

ผลของโปรแกรมการโค้ชมารดาต่อพฤติกรรมการป้องกันทารกตัวเหลืองจากการได้รับน้ำนมไม่เพียงพอและระดับบิลิรูบินในเลือดของทารกเกิดก่อนกำหนดระยะท้าย

Effects of Maternal Coaching Program on Maternal Behavior Regarding Breastfeeding Jaundice Prevention and Late Preterm Newborns' Blood Bilirubin Levels

นิพนธ์ต้นฉบับ

Original Article

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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาผลของการโค้ชมารดาต่อพฤติกรรมมารดาในการป้องกันภาวะตัวเหลืองจากการได้รับน้ำนมไม่เพียงพอ และระดับบิลิรูบินในเลือดของทารกเกิดก่อนกำหนดระยะท้าย **วิธีการศึกษา:** การวิจัยแบบกึ่งทดลอง ศึกษาสองกลุ่มวัดก่อนและหลังการทดลอง กลุ่มตัวอย่างเป็นมารดาหลังคลอดและทารกเกิดก่อนกำหนดระยะท้ายที่เข้ารับการรักษาในหอผู้ป่วยสูติกรรมหลังคลอดโรงพยาบาลแห่งหนึ่งในจังหวัดสมุทรปราการที่เลือกแบบเจาะจง 40 ราย แล้วสุ่มเข้ากลุ่มควบคุมและกลุ่มทดลองอย่างละ 20 ราย กลุ่มทดลองเข้าโปรแกรมการโค้ชมารดาส่วนกลุ่มควบคุมได้รับการดูแลตามปกติ รวบรวมข้อมูลทั่วไปของมารดาและทารก ประเมินพฤติกรรมโดยใช้แบบสอบถามพฤติกรรมมารดาป้องกันภาวะตัวเหลืองจากการได้รับน้ำนมไม่เพียงพอ และตรวจวัดระดับบิลิรูบินที่วันที่ 2 และ 5 หลังคลอด วิเคราะห์ข้อมูลด้วยสถิติพรรณนาและสถิติการทดสอบค่าที่ ผลการศึกษา: หลังการทดลอง มารดากลุ่มทดลองมีคะแนนพฤติกรรมเพิ่มขึ้นสูงกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ (P -value < 0.001) ระดับบิลิรูบินที่วันที่ 5 เพิ่มขึ้นจากวันที่ 2 ในทั้งสองกลุ่ม โดยค่าที่วันที่ 5 ในกลุ่มทดลองมีค่าน้อยกว่าเกณฑ์ปกติ 15 mg/dl ค่าที่เพิ่มขึ้นในกลุ่มทดลองมีค่าน้อยกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ (P -value = 0.047) สรุป: โปรแกรมการโค้ชมารดาช่วยให้มารดามีพฤติกรรมการป้องกันภาวะตัวเหลืองจากการได้รับน้ำนมไม่เพียงพอได้อย่างเหมาะสม ระดับบิลิรูบินในเลือดของทารกเพิ่มขึ้นน้อยกว่าการดูแลแบบปกติ

คำสำคัญ: โปรแกรมการโค้ชมารดาในการป้องกันภาวะตัวเหลืองจากการได้รับน้ำนมไม่เพียงพอ; ภาวะตัวเหลืองในทารก; ทารกเกิดก่อนกำหนดระยะท้าย

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Objective: To study effects of a maternal coaching program on preventive behaviors for jaundice due to insufficient milk supply and serum bilirubin levels of late preterm infants. **Method:** This quasi-experimental research used a two-group pretest-posttest design. Participants were 40 mothers and late preterm infants who were admitted to the postnatal ward at a hospital in Samutprakan province, Thailand by purposive sampling and randomized to the test (coaching program) and control (usual care) groups ($n = 20$ each). Maternal and infant characteristics were collected and behaviors regarding breastfeeding jaundice prevention were assessed using a questionnaire. Blood bilirubin level was tested at days 2 and 5 after birth. Data were analyzed by descriptive statistics and t-test. **Results:** After the experiment, the increased behavior score in the test group was significantly higher than that in the control group (P -value < 0.001). At day 5, bilirubin levels increased from that at day 2 in both groups. Bilirubin level at day 5 in the test group was lower than the normal criterion of 15 mg/dl. The increased bilirubin level in the test group was significantly lower than that in the control group (P -value = 0.047). **Conclusion:** The coaching mother program improved the mother's behaviors to prevent jaundice from insufficient milk intake. Blood bilirubin level in those receiving the program increased to a smaller extent than those receiving the usual care.

Keywords: maternal coaching program on breastfeeding jaundice prevention; neonatal jaundice; late preterm infants

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Introduction

Neonatal jaundice is a significant illness with a worldwide incidence of 60 - 85% of all newborns.^{1,2} 60% of all births and 80% of preterm births.¹ In Thailand, there has not been report on neonatal jaundice in each gestational age. A statistical report from the Sick Newborn Department of Samutprakan Hospital showed that neonatal jaundice was the number one problem among newborn health problems. The incidence of newborns re-hospitalized for neonatal jaundice was 64.2%, 65% and 65.9%, in 2019, 2020, and 2021.² Some cases were found to have severe jaundice and needed to undergo

phototherapy. If treatment is delayed, it can cause severe brain damage or serious neurological disorders known as kernicterus resulting in slow development, disability, or even death.

Neonatal jaundice occurs after red blood cells break down prematurely. Heme is converted to bilirubin. In the liver, bilirubin is conjugated to the water-soluble form. A newborn's immature liver cannot remove bilirubin quickly enough, causing a high level of bilirubin in blood. When a bilirubin level is greater than 5 mg/dl, newborns will have yellow skin. The

yellowing of the skin starts on face, followed by head, and feet. Causes of neonatal jaundice are a blood type incompatibility between the mother and baby, enzyme deficiency in red blood cells, babies being born alive before 37 weeks of pregnancy, and mothers' ineffective breastfeeding skills.^{1,3-5} All of these causes are treatable. It is also found that babies born too early, i.e., before completion of 34 - 36 weeks, or late preterm infants are at a higher risk of jaundice than full-term babies. They need to be re-hospitalized within 14 days of birth due to jaundice.^{1,6} Hospital re-admission of babies causes stress and anxiety in the parents and higher expenditure for caring newborns with jaundice undergoing phototherapy.² Therefore, jaundice in late preterm infants is a significant problem that should be prevented.

Neonatal jaundice in late preterm infants is an important problem. Even though some preterm infants have birth weight almost the same as the full-term newborns, they have physiology of preterm newborns, which may trigger more severe effects than full term newborns. This is because their livers are not fully developed caused by a low level of UDP-glucuronyl transferase enzyme that slightly binds to bilirubin, making bilirubin more independent. The highest bilirubin can be 1 - 12 mg/dl during the first 5 days after birth and it can last for 2 - 3 weeks after birth.^{1,3,5} According to data from the Sick Newborn Department of Samutprakan Hospital, jaundice in babies born before 34 - 37 weeks of pregnancy in 2019, 2020, and 2021 accounted for 14.3%, 17.8% and 20.3% of all newborns, respectively.² Based on history taking, the most common causes of neonatal jaundice were mothers not waking their babies to have breast milk, improper breastfeeding positions, and mothers giving their babies water while breastfeeding making the babies not having enough breast milk. In this regard, mothers should be aware of caring behavior to ensure their babies to have enough and proper breast milk to help prevent jaundice and reduce bilirubin levels in newborns' blood.^{3,7,8}

Based on a study of maternal behaviors affecting breastfeeding the newborns, it was found that mothers who had improper breastfeeding did not have knowledge or understanding about breastfeeding for jaundice prevention in newborns.^{9,10} The important thing is ineffective breastfeeding techniques, namely, mothers initiated breastfeeding later than 1 hour after birth, the frequency of breastfeeding of less than 8 -12 times per day, and the duration of each breastfeeding

of less than 10 minutes.^{3,8,11} With regard to the improper breastfeeding positions, since preterm babies are small and have low birth weight, mothers are afraid to hold the babies while breastfeeding. It was found that a latch score was poor (i.e., less than 8 points)^{3,8,11} regarding baby caring behavior which include feeding water, feeding glucose, not waking the baby up to breastfeed every 2 - 3 hours,^{9,12,13} and maternal self-care behavior including mothers getting stressed and anxious, not receiving enough food and water, or not having enough sleep.^{10,12} Such behavior caused babies to be unable to get enough breast milk leading to decreased intestinal motility, ultimately slowing elimination of meconium. Therefore, bilirubin is reabsorbed and an increase in bilirubin levels in blood occurs causing neonatal jaundice. Effective support techniques for breastfeeding should be promoted.

Breastfeeding should start immediately after birth or half an hour of birth. Newborns should be breastfed frequently. A breastfeeding session should last long enough. Right positions should be introduced in first breastfeeding which will help mothers to have enough milk to feed the baby, hence reducing neonatal jaundice.¹⁴ As a consequence, nurses play an important role in promoting knowledge about neonatal jaundice caused by not receiving optimal milk intake and promoting effective breastfeeding techniques after birth to help prevent breastfeeding jaundice in newborns.

Promoting proper maternal behavior for caring a newborn by providing knowledge to mothers could be done by various teaching methods, such as Orem's self-care nursing theory¹⁵, teaching health education and post-teaching skill practice¹⁶, and the process of empowerment in teaching⁹, enabling mothers to gain knowledge and change their newborn care behavior in a correct way. Based on the literature review, it was found that promoting maternal behavior regarding breastfeeding jaundice prevention through giving knowledge and practicing skills by encouraging mothers to participate in problem analysis, action planning, skills practice, and self-assessment while a mentor is available to teach them closely. Each procedure could encourage mothers to achieve learning and be able to solve problems by themselves. In the meantime, mothers must have sustainable knowledge and practical skills. This is consistent with Haas' coaching theory (1992) stating that coaching by experts or experienced individuals could help enhance persons' knowledge and skills practice, leading to action change while the skills can be put into practice by 4 procedures namely 1) problem assessment

and analysis, 2) action planning, 3) implementation of the action plan, and 4) performance assessment. These coaching procedures could help learners to gain more knowledge and have confidence in taking action¹⁷ leading to a change in maternal behavior regarding breastfeeding jaundice prevention.

In Thailand, Haas' s coaching theory (1992) has been applied among groups of nurses and mothers whose babies suffered from various diseases. A study was conducted among a group of nurses to serve nursing intervention for caring preterm newborns and the preterm newborns was better taken care of.^{18,19} With regard to coaching maternal practice for caring children under 5 years old with pneumonia, it revealed that after coaching, mothers in the experimental group had a higher level of behavior for caring children than mothers in the control group (P -value < 0.001).²⁰ A study conducted by Kaewnil et al (2013) on coaching to maintain breastfeeding among mothers of preterm infants indicated that after coaching, mothers in the experimental group had statistically significant higher practice scores than those in the control group (P -value < 0.001).²¹ In abroad, a study conducted by Jang et al (2020) on the breastfeeding coaching program for mothers of late preterm infants revealed that after coaching the breastfeeding rate in the experimental group was significantly higher than in the control group (P -value = 0.028).²² A study conducted by Cinar et al (2022) on the effect of breastfeeding and an intensive breast milk nutritional support program in normal term newborns indicated that after coaching, the experimental group's hospitalization rate for hyperbilirubinemia was lower than the control group's rate (P -value < 0.01).⁸ Therefore, for the benefit of breastfeeding jaundice prevention among late-preterm newborns, nurses could set a guideline for coaching postpartum mothers by giving knowledge about jaundice caused by inadequate milk intake in newborns and training effective breastfeeding skills at the beginning to ensure mothers are skillful, confident and able to practice correctly to achieve maternal behavior regarding breastfeeding jaundice prevention.

Conceptually, Haas's coaching model (1992) was employed in this study to make a maternal coaching program on maternal behavior regarding breastfeeding jaundice prevention to enable mothers to have proper behavior for preventing jaundice. The coaching consists of 4 procedures. The first procedure was problem assessment and analysis. Mothers participated in problem analysis to prevent jaundice

caused by inadequate milk intake in newborns. The second procedure was action planning with mothers. The researcher acted as a coach to help practice the behavior on preventing jaundice caused by inadequate milk intake in newborns. The third procedure was the implementation of the action plan. The researcher acted as a coach and helped solve problems until the mothers were able to practice correctly. The fourth procedure was performance assessment. The mothers participated in their self-assessment. The researcher gave additional advice in some activities that the mothers were unable to practice correctly. The maternal behavior on breastfeeding jaundice prevention was followed up. An appointment was made to monitor blood bilirubin levels when the babies were 5 days old. The study results were expected to enable mothers to develop behavior of breastfeeding jaundice prevention and late preterm infants would not have jaundice and their blood bilirubin levels were in normal range.

Specifically, this present study aimed to compare pretest and posttest changes (increases) of maternal behavior scores regarding breastfeeding jaundice prevention between mothers receiving the coaching program (test group) and those receiving only the usual care (control group). We also compared the changes in the infant's blood bilirubin levels (from day 2 to day 5 after birth) between the test and control groups. Accordingly, we hypothesized that the increase in the behavior scores in the test group was higher than that in the control group, and the increase in the bilirubin in the test group was lower than that in the control group.

Methods

The study was conducted on the basis of pretest-posttest quasi-experimental research design. Research participants were postpartum mothers and late preterm newborns undergoing treatments in the postpartum ward of a hospital in Samutprakan province. The size of sample was calculated from the effect size from the mean scores of two groups from a study of Montawee and Thato (2012).²³ With a large effect size of 0.8²³, a confidence level of 80% and a type I error of 5% (P -value < 0.05), the Cohen's formula (1988)^{24,26} resulted in a sample size of 40 participants, with 20 each for the test and control groups. Participants were selected by purposive sampling method from patient medical records in the postnatal ward at a hospital in Samutprakan province.

For **the mothers** to be eligible, they had to give birth through a vaginal delivery, regardless of the number of pregnancies, 12 hours or above after delivery, and being kept with their newborns at birth. They had to be able to breastfeed newborns without complications and obstacles of breastfeeding, such as hypovolemic shock after delivery, hypertension, drug addiction, or being HIV positive. They had to be at least 18 years of age, be able to read, write and communicate Thai language, and be able to use a smartphone. For **the infants**, they had to be born between 34 and 36⁺⁶ weeks of gestational age as assessed by Ballard score. They had to have no complications and obstacles in breastfeeding, such as on hyperventilation, cleft lip and cleft palate, congenital heart disease, ABO incompatibility, or glucose-6-phosphate dehydrogenase (G6PD) deficiency.

In terms of **exclusion criteria**, the **mothers** who could not attend the full schedule of activities, had complications while attending activities such as blood loss after delivery or hypertension were excluded. For the **infants**, those who had health problems while attending activities, such as respiratory infection or infection in bloodstream, had been admitted to the neonatal ward or transferred to another hospital, and whose mothers did not wish to have baby's bilirubin levels checked within 5 days of birth were excluded.

Research instruments

The instruments consisted of the maternal coaching program on maternal behavior regarding breastfeeding jaundice prevention and the data collection instruments. The details are as follows.

The maternal coaching program on maternal breastfeeding behavior for jaundice prevention was developed by the researcher based on Haas' s coaching theory (1992). The four procedures included 1) problem assessment and analysis, 2) maternal action planning, 3) implementation of the action plan, and 4) performance assessment. Participants were taught individually. The participants met with the trainer 5 times. Specifically, three 45-minute sessions of activities at the postnatal ward were held on days 0 - 3 of hospital stay. The fourth meeting was a telephone follow-up was for 10 minutes. The final meeting was a follow-up held at Pediatric Outpatient Department (OPD) for 15 minutes.

The maternal coaching program on breastfeeding to prevent jaundice used 1) a handbook of how to prevent neonatal jaundice caused by inadequate milk intake, in the form of a book and LINE application, 2) individual teaching plan on how to prevent jaundice caused by inadequate milk intake in late preterm infants, and 3) video on neonatal jaundice, prepared by the researcher.

The data collection instruments consisted of demographic and clinical status of the mother and the infants, and the jaundice preventing behavior questionnaire. The questionnaire asked the mother's age, number of pregnancies, marital status, education level, occupation, average monthly family income, experience in caring for neonatal jaundice and breastfeeding experience. For the infant, the questionnaire collected the infant's gender, gestational age, and birth weight and infant bilirubin levels at 2 days of age and at 5 days of age from the electronic medical records. The researcher completed this part of the questionnaire.

The jaundice preventing behavior questionnaire consisted of 24 questions developed by the researchers as guided by the literature. Four parts of the questionnaire included 1) 7 items of breastfeeding skills, 2) 8 items of breastfeeding position and latch, 3) 4 items of feeding extra nutrients to babies in addition to breast milk, and 4) 5 items of maternal self-care behavior. The response was a 4-point rating scale ranging from 1-never practice, to 2-practice sometimes, 3-practice almost every day, and 4-practice every time. With a total score of 24 – 96 points, jaundice preventing behavior level was categorized as low, moderate and high (24.00 - 48.99, 49.00 - 72.99, and 73.00 - 96.00 points, respectively).

Research instrument quality assurance

Content validity

The research instrument was examined for content validity by 3 experts who were a neonatal nursing instructor, a pediatrician, and a neonatal nurse: The maternal coaching program for jaundice prevention breastfeeding was examined for content validity, content consistency, appropriateness of language use, and sequence of content. It was improved according to the experts' suggestions. The questionnaire about jaundice preventing behavior regarding breastfeeding was rated for content validity, content consistency, appropriateness of language use, sequence of content. The questionnaire had a good content validity with a content validity index of 0.95.

Reliability

The revised questionnaire of jaundice prevention behavior by breast feeding was tested in 15 mothers with characteristics comparable to the prospective participants.²⁶ The questionnaire had a high internal consistency reliability with a Cronbach's alpha coefficient of 0.804. Blood bilirubin level was measured by the bilirubin meter BR-5200® in the unit of milligram/deciliter. This device was commercially tested for reliability by the manufacturer and re-tested by medical device engineers of the hospital once a month.

Participants ethical protection

The research proposal was approved by Ethics Committee for Human Research, Burapha University (approval number: G-H5072/2565; approval date: September 26, 2022) and Ethics Committee of Samutprakan Hospital (approval number: Nq04365; approval date: September 27, 2022). The participants were purposely selected according to the characteristics specified. Research participants were informed of research objectives, the experiments, data collection process, benefits, and voluntary nature of the study. Emphasis was placed that participants were free to participate in or withdraw from the participation at any time with no negative consequences on the care provided. Written informed consent was obtained.

Training and data collection procedure

The study phase and meetings were as follows.

1. Preparation phase

Preparation for participants in the test and control groups was identical. The researcher visited mothers staying at the postnatal ward to introduce and create relationship. Participants in both groups were asked to complete the questionnaire (pre-test assessment).

2. Experimental phase

A) The control group

Participants in the control group received the usual care as follows. In the 1st - 2nd meetings (i.e., day 0 - 2 of hospitalization), a nurse assessed the mother's readiness and breast before bringing the baby to stay with the mother and providing pieces of advice on breastfeeding to the mother. Mothers who had problems related to breastfeeding, such as inverted nipples or short nipples were assigned to visit the

breastfeeding clinic. Newborns were tested for blood bilirubin levels when they were 2 days old (1st time) by nurses on duty at the postnatal ward. The blood bilirubin level result was recorded from the hospital computer system within 2 hours.

In the 3rd meeting (i.e., day 3 of hospitalization), before being discharged from the hospital, the mothers were taught with postnatal health education by nurses on duty at the postnatal ward, especially, the baby being exclusively breastfed up to 6 months of age. A handbook for caring preterm babies and an appointment schedule to follow up neonatal jaundice were given. The second blood draw for bilirubin test at the age of 5 days old was done at Pediatric Outpatient Department (OPD).

B) Experimental group

With the maternal coaching program in addition to the usual care, the participants had 4 meetings with the researcher. The first three meetings of activities (i.e., on day 0 - 3 of hospitalization) were held for 45 minutes each at the postnatal ward. The fourth meeting was a telephone follow-up for 10 minutes. Emphasis was placed on encouraging mothers to participate in the following activities.

The 1st meeting (day 0 – 1 of hospitalization): The activity "Getting the latch right, the baby get enough milk" was conducted. The researcher visited mothers and introduced herself to build a good relationship. Mothers were assigned to respond to the questionnaire about general information and the questionnaire about maternal behavior of breastfeeding jaundice prevention (pre-test). A handbook for caring newborns to prevent jaundice caused by insufficient milk intake was given in the form of a book and LINE application. Emphasis was placed on giving knowledge to mothers through video on LINE application on neonatal jaundice. Mothers were taught to assess breastfeeding by themselves using a latch score through LINE application.

The 2nd meeting (day 2 of hospitalization): The activity "How to make a good plan to get enough breast milk" was conducted. Emphasis was placed on teaching mothers to assess the babies whether they got enough milk including reviewing a good latch to successful breastfeeding. Babies were tested for blood bilirubin levels when they were 2 days old (the 1st meeting) by nurses on duty at the postnatal ward. The blood bilirubin result was obtained from the electronic medical record system within 2 hours.

The 3rd meeting (day 3 of hospitalization or the day of discharge): The activity “Reviewing existing knowledge, adding new knowledge” was conducted. Emphasis was placed on reviewing knowledge and practicing breastfeeding skills, a good breastfeeding latch, baby care behavior, and maternal self-care behavior.

The 4th meeting (implementation of the activity 1 day after the discharge): Activity “Continuing care for neonatal jaundice” was carried out. The researcher paid a telephone visit to follow up maternal behavior regarding breastfeeding jaundice prevention, problems and obstacles when staying at home, and to encourage mothers to perform activities. Mothers were informed about the next visit for the infant’s jaundice follow-up.

3. Assessment phase

It was the follow-up of a scheduled appointment of newborns with jaundice when they were 5 days old at the Pediatric Outpatient Department (OPD).

A) The control group

The mothers were asked to complete the questionnaire of maternal behavior for breastfeeding jaundice prevention (post-test). The manual for jaundice prevention for infants with insufficient milk intake was given in the form of a book and LINE application. The second blood bilirubin level was assessed when they were 5 days old. The result was obtained through the electronic medical record system 2 hours later. The researcher thanked the participants, and the study process ended.

B) The experimental group

The 5th meeting: The activity “Follow up on newborns with jaundice” of 15 minutes was performed. The researcher met the mothers to review the knowledge about preventing newborn jaundice caused by insufficient milk intake including problems and obstacles when staying at home. For any problems, additional information was given and the mothers unable to practice the activities correctly were trained to have more confidence and be able to practice. The second blood bilirubin level was assessed when they were 5 days old. The result was obtained through the electronic medical record system 2 hours later. The researcher thanked the participants, and the study process ended.

Data analysis

Descriptive statistics including mean with standard deviation and frequency with percentage were used to summarize demographic and clinical characteristics of the participants and maternal behavior. These differences between the two groups were tested using chi-square test or independent t test as appropriate. Differences of the maternal behavior score and after the experiment between the two groups were compared using independent t test. Differences of blood bilirubin levels at days 2 and 5 after birth between the two groups were compared independent using t test. Statistical significance was set at a type I error of 5% (i.e., P-value < 0.05). All statistical analyses were performed using software program SPSS version 20.

Results

The mothers in the control and test groups were comparable in their mean age (27.70 and 26.05 years old, respectively, P-value = 0.344) (Table 1). It was obvious that the first pregnancy in the control group (80.0%) was significantly lower than that in the test group (50.0%) (P-value = 0.047). Most mothers in both groups were married (95.0% both). While the majority of the mothers in the control group had bachelor’s degree (60.0%), their counterparts in the test group had high school education (60.0%) (P-value = 0.206). The mothers in both groups were laborers (60% in both groups). The majority of the mothers in the control and test groups had a monthly family income of 10,001 - 20,000 baht (40% and 30%, respectively). Their mean monthly family incomes were 32,750 and 32,450 baht, respectively, P-value = 0.967). More mothers in the control group had no experience in caring infants with jaundice (100.0% and 85.0%, respectively, P-value = 0.231) and no experience in breastfeeding (80.0% and 50.0%, P-value = 0.013) (Table 1).

For the infants, most of them in the control and test groups were with the gestational age of 36 weeks (75.0% and 95.0%, respectively) (Table 1). Their average age was 35.75 and 35.95 weeks, respectively (P-value = 0.080). There were fewer male infants in the control group (25.0%) while more of them in the test group (55.0%), with no statistical significance (P-value = 0.053). Mean age at birth of the control group was slightly higher than that in the test group (2,711.0 and 2,619.0 grams, respectively, P-value = 0.405). A similar pattern was observed at 2 days, (2,591.5 and 2,538.5 grams, respectively,

Table 1 Demographic and clinical characteristics of the participants (N = 40).

Characteristics	N (%)		P-value
	Control group (n = 20)	Test group (n = 20)	
Mothers			
Age (years)			
18 - 23	4 (20)	8 (40)	
24 - 29	8 (40)	7 (35)	
30 - 35	6 (30)	4 (20)	
> 35	2 (10)	1 (5)	
mean ± SD	27.70 ± 5.53	26.05 ± 5.34	0.344 ^a
Number of pregnancy			
1	16 (80)	10 (50)	0.047 ^b
> 1	4 (20)	10 (50)	
Marital status			
Married	19 (95)	19 (95)	1.00 ^c
Divorced	1 (5)	1 (5)	
Education level			
High school	8 (40)	12 (60)	0.206 ^b
Bachelor's degree	12 (60)	8 (40)	
Occupation			
Freelancer/business owner	8 (40)	8 (40)	1.00 ^b
Labor	12 (60)	12 (60)	
Monthly family income (baht)			
< 10,000	3 (15)	3 (15)	
10,001 - 20,000	8 (40)	6 (30)	
20,001 - 30,000	2 (10)	4 (20)	
30,001 - 40,000	3 (15)	1 (5)	
> 40,000	4 (20)	6 (30)	
mean ± SD	32,750 ± 24,680.85	32,450 ± 21,149.78	0.967 ^a
Experience of taking care of infants with jaundice			
Yes	0 (0)	3 (15)	0.231 ^d
No	20 (100)	17 (85)	
Experience of breastfeeding			
Yes	4 (20)	10 (50)	0.013 ^b
No	16 (80)	10 (50)	
Infants			
Number of gestational age (weeks)			
	mean = 35.75 ± .444	mean = 35.95 ± .224	
35	5 (25)	1 (5)	
36	15 (75)	19 (95)	
mean ± SD	35.75 ± .444	35.95 ± .224	0.080 ^a
Sex			
Male	5 (25)	11 (55)	0.053 ^b
Female	15 (75)	9 (45)	
Weight at birth (gram)			
2,000 - 2,500	5 (25)	10 (50)	
2,501 - 3,000	11 (55)	8 (40)	
> 3,000	4 (20)	2 (10)	
mean ± SD	2,711 ± 405.16	2,619 ± 272.53	0.405 ^a
Weight at 2 days (gram)			
2,000 - 2,500	8 (40)	14 (70)	
2,501 - 3,000	8 (40)	4 (20)	
> 3,000	4 (20)	2 (10)	
mean ± SD	2,591.5 ± 408.54	2,538.5 ± 273.85	0.633 ^a
Weight at 5 days (gram)			
2,000 - 2,500	8 (40)	12 (60)	
2,501 - 3,000	8 (40)	7 (35)	
> 3,000	4 (20)	1 (5)	
mean ± SD	2,605.5 ± 408.28	2,557 ± 276.22	0.663 ^a
Blood bilirubin level at 2 days (mg/dl)*	10.78 ± 0.87	6.74 ± 1.25	0.001 ^a
Blood bilirubin level at 5 days (mg/dl)*	15.91 ± 1.01	10.73 ± 1.88	0.001 ^a

* Independent t-test. ^b Chi-square. ^c Fisher's exact test. ^d mean ± SD.

P-value = 0.633), and 5 days (2,605.5 and 2,557.0 grams, respectively, P-value = 0.633). For blood bilirubin levels, at 2 days, mean level in the control group (10.79 mg/dl) was significantly higher than that (6.74 mg/dl) in the test group (P-

value < 0.001). Similar pattern was seen at 5 days (15.9 and 10.7 mg/dl, P-value < 0.001) (Table 1).

Before the experiment, the overall pre-test score of the breastfeeding behavior to prevent jaundice in the control and test groups were comparable and at the moderate level in both groups (mean = 54.25 ± 3.85 and 55.90 ± 3.91 points, respectively). For individual aspects of the behavior, mean scores of each aspect between the two groups were comparable and most aspects were at a moderate level except breastfeeding positions and latch, which was at a low level (Table 2).

After the experiment, the overall post-test score of the breastfeeding behavior in the control was at a moderate level (mean = 61.80 ± 3.64 points) while that in the test group was at a high level (mean = 90.45 ± 2.37 points). For individual aspects of the behavior, mean scores of the behavior in the test group were at a high level and higher than those in the control group which were all at the moderate level (Table 2).

Table 2 Level of breastfeeding jaundice prevention behavior (N = 40).

	Control group (n = 20)			Test group (n = 20)		
	Mean ± SD	Range	Level	Mean ± SD	Range	Level
Pre-test						
Overall behavior	54.25 ± 3.85	49 - 72	Moderate	55.90 ± 3.91	49 - 72	Moderate
1. Breastfeeding skills	14.75 ± 1.65	7 - 14	Low	14.75 ± 1.65	15 - 21	Moderate
2. Effective breastfeeding positions and latch	15.05 ± 1.95	8 - 16	Low	15.05 ± 1.95	8 - 16	Low
3. Baby care behavior	10.55 ± 0.82	9 - 12	Moderate	10.55 ± 0.82	9 - 12	Moderate
4. Maternal self-care behavior	13.90 ± 1.86	11 - 15	Moderate	13.90 ± 1.86	11 - 15	Moderate
Post-test						
Overall behavior	61.80 ± 3.64	49 - 72	Moderate	90.45 ± 2.37	73 - 96	High
1. Breastfeeding skills	17.80 ± 2.40	15 - 22	Moderate	26.20 ± 1.01	22 - 28	High
2. Effective breastfeeding positions and latch	19.50 ± 3.07	17 - 24	Moderate	30.00 ± 1.53	25 - 32	High
3. Baby care behavior	10.75 ± 1.57	9 - 12	Moderate	15.30 ± 0.67	13 - 16	High
4. Maternal self-care behavior	13.75 ± 2.22	11 - 15	Moderate	18.65 ± 1.09	16 - 20	High

In the control group the increase in overall behavior score (7.55 ± 3.61 points) (from 54.25 ± 3.85 points at pre-test to 61.80 ± 3.64 points at post-test) was significantly lower than that in the test group (34.55 ± 5.13 points) (from 55.90 ± 3.91 to 90.45 ± 2.37 points) (P-value < 0.001, t test).

Blood bilirubin levels in the control group both at before and after the intervention (10.79 ± 0.87 and 15.9 ± 1.01 mg/dl, respectively), were higher than those of the test group (6.74 ±

1.25 and 10.7 ± 1.88 mg/dl, respectively). The increase of bilirubin in the control group (5.13 ± 1.22 mg/dl) was significantly higher than that in the test group (3.90 ± 2.08 mg/dl) (*P*-value 0.047, *t* test).

Discussions and Conclusion

The quasi-randomized controlled trial indicated that the increase in the breastfeeding behavior scores in the mothers in the test group (i.e., those participating the program to improve the breastfeeding behavior to prevent jaundice) was significantly higher than that in the control group (*P*-value < 0.05).

Based on Haas' s coaching theory (1992) and relevant literature, the maternal coaching was made with the basis of 1) problem assessment and analysis, 2) action planning, 3) implementation of the action plan, and 4) performance assessment. These four components allow the mothers to learn about problems that need to be solved. The program helps mothers to participate in finding causes and solutions to the problems. It helps the mothers to be aware of the importance of practice and putting the action plan into practice by using maternal coaching. It helps the mothers to practice repeatedly to be skillful to gain confidence to do various activities by themselves. It allows the mothers to participate in self-assessment to find the defects for improving themselves. It enables the mothers to have appropriate maternal behavior regarding breastfeeding jaundice prevention.

It was found that before coaching, mothers in the test group had a moderate level of maternal behavior regarding breastfeeding jaundice prevention (mean = 55.90 ± 3.91 points). For specific of breastfeeding behavior, breastfeeding positions and latch behavior was at a low level (mean = 15.05 ± 1.95 points). Even though the number of mothers with first pregnancy and those with more than one were equal, they were unable to practice breastfeeding positions and latch correctly. This could be because after giving births, mothers felt uncomfortable caused by pain during labor and delivery which could affect practicing various activities. When mothers received the individual coaching program regarding effective breastfeeding positions and latch, they were more skillful and confident. Therefore, their mean score was at a high level (mean = 30.00 ± 1.53 points). A good breastfeeding latch will help prevent nipple problems, such as cracked nipples and breast engorgement leading to appropriate breastfeeding skills

such as being able to breastfeed a newborn for 15 - 20 minutes, encouraging babies to breastfeed every 2 - 3 hours. For other aspects of the maternal breastfeeding behavior, mean scores of breastfeeding skills, baby care behavior, and maternal self-care behavior were at a high level (mean = 26.2, 15.3, and 18.65 points, respectively). Thus, the mean score of maternal behavior regarding breastfeeding jaundice prevention was at a high level (mean 90.45 ± 2.37 points).

In the control group, where the mothers received the usual care, it was found that before coaching, they had a moderate level of maternal behavior regarding breastfeeding jaundice prevention (mean 54.25 ± 3.85 points). For individual aspects of the behaviors, aspects with a low level were breastfeeding and breastfeeding positions and latch (mean = 14.75 and 15.05 points, respectively). 50% of the mothers in the control group had their first pregnancy and did not have breastfeeding experience. As a consequence, they did not have knowledge and experience caring a baby. However, they received the usual care and treatments from the hospital through pieces of advice on breastfeeding promotion. They adhered to breastfeeding the baby in the first hour after birth, with a frequency of breastfeeding in every 2 - 3 hours or as per baby's demand, and effective breastfeeding and latch, making the mean scores of breastfeeding skills and breastfeeding positions and latch increased to a moderate level. However, the overall mean score of maternal behavior regarding breastfeeding jaundice prevention was at a moderate level at post-test (mean = 61.80 ± 3.64 points). It can be seen that even though mothers in the control group received regular care and treatments from the hospital, it was different from those in the test group where more intensive activities were applied. Therefore, the mothers in the control group had a lower mean score of maternal behavior regarding breastfeeding jaundice prevention.

The study results are consistent with previous studies showing that after receiving the maternal coaching program, the mothers had a higher level of baby care behavior than those who did not with statistical significance (*P*-value < 0.01).^{21,23} Similarly, the study conducted by Jang et al (2020) on the influence of a breastfeeding coaching program for mothers of late preterm infants on the breastfeeding rates revealed that after coaching the breastfeeding rate was significantly higher than that in the control group (*P*-value = 0.028).²² The study conducted by Cinar et al (2022) on the effect of breastfeeding and an intensive breast milk nutritional

support program on hospitalization rates for hyperbilirubinemia in normal term newborns indicated that after coaching, the mothers had better breastfeeding skills and lower incidence of jaundice those in the control group statistically (P -value < 0.01).⁸

For bilirubin, in our study blood bilirubin level at day 5 was higher than that at day 2 in both groups. The increase in bilirubin could be at the highest level at day 5 which is usually not higher than 15 mg/dl.^{3,7} At day 5, bilirubin in the control group was 15.9 mg/dl by average; while that in the test group was 10.7 mg/dl by average which could suggest the effective training on the mother behavior. In addition, the training could be effective since the increase of bilirubin in the control group (5.13 mg/dl) was significantly higher than that in the test group (3.90 mg/dl) (P -value 0.047). The study results can explain that jaundice is one of the most common conditions that can affect all newborns, especially late-preterm infants. The knowledge and skills enable mothers to have increased scores of maternal behavior of breastfeeding jaundice prevention from a moderate level (mean = 55.90 ± 3.91 points) to a high level (mean = 90.45 ± 2.37 points). As soon as the infants receive enough breast milk, bilirubin is eliminated by the liver. Such better breastfeeding behavior could result in an improved biological outcome of blood bilirubin level. In the liver, bilirubin is changed from unconjugated to conjugated form and removed from the body through the digestive system as part of the bile from the liver. It moves through the bile duct into the digestive tract and is eliminated from the body. Most bilirubin is eliminated in stool, but a small amount is eliminated in urine.³

The study results are similar to previous studies finding that appropriate breastfeeding skills are the first time breastfeeding after birth, frequency of breastfeeding, duration of breastfeeding, and effective breastfeeding positions and latch which could promote breastfeeding and reduce neonatal jaundice.^{4,10,13} It can be seen that appropriate and correct maternal behavior regarding breastfeeding jaundice prevention could help maintain newborns' blood bilirubin levels at a normal standard and prevent neonatal jaundice.

This study has certain limitations. Due to the spread of Covid-19, safety and the prevention of the spread of Covid-19 among research participants had been taken into consideration. Measures for prevention including body temperature taking, washing hands using alcohol gel, wearing

a face mask, and maintaining social distancing were followed strictly.

Based on our findings, it is recommended that nursing profession could apply the maternal coaching program to promote mothers of late preterm newborns to have maternal behavior regarding breastfeeding jaundice prevention. The program should be adjusted to suit the context of each hospital. In education, nursing instructors could teach nursing students to be aware of the importance of the maternal coaching program that enhances maternal behavior breastfeeding jaundice prevention in late-preterm newborns. Nurse executives could use the study results to determine a policy or strategy for relevant agencies, based on the maternal coaching program for mothers having late-preterm infants to reduce jaundice caused by insufficient milk intake.

It is recommended that future studies should be conducted on a maternal coaching program that promotes breastfeeding in babies born with an illness who feed only on breast milk, such as babies with ulcerative colitis, babies allergic to cow milk, babies after bowel surgery, or babies with digestive problems. Future studies could be conducted on a maternal coaching program and a longer period of follow-up should be made such as 1, 2, 6 and 12 months to ensure breastfeeding could be maintained.

In conclusion, the maternal coaching program that enhances maternal behavior regarding breastfeeding jaundice prevention helped the mothers to have baby care behavior that enables their baby to have adequate breast milk, making late preterm newborns to have blood bilirubin levels at a normal range and do not have jaundice.

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References

1. Queensland Health Department. Queensland Clinical Guidelines [QCG]: Neonatal jaundice. 2019. (Accessed on Aug. 20, 2021, at <https://www.health.qld.gov.au>)
2. Samutprakarn Hospital. Sick newborn statistics report. 2022. (Accessed on Jan. 20, 2023, at <http://smpkhos.thaismartoffice.com>) (in Thai)
3. Corana M. Common problem in the nursery. In: Punnahitanon S (ed.). Practical approaches for neonatal problems. Bangkok. Active Print Company Limited, 2019: pp.68-87. (in Thai)

4. American Academy of Pediatrics. American Academy of Pediatrics clinical practice guideline [AAP]. Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. *Pediatrics* 2004; 114(1):297-316.
5. Clarence W, Gowen MD. Hyperbilirubinemia. In: Karen J, Robert MK (eds.) *Nelson essentials of pediatrics*. Philadelphia. Elsevier, 2019: pp.672-673.
6. Thaitumyanon P. Nursing care for the premature infants with low birth weight. *The Royal College of Pediatricians of Thailand (ed.). Newborn*. Bangkok. The Royal College of Pediatricians of Thailand, 2018: pp.37-48. (in Thai)
7. Boskabadi H, Rakhshanizadeh F, Zakerihamidi M. Evaluation of maternal risk factors in neonatal hyperbilirubinemia. *Arch Iran Med* 2020; 23(2):128-140.
8. Cinar N, Suzan OK, Caner I, Peksen S, Tabakoglu P, Cinar V. The effect of breastfeeding and an intensive breast milk nutritional support program on hospitalization rates for hyperbilirubinemia in term newborns: An open randomized controlled trial. *J Trop Pediatr* 2022; 68(2):1-12.
9. Srisawat N, Chanthapreeda N. The effects of empowerment program on breastfeeding behaviors among mothers and neonatal jaundice. *J Nurs Sci Health* 2020;43(3):34-44. (in Thai)
10. Kaur N, Dhillon GK, Sasidharan S, Dhillon HS. Maternal and neonatal risk factors for neonatal jaundice and readmission: An Indian perspective. *Acta Med Int* 2021;8(1):20-31.
11. Ketsuwan S, Baiya N, Maelhacharoenporn K, Puapornpong P. The association of breastfeeding practices with neonatal jaundice. *J Med Assoc Thai* 2017;100(3):255-261. (in Thai)
12. Thummarattanakul K, Tongswat T, Somboon L. Perception of insufficient breast milk: Nurse-midwife role. *APHEIT J Nurs Health* 2020; 2(2):13-36. (in Thai)
13. Siripattanapipong P. Breastfeeding jaundice. *Thai J Pediatr* 2018;57(1): 4-8. (in Thai)
14. Thai Breastfeeding Center. Overcome 5 obstacles for your beloved baby to receive breast milk from birth public health personnel edition. Nonthaburi. Sahamitr Printing & Publishing, 2019: pp.36-42. (in Thai)
15. Paprom W. Effects of the supportive program and application towards care behavior of caregivers of newborns with neonatal hyperbilirubinemia undergoing phototherapy. *Songklanagarind J Nurs* 2018;38(3):167-178. (in Thai)
16. Srisukwan D, Matgate W, Nichaiyok N. The effects of health education program on knowledge and practice in postpartum woman, Krathumbaen Hospital. *J Maharaj Nakhon Si Thammarat Hosp* 2020;3(2):37-43. (in Thai)
17. Haas SA. Coaching: Developing key players. *J Nurs Admin* 1992;22(6): 54–58.
18. Paengsook T, Urharmnuay M, Chotibang J. Effects of coaching on nurses' practices regarding positioning in preterm infants with endotracheal tube. *Nurs J* 2017;44(3):1-8. (in Thai)
19. Wongngam B, Urharmnuay M, Klunkin P. Effect of coaching on practices of nurses in responding to stress cues of preterm infants during invasive procedures. *Nurs J* 2016;43(1):12-21. (in Thai)
20. Pinhom S, Sananreangsak S, Teerarungsiku N. Effect of maternal coaching program on maternal behaviour in caring for children with pneumonia. *J Bamrasnaradura Infect Dis Instit* 2021;15(2):82-93. (in Thai)
21. Kaewnil W, Jintrawet U, Urharmnuay M. Effects of coaching on maintaining breast milk among mothers of preterm infants. *Nurs J* 2013; 40(3):11-20. (in Thai)
22. Jung GJ. Influence of a breastfeeding coaching program on the breastfeeding rates and neonatal morbidity in late preterm infants. *Child Health Nurs Res* 2020;26(3):376-383.
23. Mornthawee S, Thato R. The effect of coaching program on maternal behavior to prevent breast feeding jaundice in full term neonate. *J Nurs Sci Chulalongkorn Univ* 2015;27(1):22-34. (in Thai)
24. Munro BH. *Statistical methods for health care research*. Philadelphia. Williams & Wilkins, 2001: pp.128-129.
25. Slusher TM, Zamora TG, Appiah D, et al. Burden of severe neonatal jaundice: a systematic review and meta-analysis. *BMJ Paediatr Open* 2017;1:1-10.
26. Polit DF, Hungler JB. *Nursing research: Principles and methods*, 6th ed). Philadelphia. JB Lippincott, 1999: pp.417-419.