



Clinical trial

The effect on Bilirubin levels of massage, tub bath, and sponge bath in newborns with hyperbilirubinemia: A randomized controlled trial



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ARTICLE INFO

Keywords:

Neonatal jaundice
 Massage
 Tub bathing
 Sponge bathing
 Randomized controlled trial

ABSTRACT

Introduction: Neonatal jaundice is a common condition in newborns. Neonatal jaundice is usually treatable, but it may cause kernicterus that leads to bilirubin encephalopathy. The aim of this study was to examine the effect of massage, tub bath and sponge bath on bilirubin levels of newborn infants with hyperbilirubinemia.

Methods: This is a randomized controlled experimental study. This study was conducted with 140 newborns in the 34th and following weeks of gestation who were receiving phototherapy in the neonatal intensive care unit of a university hospital in eastern Turkey. The newborns were given either a massage (n = 35), a tub bath (n = 35) or a sponge bath (n = 35) by the researcher. Except for routine clinical procedures, no other procedures were administered to the newborns in the control group (n = 35). The total bilirubin values of the newborns were measured using non-invasive bilirubin device before the procedures, and six hours and 12 h after.

Results: This study found that there was a significant difference between the bilirubin levels in massage (3.82 ± 1.78 ; $p = 0.000$), sponge bath (4.42 ± 1.30 ; $p = 0.000$), tub bath (3.63 ± 1.50 ; $p = 0.000$) and control groups (7.62 ± 2.54 ; $p = 0.000$). A similar case was observed in the duration of receiving phototherapy mean scores in massage (13.60 ± 2.45 ; $p = 0.000$), sponge bath (20.05 ± 0.72 ; $p = 0.000$), tub bath (16.97 ± 1.75 ; $p = 0.000$) and control groups (32.05 ± 9.03 ; $p = 0.000$).

Conclusions: In this study, the bilirubin levels and the duration of phototherapy treatment of newborns decreased most rapidly in the massage group, followed by tub bath group and sponge bath group.

1. Introduction

Neonatal hyperbilirubinemia refers to an excess of more than 5 mg/dl bilirubin above the normal level. Jaundice (icterus), is a result of the increased breakdown of red blood cells and/or decreased hepatic excretion of bilirubin and appears as a result of the deposition of bilirubin in the skin and mucosa [1,2]. It is one of the most common clinical findings in newborns during the first weeks of their lives (in 60% of the term infants and 80% of the preterm infants). Neonatal jaundice is usually treatable, but it can lead to bilirubin encephalopathy which can progress to kernicterus. Also, incurable cases may develop permanent neurological and developmental disorders [3–6]. For this reason, patients should be monitored carefully and treated as soon as possible even though neonatal jaundice is mostly temporary and treatable [7,8].

There are several treatment methods for infants with hyperbilirubinemia; phototherapy and blood exchange transfusion are two of these methods [9]. Although studies have shown that these treatments may control the disease, they may also cause a number of potential side effects such as: blood transfusion allergies, omphalocele, diarrhea,

dehydration, skin eruption, blue baby syndrome [2–4,10]. Therefore, nurses should identify newborns at hyperbilirubinemia risk, ensure their safety and care, and monitor them by making appropriate assessments to optimize outcomes [3].

A review of the relevant literature showed that there are several studies that have attempted to help newborns with hyperbilirubinemia and shown that they suffer less from the side effects of phototherapy and recovery is accelerated. Some studies showed that massage is effective in reducing the bilirubin levels of term infants receiving phototherapy on the third and fourth days [10,11]. Other studies also reported that massaging before phototherapy helps decrease the serum total bilirubin [3,12,13]. Moreover, a study showed that giving sponge baths to premature infants before the phototherapy is effective in decreasing the level of bilirubin [14]. Generally, nurses give a routine sponge bath to the newborn, and a tub bath is not suggested until umbilical cord heals; these guidelines, however, may vary by health institutions and countries [15,16] there are also studies reporting that tub baths for newborns do not cause any harm [17,18]. Some studies report that bathing has some benefits for infants such as reducing pain,

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relaxing muscles, regulating blood circulation and the respiratory system, increasing intestinal motility, increasing sleep duration, and encouraging parent-infant interaction [17–20]. Reviewing the literature indicated that there have been no studies investigating the relationship between bilirubin level and tub bathing.

Moghadom et al. (2015), performed massage twice a day on infants with hyperbilirubinemia and monitored them for four days. They reported that performing massage may increase bowel activity and the frequency of defecation by stimulating the vagus nerve. They also demonstrated that the increase in defecation frequency can lead to effects, including the reduction of conjugated bilirubin secreted in the bowels and an increase in the excretion of waste products, such as bilirubin [20].

Semmekrot et al. (2004) reported that the increase of bowel activity in newborn infants reduces enterohepatic circulation, which leads to an increase in the excretion of bilirubin [21]. Chen (2011) monitored hyperbilirubinemia-diagnosed infants for five days and showed that performing massage on them accelerated the flow of blood, lymph and tissue fluids through the tactile stimulation, which in turn increased the collection and excretion of waste products, such as bilirubin [12]. Çınar (2004) and Kurtulan Bulut (2009) reported in their studies that bathing had certain benefits for infants, including increasing bowel activity and yielding positive effects on respiratory, circulatory and excretory systems [14,22]. This study conducted a combined analysis of massage and bathing applications, assuming that bathing would increase blood circulation and bowel activity in newborn infants, just as it does in massage application, as well as increase the frequency of defecation and bilirubin excretion by affecting infants' enterohepatic circulation.

2. Design and methods

To conduct this study, the researcher obtained permission from the institution where the study was performed as well as the approval of the Scientific Research and Publication Ethics Committee of İnönü University's Health Sciences Faculty (2017/8-10-Turkey). The researcher also provided the necessary information to the parents who agreed to participate in the study and asked them to sign informed consent forms.

This is a randomized controlled experimental study. The population of the study consisted of newborns who were receiving phototherapy in the neonatal intensive care unit of a university hospital in eastern Turkey.

The study was conducted between March and August 2017. The study sample included infants a) who were in their 34th and following pregnancy weeks, b) who were fed only formula milk, c) jaundice occurring in the first week after birth and infants without pathological diagnosis d) who did not have any gastrointestinal system diseases (liver enzyme disorder, Necrotizing enterocolitis (NEC), GIS malformation, etc.), and e) who did not have any conditions that restricted them from being bathed.

The G*Power software package was used to calculate the sample size. The sample consisted of 140 newborns who comprised ($d = 0.5$) effect size and ($\alpha = 0.050$) alpha level and 95% confidence level ($1-\beta$) according to the power analysis. Each group consisted of 35 patients.

2.1. Randomization

Newborns meeting the inclusion criteria were randomly allocated to one of the 4 groups (Fig. 1). Numbers were given to newborns sequentially on entry into the study and the random numbers table used to allocate to one of 4 groups.

2.2. Data collection tools

Newborn Follow-up Form: This form was created by the researcher based on a literature review. It includes information about newborns

such as height, weight, gender, gestational age, blood bilirubin value.

2.2.1. Transcutaneous bilirubinometry device

Serum bilirubin of infants was measured using a transcutaneous bilirubinometry device which is non invasive and contacts with the baby's forehead and has a measuring range of at least 0.0–20 mg/dl. The reader tip of the transcutaneous bilirubin device measures by contacting with the baby's forehead.

2.3. Interventions

The researcher followed the routine procedures of the phototherapy clinic a) participating newborns receiving phototherapy had their clothes removed b) newborns had their diaper changed c) the newborns' eyes were covered with eye patches, d) the position of infants was changed every two hours, e) infants were fed every three hours f) after feeding, the researcher resumed the phototherapy.

2.3.1. Control group

The infants in the control group received no procedures other than the clinical ones. The bilirubin levels of the infants were measured by transcutaneous bilirubinometry device and recorded in the "Newborn Follow-Up Form" three times during a 24-hour period with a consideration of the time they received phototherapy.

2.3.2. Massage group

Massage was performed for infants in the massage group by the researcher. First, the gentle massage focused on their face, forehead, around the eyes, and cheeks using two fingers. Then, the chest area was massaged with circular movements from right to left, followed by their upper and lower limbs. Finally, the researcher completed the massage by turning the infants face down and applying gentle pressure to their back area. After this procedure, the bilirubin values of infants were measured by transcutaneous bilirubinometry device and recorded in the "Newborn Follow-up Form".

2.3.3. Sponge bath group

The sponge bath was performed in this group by the researcher. First, the researcher wiped their eyes from the center of the face to the periphery. Then, cotton wipes were used to clean and dry their noses, ears and surrounding area. Other parts of their body (arms, abdomen and back, legs and feet) were wiped and dried as well. Finally, the genital area was cleaned and the infants were diapered. After this procedure, the bilirubin values of infants were measured by transcutaneous bilirubinometry device and recorded in the "Newborn Follow-up Form".

2.3.4. Tub bath group

The tub bath was performed in this group by the researcher. The researcher performed face and head cleaning as in the sponge bath (from the bridge of the nose to the outer corner of the eye). The infants were placed in a tub filled with lukewarm water and supported with a towel. The researcher soaped neck, chest, arms, back, legs and genital area of the infants, and the whole body was washed and dried. Umbilical cord care was performed and the infants were diapered. After this procedure, the bilirubin values of infants were measured by transcutaneous bilirubinometry device and recorded in the "Newborn Follow-up Form".

2.4. Statistical analysis

The data were analyzed using the SPSS (Statistical Package for Social Sciences) 22.0 package program. For the statistical analysis, the study used frequency distributions and ANOVA tests.

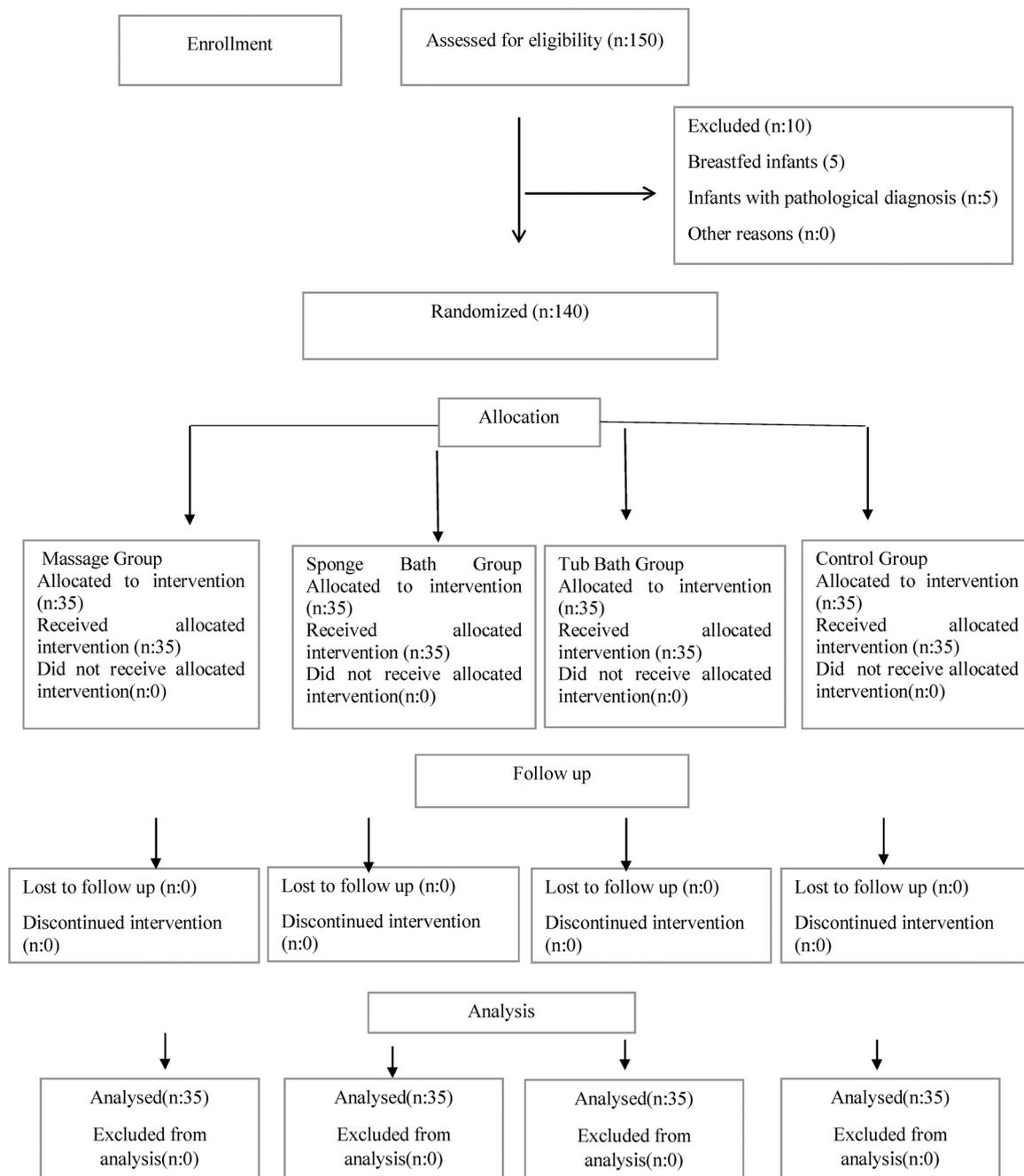


Fig. 1. CONSORT Flow Diagram.

3. Results

Study participants comprised 44.3% females and 55.7% males. A total of 13.6% were born through vaginal delivery while 86.4% were born through cesarean section and 97.1% did not have any accompanying disease.

3.1. Comparison of the newborn groups according to the gestational age, birth weight and height

At baseline there were no significant differences between the four groups in terms of gestational age, birth weight, and birth height in babies with neonatal jaundice (massage; tub bath; sponge bath; control group) ($p > 0.05$) (Table 1).

3.2. Comparison of the bilirubin values according to the groups

The advanced analyses conducted for the bilirubin levels six hours after the procedure revealed that the tub bath group (7.70 ± 1.19 ; $p = 0.000$) and the massage group (7.79 ± 2.04 ; $p = 0.000$) had similar bilirubin levels, and the difference resulted from the control (11.44 ± 3.06 ; $p = 0.000$) and sponge bath groups (8.82 ± 1.81 ; $p = 0.000$). The bilirubin levels monitored 12 h after the procedure had similar relationships ($p = 0.000$) (Table 2).

3.3. Comparison of the newborn groups according to the duration of receiving phototherapy

The groups were compared by the duration of the newborns' phototherapy treatment. Tukey's test was performed to determine from

Table 1
Comparison of the newborn groups according to the gestational age, birth weight and height.

	Control Mean ± SD	Tub Bath Mean ± SD	Sponge Bath Mean ± SD	Massage Mean ± SD	P value
Gestational age	36.40 ± 1.66	35.95 ± 1.26	35.11 ± 1.49	36.25 ± 1.80	0.240
Birth weight	2240.62 ± 724	2160.72 ± 521	2112.28 ± 586	2232.28 ± 592	0.365
Birth height	46.67 ± 3.67	45.93 ± 3.05	44.65 ± 4.02	45.96 ± 3.36	0.297

Table 2
Comparison of the bilirubin values according to the groups.

Group N	Before the procedure	6 hours after the procedure	12 hours after the procedure
Control (n:35)	Mean ± SD 13.74 ± 3.24	Mean ± SD 11.44 ± 3.06	Mean ± SD 7.62 ± 2.54
Tub bath (n:35)	13.10 ± 2.41	7.70 ± 1.19	3.63 ± 1.50
Sponge bath (n:35)	13.13 ± 2.41	8.82 ± 1.81	4.42 ± 1.30
Massage (n:35)	14.75 ± 2.64	7.79 ± 2.04	3.82 ± 1.78
Test value	8,046	23.29	35.65
P value	0.000	0.000	0.000

which group the difference originated, and it showed that the difference resulted from all of the groups; the shortest duration was found in the massage group (13.60 ± 2.45), followed by tub bathing (16.97 ± 1.75) and sponge bathing groups (20.05 ± 0.72). This study also found that the newborns in the control group (32.05 ± 9.03) received phototherapy for more than 24 h (Table 3). A significant difference was found between the tub bath group and the sponge bath group (p = 0.38) as well as the tub bath group and the massage group (p = 0.19). This study also found that there was a significant difference between the sponge bath group and the massage group (p = 0.000).

4. Discussion

A comparison of the massage, sponge and tub bath groups showed that both had an effect on the bilirubin levels of newborns. Further analysis showed that the bilirubin levels decreased most rapidly in the massage group, which was followed by the tub bath group and the sponge bath group.

A review of the literature on neonatal jaundice shows that there are various studies of performing massage. Moghadam et al. (2015) examined the effect of massage on 40 premature infants (20 experimental, 20 control) twice a day for 20 min over a four-day period before phototherapy. They reported that the bilirubin levels decreased in the third and fourth days [20]. Dalili et al. (2016) also found that a four-day intermittent massage performed on 50 (25 experimental, 25 control) term infants who were not receiving phototherapy helped decrease serum total bilirubin levels [3]. Similarly, there are studies which show that the total serum bilirubin levels significantly decreased on the fourth day of the massage before phototherapy [12,13].

A study by Lin et al. (2015) performed 15–20 minutes of massage on 56 newborns whose bilirubin levels were higher than 15 and who were receiving phototherapy (27 experimental, 29 control) during pauses

between phototherapy treatments twice a day for three days. At the end of third day, the mean bilirubin level of the control group decreased from 15.9 to 12.2, while the mean bilirubin level of the massage group decreased from 15.6 to 10.8 [11]. Another a study conducted by Eghbalian et al. found that the frequency of intestinal motility increased and the serum bilirubin levels decreased on the third and fourth days of massage [10,11]. In the present study, massage was performed before and during phototherapy treatments. The present study found that massage caused significant decreases in bilirubin levels, which is consistent with the literature. Therefore, it resulted in the number of hours for receiving phototherapy to reduce to 13 h on average.

The present study also found that sponge bathing performed on newborns receiving phototherapy shortened the duration of their phototherapy treatment. There are no studies in the relevant literature that examine this topic; however, a study conducted by Çınar with 90 premature infants (45 experimental, 45 control) examined whether sponge bathing before phototherapy is effective in decreasing bilirubin levels. The mean bilirubin level of control group before the practice was 15.11, while this level decreased to 12.32 after the practice. The mean bilirubin level of the experimental group before the practice was 15.49, and it fell to 11.08 after the practice. This result supports the present study [14].

Another finding of this study is that tub bathing performed on newborns receiving phototherapy shortened the duration of their phototherapy treatment. A review of the literature showed that no study has examined the relationship between bilirubin level and tub bathing. Studies examining the effect of tub bathing on the systems of newborns reported that this practice supports their growth and development, increases their sleep duration, and positively affects the functions of their respiratory, circulatory and excretory systems in addition to the interaction between mothers, fathers and infants; it also decreases their stress [18,22]. The researcher believes that the positive effects of tub bath on the respiratory, circulatory and excretory system functions of infants may affect the bilirubin mechanism by increasing the intestinal motility and affecting the enterohepatic circulation.

5. Implications for practice

In our study, it was determined that the massage application decreased the phototherapy receiving times to 13 h in the newborns. It has been designated that tub bath reduces the phototherapy times for up to 16 h in newborns. It was found that the sponge bath application in newborns decreased the phototherapy receiving time to 20 h. Therefore massage, sponge bath and tub bath applications may reduce the length of stay of newborns in the hospital. Massage, sponge bath and tub bath applications may be used in clinical practice together phototherapy for newborns with hyperbilirubinemia.

Table 3
Comparison of the newborn groups according to the duration of receiving phototherapy.

Control (n:35) Mean ± SD	Massage (n:35) Mean ± SD	Sponge bath (n:35) Mean ± SD	Tub bath (n:35) Mean ± SD	Test value	P value
32.05 ± 9.03	13.60 ± 2.45	20.05 ± 0.72	16.97 ± 1.75	99.044	0.000

5.1. Limitations

One of the limitations of this study was that it was conducted with the infants in only one neonatal intensive care unit in a Turkish university hospital. Another limitation was that new-borns fed only with formula milk were included in the study. Neonatal jaundice consists of two types; physiological and pathological jaundice. In the case of physiological jaundice, only jaundice treatments are applied. Pathological jaundice is treated according to the underlying pathological diagnosis. In this study, only new-borns diagnosed with physiological jaundice were included in the study.

6. Conclusion

This study was conducted to examine the effect on bilirubin levels of massage, tub bath and sponge bath in newborns with hyperbilirubinemia.

The comparison of the bilirubin level mean scores of newborns in the intervention groups with the scores of the control group newborns showed that there was a significant difference between them. This study found that the bilirubin levels decreased most rapidly in the massage group, which was followed by the tub bath group and the sponge bath group. According to the clinical care practices of neonatal intensive care units, we suggest that the firstly massage later tub bath and finally sponge bath applications be used in the treatment of newborns with hyperbilirubinemia.

Funding

This research received grant from Inonu University Scientific Research Projects Coordination Unit (Grant number: TSA 697)

Conflicts of interest

The authors declare that there are no conflicts of interest.

References

- [1] C.G. Scraftford, L.C. Mullany, J. Katz, S.K. Khatri, S.C. Leclercq, G.L. Darmstadt, J.M. Tielsch, Incidence of and risk factors for neonatal jaundice among newborns in southern Nepal, *Trop. Med. Int. Health* 18 (11) (2013) 1317–1328, <https://doi.org/10.1111/tmi.12189>.
- [2] P.A. Dennery, S. Lorch, Neonatal blue-light phototherapy could increase the risk of dysplastic nevus development, *Pediatrics* 120 (1) (2007) 247–248.
- [3] H. Dalili, S. Sheikhi, M. Shariat, E. Haghazarian, Effects of baby massage on neonatal jaundice in healthy Iranian infants: a pilot study, *Infant Behav. Dev.* 42 (2016) 22–26, <https://doi.org/10.1016/j.infbeh.2015.10.009>.
- [4] S. Ip, M. Chung, J. Kulig, R. O'Brien, R. Sege, S. Glick, M.J. Maisels, J. Lau, An evidence-based review of important issues concerning neonatal hyperbilirubinemia, *Pediatr.* 114 (1) (2004) 130–153.
- [5] J.M. Maisels, V.K. Bhutani, D. Bogen, T.B. Newman, A.R. Stark, J.F. Watchko, Hyperbilirubinemia in the newborn infant \geq 35 weeks' gestation: an update with clarifications, *Pediatrics* 124 (4) (2009) 1193–1198.
- [6] E. Törüner, L. Büyükgöğneç, Çocuk sağlığı: temel hemşirelik yaklaşımları, *Göktug yay*, Ankara, (2011).
- [7] American Academy of Pediatrics Subcommittee on Hyperbilirubinemia, Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation, *Pediatrics* 114 (1) (2004) 297–316.
- [8] K. Melton, H.T. Akinbi, Neonatal jaundice, *Postgrad. Med.* 106 (6) (1999) 167–178, <https://doi.org/10.3810/pgm.1999.11.775>.
- [9] H.P. Schwartz, B.E. Haberman, R.M. Ruddy, Hyperbilirubinemia: current guidelines and emerging therapies, *Pediatr. Emerg. Care* 27 (9) (2011) 884–889, <https://doi.org/10.1097/PEC.0b013e31822c9b4c>.
- [10] F. Eghbalian, H. Rafienezhad, J. Farnal, The lowering of bilirubin levels in patients with neonatal jaundice using massage therapy: a randomized, double-blind clinical trial, *Infant Behav. Dev.* 49 (2017) 31–36, <https://doi.org/10.1016/j.infbeh.2017.05.002>.
- [11] C.H. Lin, H.C. Yang, C.S. Cheng, C.E. Yen, Effects of infant massage on jaundiced neonates undergoing phototherapy, *Ital. J. Pediatr.* 41 (94) (2015) 1–6, <https://doi.org/10.1186/s13052.015-0202-y>.
- [12] J. Chen, M. Sadakata, M. Ishida, N. Sekizuka, M. Sayama, Baby massage ameliorates neonatal jaundice in full-term newborn infants, *Tohoku J. Exp. Med.* 223 (2) (2011) 97–102, <https://doi.org/10.1620/tjem.223.97>.
- [13] M.B. Moghadam, K.B. Moghadam, M. Kianmehr, A. Jomezadeh, F. Davoudi, Effects of massage on weight gain and Jaundice in term neonates with hyperbilirubinemia, *J. Isfahan Med. Sch.* 30 (183) (2012).
- [14] V. Çınar, Yenidoğanlara Yapılan Silme Banyonun Bilirubin Düzeyine Etkisi, *Atatürk Üniversitesi*, 2013.
- [15] H. Çavuşoğlu, Çocuk sağlığı ve hastalıkları hemşireliği, Sistem Ofis, Ankara (2013).
- [16] S. Yıldız, T. Dağoğlu, G. Görak (Eds.), İlk günden sonraki bakım. İçinde: Temel neonatoloji ve hemşirelik ilkeleri, Nobel tıp, İstanbul, 2008.
- [17] J. Bryanton, D. Walsh, M. Barrett, D. Gaudet, Tub bathing versus traditional sponge bathing for the newborn, *J. Obstet. Gynecol. Neonatal Nurs.* 33 (6) (2004) 704–712, <https://doi.org/10.1177/0884217504270651>.
- [18] J.M. Medves, B. O'Brien, The effect of bather and location of first bath on maintaining thermal stability in newborns, *J. Obstet. Gynecol. Neonatal Nurs.* 33 (2) (2004) 175–182, <https://doi.org/10.1177/0884217504263081>.
- [19] H.K. Lee, Effects of sponge bathing on vagal tone and behavioural responses in premature infants, *J. Clin. Nurs.* 11 (4) (2002) 510–519, <https://doi.org/10.1046/j.1365-2702.2002.00594.x>.
- [20] M. Basiri-Moghadam, K. Basiri-Moghadam, M. Kianmehr, S. Jani, The effect of massage on neonatal jaundice in stable preterm newborn infants: a randomized controlled trial, *J. Pak. Med. Assoc.* 65 (6) (2015) 602–606.
- [21] B.A. Semmekrot, M.C. De Vries, G.P. Gerrits, P.M. Van Wieringen, Optimal breastfeeding to prevent hyperbilirubinemia in healthy term newborns, *Ned. Tijdschr.* 148 (41) (2004) 2016–2019.
- [22] H. Kurtulan Bulut, Prematüre bebeklerde iki banyo yönteminin fizyolojik ölçüm sonuçlarına etkisi, *Dokuz Eylül Üniversitesi*, 2009.