Background: Exaggerated physiological jaundice is physiological jaundice that persists longer than usual. Phototherapy is the first line of treatment for physiological jaundice, although it has many adverse reactions. Recently, field massage has become increasingly used as a complementary therapy for treating hyperbilirubinemia. Some studies have pointed out that massage therapy improves neonatal jaundice by reducing the enterohepatic bilirubin cycle or inhibiting its production.

Objectives: The current study aims to evaluate the effect of applying massage on the level of bilirubin in neonates with physiological jaundice undergoing phototherapy in Idleb University in the hospital of Al Amal in Azzaz city.

Methods: According to the experimental method, the study was applied to a random sample that included 100 neonates in the term (38- 42) gestational weeks from neonates with jaundice of both sexes in the NICU department in Al Amal hospital in Azzaz city in northern Syria who are undergoing phototherapy in the incubator. They were divided into two groups. The experimental group consisted of 50 neonates who received phototherapy and massage care, while the control group consisted of 50 neonates with physiological jaundice who received phototherapy without massage. The levels of direct bilirubin, intestinal movements and intestinal elimination were evaluated between the two groups within 4 days.

Tools of the study: tool 1 :The part one of this tool is a neonate , father ,and mother demographic data , The part two of this tool is a neonate vital signs (pulse , blood pressure , breathing , temperature , intestinal movements and intestinal elimination) The part three of this tool is a neonate laboratory values (sgpt , sgot , hemoglobin , direct bilirubin and in direct bilirubin) tool 2 : The massage protocol which developed from field massage . Tool validity and reliability :

The tools of the study were tested for content validity by five experts in the field of pediatric nursing , content validity index was 95% , reliability of the developed tools was tested through the internal consistency and the value of Cronbach's alpha coefficient was (0.911) .

A pilot study : was initially carriedout before the actual of data collection phase , it was five neonates to test the tool for its clarity , applicability , feasibility and identify obstacles that may be found during the data collection process .

Data collection was done through a period of 10 mounthes (from August of 2024 tell June 2025

. Ethical consideration : Approval from the Institutional Ethics Committee was obtained. A written informed consent was taken from one of the parents. **Inclusion and exclusion criteria:** The inclusion criteria for study participation were as follows: (1) healthy full-term (gestational age, 38 –42 weeks) neonates, (2) birth weight of 2000–4000 g, (3) APGAR score at birth more than 10 , and (4) receiving incubator phototherapy for hyperbilirubinemia (5) the age of birth between 3 - 10 days . We **excluded** infants with rhesus and ABO incompatibility, neonates who needed blood transfusion cause of high level of bilirubin subgaleal hemorrhage, nonstable hemodynamic state congenital anomalies, infections, a glucose-6-phosphate dehydrogenase deficiency , liver obstructive disease . **phototherapy applying :** the neonate's eyes and genitalia were covered to prevent damage , neonates were placed in the incubator with out clothes to allow body surface exposure to fluorescent rays , the distance between halogen lambs and body surface were 45 cm to cover neonates skin from injuries .

Data collection : All participating neonates in the intervention group received massage therapy by the researcher who received a 36 training hours course in the physical medicine center in Idleb university hospital to apply neonate massage . Neonates in the control group did not receive massage therapy. Each

massage therapy session started on the first day of phototherapy, lasted for 20 min per session, and was conducted twice daily morning and evening for 4 consecutive days. Phototherapy was stopped for the 20 min during which neonates received massage therapy. **Massage techniques** were performed in according to the developed program of (field massage) which developed by 5 physiotherapy specialists to be suitable and adequate for neonates . and applied by the following steps :

- (1-) researcher handwashing by using alcohol and wait till hands dry and wear gloves
- (2) - using medical sterile Johnson oil on hands and rubbing it to allow its warming
- (3) - examine skin area to notice skin rashes or abnormalities before massaging
- (4) - skin drying after finish the massage
- (5) - neonate touching for 30 seconds before starting massage to enhance the reassurance
- (6) - distribution of time, direction and steps on massaging on body areas according to the following table:

Part of body	Procedure	Direction	Time by minutes
Head and face	Use the two of your thumbs by the way of mild pressure and light wipe	Circular movements from the front and around the eyes and cheeks	2
Neck	Use the three middle fingers in neck massaging with a mild pressure toward below the chin	From below the chin towards the top of the chest .	3
Chest	It is done by using the palm of the hand in a sweeping motion while pulling the hand away	From far to near towards the heart from all sides of the chest in order of increase venous return to the heart	3
Abdomen	Use the three middle fingers and palm with a mild pressure	In the circular motion clockwise around by using your 4 fingers around the navel	3
Upper and lower extremities	Upper and lower extremities are massaged from proximal to distal to increase the perfusion of the extremities , with light pressure to enhance venous return .	From near to far then from far to near	4
Back	Use the three middle fingers with a mild pressure	Ascending movements from bottom to top	3

Notice : all neonates were massaged under the thermal radiator

Results: the deference's between control group and experiment group with connecting to direct bilirubin were significant from the third day morning and in the fourth day of the experiment at $p < 0,05$ the frequency of intestinal defecation was statistically significant at $p < 0,001$ from the first day till the fourth day and the deference's between control group and experiment group with connecting to bowel movements were significant at $p < 0,001$ from the first day evening till the fourth day .

Conclusion: The results of this study revealed that massage therapy could reduce the level of direct bilirubin and increase the bowel movements, intestinal defecation .

Key words : massage , phototherapy , hyperbilirubinemia , jaundice .

INTRODUCTION:

All newborns have elevated bilirubin levels, but only between 50 and 60 percent of them show outward symptoms of jaundice. Sixty percent of term neonates and eighty percent of preterm neonates develop jaundice in the first week after birth (Marshall, 2020). Neonatal jaundice results from the accumulation of unconjugated bilirubin in the blood, due to increased production (i.e., hemolysis) and/or decreased enterohepatic clearance (Satrom, et al. (2023) physiological jaundice is increase in the level of bilirubin in the blood which is not immunologically induced as seen in pathological jaundice caused by blood group incompatibility such as ABO or Rh blood groups (Obeagu, et al (2022) For many, the clinical course is benign and self-limited, but for some can require hospitalization and treatment with phototherapy and/or exchange blood transfusion. A subset of infants is at risk for severe neonatal jaundice (SNJ), often defined as a total serum bilirubin (TSB) level $>20-25$ mg/dl (Slusher et al, 2017).

Photo-isomerization by phototherapy changes the bilirubin structure to a soluble state for easier excretion, and light facilitates bilirubin excretion. Serum bilirubin levels need to be checked often, every 4 to 12 hours, once phototherapy has been started (Merenstein, 2022). When the typical pattern of physiological jaundice persists for more than the expected duration, it may be deemed to be exaggerated physiological jaundice. Identifying high-risk neonates for increased physiological jaundice, frequent monitoring of serum bilirubin levels, and avoiding bilirubin encephalopathy are the main priorities of treatment (Kiliac, 2021). Massage therapy has been recognized as a novel approach to neonatal care that improves the management of neonatal illnesses and overall health (Lel, 2021). It is the process of adjusting body tissues to reduce stress and suffering while promoting well-being. It involves a range of techniques, such as kneading, massaging, and applying pressure to specific locations (Nawaz, 2021). Infant massage is a common tradition in India and many other countries. Research consistently demonstrates that infant massage promotes weight gain, improves sleep patterns, supports growth and development, and optimizes autonomic nervous system function, while also reducing colic and infant mortality rates (Field et al, 2009). Several studies were performed to investigate the effect of massage on the bilirubin level and jaundice of the infants, considering different techniques of massage (Seyyedrasooli et al, 2014). According to certain clinical studies, massage promotes bowel movement and defecation, which in turn helps to decrease bilirubin level (Abdelhamid Hamid 2019). This decrease is associated with vagus nerve stimulation, which increases intestinal motility and, thus, improves the frequency of bowel movements. It also reduces bilirubin therapy's enterohepatic circulation, which ultimately increases bilirubin excretion (Kenaria et al 2020).

METHODS AND STATISTICAL ANALYSES :

Data were organized using SPSS software version 25. Comparison between two groups was done by using the chi-square test (χ^2) for comparison between means of two different groups of parametric data. An independent samples t-test was used for comparison between more than two means of parametric data, and the F value of the ANOVA test was calculated. Correlation between variables was evaluated using Pearson's correlation coefficient (r). A significance was adopted at $p < 0,05$ for interpretation of results of the test of significance (*). Also, a highly significant value was adopted at $p < 0,001$ for interpretation of results of the test of significance.

Results : Table (1) : shows the distribution according to studied neonates percentages and their demographic data and characteristics regarding to delivery type 63,2 % from control group were normal delivery while 45,8 % from experimental group were normal delivery , 60% from control group were males while 64,6% from experimental group were males , the mothers and fathers in control group were relatives in 26,3% while 29,2% from experimental group fathers and mothers were relatives , the level of total bilirubin during the entrance to the hospital were divided into two groups the first one less than 15 mg % ml , their were 35,4 % from control group and 64,6 % from experimental group , while the level of total bilirubin at hospital discharge were divided into two groups the first one is less than 7 mg % ml , 13,2 % of control group them total bilirubin at discharge were less than 7 mg % ml while 86,8 % of experimental group them total bilirubin were less than 7 mg % ml and it was highly significant at p value $< 0,001$ ***.

Table (2): percentage distribution of studied neonates regarding to direct bilirubin levels during the days of the intervention the neonates were divided in every group into two groups according to the level of direct bilirubin (less than 3 and more than 3), the table shows that the direct bilirubin in the third day after massage in the experimental group was more than 3 for only 2.1 % of this group while 2.6% of control group them direct bilirubin was more than 3 after massage in the third day. There was a statistical difference between the intervention and control group on the third day ($p = 0,028$)*.

Table 3: Percentage distribution of studied neonates regarding intestinal defecation during the days of the intervention. In this table, the neonates were divided into two groups according to the times of intestinal defecation in the day (less than 3 times, between 3- 6 times)

In the first day the percentage of times of intestinal defecation in control group was 97.4 % less than 3 times per day while only 64.6% from experimental group in the first day the times of intestinal defecation was less than 3 times per day, while in the fourth day 0 % of control group the times of intestinal defecation were between 3 – 6 times per day while 62.5% of experimental group the times of intestinal defecation for them were between 3 – 6 times per day, it was statistic ally significant deference between both intervention and control group in the third day of massage at p value less than 0.001*** in all days of the experiment, this is very high statistical significant.

Table (4): percentage distribution of studied neonates regarding to bowel movement during the days of the intervention, in this table the neonates were divided in every group into two groups according to the times bowel movement per minute (less than 6 m/ m- and between 6- 12 m/ m) the results was that 81.3% from experimental group them bowel movements were between 6- 12 in the first day while the control group neonates has less than 6 m/ m in 100% percentage in the first day of experiment and there were deference's also in the second and third and fourth day this refer to statistically significant deference between both intervention and control group at p value < 0,001***.

Table (1): distribution of the data from the studied groups according to their demographic characteristics (n = 86)

		Control		Experimental		X2	
		N	%	N	%	P	
Delivery type	Normal	24	63.2%	22	45.8%	2.559	
	Caesarean	14	36.8%	26	54.2%	0.110ns	
Neonate sex	female	15	39.5%	17	35.4%	0.149	
	male	23	60.5%	31	64.6%	0.699ns	
Gestational age	38	15	39.5%	21	43.8%	1.14	
	39	7	18.4%	9	18.8%		
	40	13	34.2%	14	29.2%	0.888ns	
	41	3	7.9%	3	6.3%		
	42	0	0.0%	1	2.1%		
Jaundiced neonatal birth history	NO	22	57.9%	31	64.6%	0.401	
	Yes	16	42.1%	17	35.4%	0.526ns	
Pharma logical history	NO	35	92.1%	45	93.8%	0.088	
	Yes	3	7.9%	3	6.3%	0.766ns	
Medical history	NO	32	84.2%	39	81.3%	0.129	
	Yes	6	15.8%	9	18.8%	0.719ns	
Father and mother relationship	No relation	28	73.7%	34	70.8%	0.086	
	Ther is relation	10	26.3%	14	29.2%	0.770ns	
Neonate age in days	3	5	13.2%	12	25.0%	6.042	
	4	8	21.1%	12	25.0%		
	5	9	23.7%	6	12.5%	0.302ns	
	6	7	18.4%	4	8.3%		
	7	8	21.1%	10	20.8%		
Bilirubin level at admission	<15	13	34.2%	25	65.8%	0.014	
	>15	17	35.4%	31	64.6%	0.907ns	
Bilirubin level at Discharge	<7	5	13.2%	33	86.8%	50.231	
	>7	43	89.6%	5	10.4%	<0.001***	

*** highly statistically significant difference at (p < 0,001)

Table (2) percentage distribution of studied neonates regarding to direct bilirubin levels during the days of the intervention (n = 86)

		control		Experimental		X2
		N	%	N	%	P
Direct bilirubin at first day morning premassage	< 3	37	97.4%	45	93.8%	0.626
	> 3	1	2.6%	3	6.3%	0.429ns
Direct bilirubin at first day morning after massage	< 3	38	100.0%	46	95.8%	1.621
	> 3	0	0.0%	2	4.2%	0.203ns

Direct bilirubin at first day evening premessage	< 3	36	94.7%	44	91.7%	0.308
	> 3	2	5.3%	4	8.3%	0.579ns
Direct bilirubin at first day evening after massage	< 3	38	100.0%	45	93.8%	2.461
	> 3	0	0.0%	3	6.3%	0.117ns
Direct bilirubin at second day morning premessage	< 3	36	94.7%	46	95.8%	0.057
	> 3	2	5.3%	2	4.2%	0.810ns
Direct bilirubin at second day morning after massage	< 3	38	100.0%	44	91.7%	3.321
	> 3	0	0.0%	4	8.3%	0.068ns
Direct bilirubin at second day evening premessage	< 3	37	97.4%	46	95.8%	0.148
	> 3	1	2.6%	2	4.2%	0.700ns
Direct bilirubin at second day evening after massage	< 3	37	97.4%	45	93.8%	0.626
	> 3	1	2.6%	3	6.3%	0.429ns
Direct bilirubin at therd day morning premessage	< 3	37	97.4%	47	97.9%	0.028*
	> 3	1	2.6%	1	2.1%	0.867ns
Direct bilirubin at therd day morning after massage	< 3	37	97.4%	48	100.0%	1.278
	> 3	1	2.6%	0	0.0%	0.258ns
Direct bilirubin at therd day evening premessage	< 3	37	97.4%	48	100.0%	1.278
	> 3	1	2.6%	0	0.0%	0.258ns
Direct bilirubin at therd day evening after massage	< 3	38	100.0%	48	100.0%	#
	> 3	0	0.0%	0	0.0%	#
Direct bilirubin at fourth day morning premessage	< 3	37	97.4%	48	100.0%	1.278
	> 3	1	2.6%	0	0.0%	0.258ns
Direct bilirubin at fourth day morning after massage	< 3	38	100.0%	48	100.0%	#
	> 3	0	0.0%	0	0.0%	#
Direct bilirubin at fourth day evening premessage	< 3	38	100.0%	48	100.0%	#
	> 3	0	0.0%	0	0.0%	#
Direct bilirubin at fourth day evening after massage	< 3	38	100.0%	48	100.0%	#
	> 3	0	0.0%	0	0.0%	#

*statistically significant difference at (p <0,05)

Table (3) : : percentage distribution of studied neonates regarding to intestinal defecation during the days of the intervention (n = 86)

		control		Experimental		X2
		N	%	N	%	P
Intestinal defecation frequency first day morning	0 - 3	37	97.4%	31	64.6%	13.775
	3 - 6	1	2.6%	17	35.4%	<0.001***
Intestinal defecation frequency first day evening	0 - 3	38	100.0%	20	41.7%	32.868
	3 - 6	0	0.0%	28	58.3%	<0.001***
Intestinal defecation frequency second day morning	0 - 3	38	100.0%	22	45.8%	29.503
	3 - 6	0	0.0%	26	54.2%	<0.001***
Intestinal defecation frequency second day evening	0 - 3	38	100.0%	16	33.3%	40.346
	3 - 6	0	0.0%	32	66.7%	<0.001***
Intestinal defecation frequency third day morning	0 - 3	38	100.0%	17	35.4%	38.374
	3 - 6	0	0.0%	31	64.6%	<0.001***

Intestinal defecation frequency third day evening	0 - 3	38	100.0%	21	43.8%	31.157
	3 - 6	0	0.0%	27	56.3%	<0.001***
Intestinal defecation frequency fourth day morning	0 - 3	38	100.0%	24	50.0%	26.355
	3 - 6	0	0.0%	24	50.0%	<0.001***
Intestinal defecation frequency fourth day evening	0 - 3	38	100.0%	18	37.5%	36.473
	3 - 6	0	0.0%	30	62.5%	<0.001***

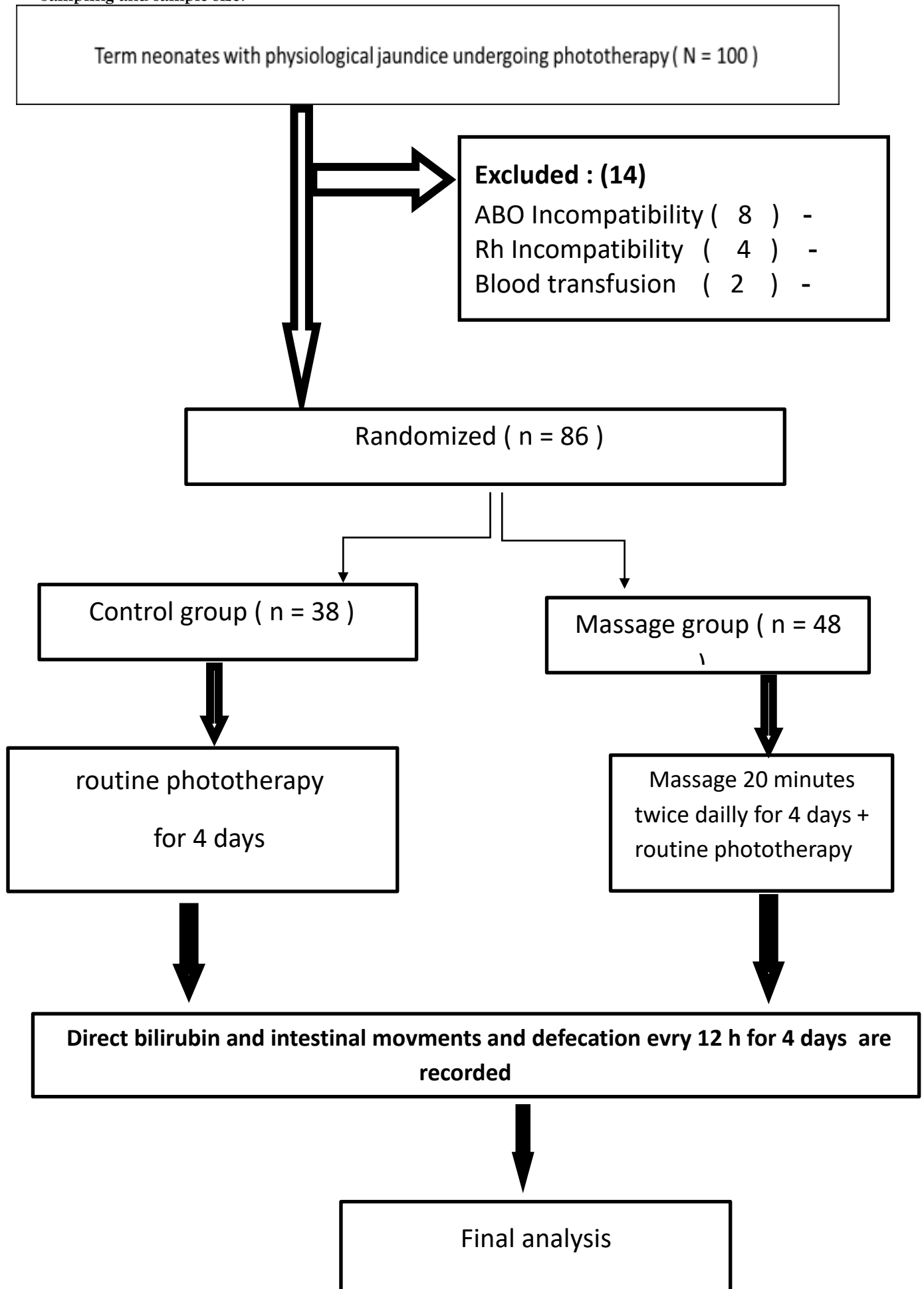
*** Highly statistically significant difference at (p <0,001)

Table (4) : percentage distribution of studied neonates regarding to bowel movements during the days of the intervention (n = 86)

		control		Experimental		X2
		N	%	N	%	P
Bowel movements at the first day morning	0 - 6	38	100.0%	48	100.0%	#
	6 - 12	0	0.0%	0	0.0%	#
Bowel movements at the first day evening	0 - 6	38	100.0%	9	18.8%	56.495
	6 - 12	0	0.0%	39	81.3%	<0.001***
Bowel movements at the second day morning	0 - 6	38	100.0%	7	14.6%	62.031
	6 - 12	0	0.0%	41	85.4%	<0.001***
Bowel movements at the second day evening	0 - 6	38	100.0%	5	10.4%	68.083
	6 - 12	0	0.0%	43	89.6%	<0.001***
Bowel movements at the third day morning	0 - 6	38	100.0%	4	8.3%	71.325
	6 - 12	0	0.0%	44	91.7%	<0.001***
Bowel movements at the third day evening	0 - 6	38	100.0%	6	12.5%	64.989
	6 - 12	0	0.0%	42	87.5%	<0.001***
Bowel movements at the fourth day morning	0 - 6	38	100.0%	3	6.3%	74.726
	6 - 12	0	0.0%	45	93.8%	<0.001***
Bowel movements at the fourth day evening	0 - 6	38	100.0%	4	8.3%	71.325
	6 - 12	0	0.0%	44	91.7%	<0.001***

*** Highly statistically significant difference at (p <0,001)

Sampling and sample size:



Results: this study was performed on 100 full-term neonates 16 neonates were excluded, 38 neonate in the control group and 48 neonate in the massage group .

(Table 1) tabulates that there was no significant difference between the control and massage groups in demographic data but in the same table there was deference between the total bilirubin level in the first day of hospitalization and discharge was highly significant at $p < 0,001$ and $x^2 = 50.231$, (table 2) the deference's between control group and experiment group with connecting to direct bilirubin was significant in the morning of the third day of massage at $p = 0.028^*$ and $x^2 = 1.278$

Table (2): percentage distribution of studied neonates regarding to direct bilirubin levels during the days of the intervention the neonates were devided in every group into two groups according to the level of direct bilirubin (less than 3 and more than 3), the table shows that the direct bilirubin in the third day after massage in the experimental group was more than 3 for only 2.1 % of this group while 2.6% of control group them direct bilirubin was more than 3 after massage in the third day. There was a statistical difference between the intervention and control group on the third day ($p = 0,028^*$). B

(Table 3) : the deference's between control group and experiment group with connecting to the frequency of intestinal defecation was statistically significant at $p < 0,001$ and $x^2 = 13.775$ from the first day tell the fourth day at $p < 0,001$ and $x^2 = 36.473$ (table 5): the deference's between control group and experiment group with connecting to bowel movements were significant at $p < 0,001$ and $x^2 = 56.495$ at the first day evening tell the fourth day at $p < 0,001$ and $x^2 = 71.325$.

Table (4): percentage distribution of studied neonates regarding to bowel movement during the days of the intervention, in this table the neonates were divided in every group into two groups according to the times bowel movement per minute (less than 6 m/ m- and between 6- 12 m/ m) the results was that 81.3% from experimental group them bowel movements were between 6- 12 in the first day while the control group neonates has less than 6 m/ m in 100% percentage in the first day of experiment and there were deference's also in the second and third and fourth day this refer to statistically significant deference between both intervention and control group at p value $< 0,001^{***}$.

DISCUSSION

Results of this study showed that the massage group had a lower level of direct bilirubin at the third and fourth day of experiment and total bilirubin at discharge with comparing to the control group, also bowel movements and intestinal defecation increased from the first day of massage with comparing between massage group and control group, The increased of bowel movement and intestinal defecation that done by massage to the experimental group in the first day caused the decreased of direct bilirubin level at the third day of massage, In the study that done by (**Homa Babaei et al 2018**) on 102 term neonate 50 of them were massage group and 52 were control group it results showed that there was statistical significant between massage group and control group in the third day of massage at $p < 0,005\%$ and $t = -4,771$, a study conducted by Dalili et al in 2016 at 50 neonates 25 of them control group and 25 of them experimental group the results showed a significant difference between the control and massage groups in transcutaneous bilirubin level ($P=0.000$) that was lower in the massage group compared to that in the control group. As for the frequency of bowel movements, it was higher in the control group on the first day ($P=0.042$); however, no significant difference was found between the two groups in the following days (Dalili et al. 2016). In a study performed by Seyyedrasooli et al., on 43 neonates 25 from them control group and 18 of them experimental group the results showed no significant difference was observed between the control and massage groups about transcutaneous bilirubin level; however, there was a significant difference between the two groups regarding the number of bowel movements, which was reported to be higher in the case group compared to that in control group (Seyyedrasooli et al 2014), In a study that done by (Kumar et al 2025) on a 160 neonates 84 of them intervention group and 76 of them were control group the results were: stool frequency and urine output were significantly higher in the intervention group. The average duration of phototherapy was 19.4 ± 4.17 hours in the intervention group compared to 28.4 ± 6.58 hours in the control group ($p < 0.001$). The rate of Transcutaneous bilirubin reduction was significantly higher in the intervention group during the first 24 hours. A rebound increase in bilirubin levels was observed at 40 and 48 hours in both groups after phototherapy was discontinued . in a study that done by (Amelia et al 2025) on a 20 neonates 10 of them control group and ten of them intervention group The results of the study showed serum bilirubin levels decreased significantly in both groups, with a greater reduction observed in the treatment group (15.28 ± 3.01 mg/dL to $7.09 \pm$

1.60 mg/dL, $p = 0.000$) compared to the control group (15.94 ± 2.88 mg/dL to 8.63 ± 1.57 mg/dL, $p = 0.000$). Post-intervention analysis confirmed the superior efficacy of the combined therapy ($p = 0.043$). In a study conducted in 2025 by Elkandoz et al, on 60 neonates, 30 of them were in the control group and 30 of them were in the experimental group. They were massaged at five days. The results indicated that the mean score of total serum bilirubin reduced in the intervention group on the third, fourth, and fifth day of the study. Also, there was an increase in the mean scores of intervention group frequencies of daily defecation compared to the mean score of the control group on the second, third, fourth, and fifth day of the study.

In a study conducted in 2015 by Basiri et al (2015) on 40 neonates, 20 of them were in the control group and 20 of them were in the experimental group. The Results: There were 40 newborns in the study, 20(50%) each in the two groups. There was a significant difference in the number of defecations ($p=0.002$) and in the level of bilirubin ($p=0.003$) between the groups, with those in the massage group having a higher number of defecations as well as a lower level of transcutaneous bilirubin.

CONCLUSION

Based on the results of the current study, we can conclude that there was a statistically significant relationship between direct and indirect bilirubin at the third day of applying massage, bowel movements, and daily intestinal defecation from the first day of applying massage.

RECOMMENDATIONS

- Neonate massage should be included in the routine care for jaundiced neonates.
- Staff and teams who work with jaundiced neonates in NICU departments should be trained on massaging neonates.
- Neonate mothers should be trained on neonate massage to apply it as home care for jaundiced neonates after discharge.
- Further studies are needed to obtain a larger sample size to enhance the generalization of results.

Funding of the research :

- This research is not funded by any party or organization , blood tests were performed at Al amal hospital for free .

Ethics :

- the research was presented to the scientific ethics committee at idleb university , and approval was obtained to conduct the research and declare that it is consistent with the ethics of scientific research. informed consent was also obtained from the research , while ensuring the confidentiality of information and the right to withdraw from the research at any moment .

Approval :

we , the researchers , hereby agree to publish this research in the Egyptian liver journal .

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