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## OBSTETRICS

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# Face Recognition of Newborn by Mother during Immediate Postpartum Period: An observational study

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### ABSTRACT

**Objectives:** To determine the proportion of new mothers who could correctly recognize their newborns' face during immediate postpartum period for the mother-newborn identification method.

**Materials and Methods:** A prospective observational study of healthy mothers and infants, who delivered vaginally without complications was conducted. Each mother was let to have a skin-to-skin contact with her newborn for 15 minutes. Then, she was tested if she could recognize her newborn's face at two hours postpartum by picking the photo among other five different ones. The mother who could correctly identify the photo of her own baby was deemed as capable of recognizing hers.

**Results:** Among 88 participants, 54 (61.4%) could correctly identify the photos of their newborns while 34 (38.6%) could not. When the data between these two groups were compared with multivariate analysis, there was a statistical difference in maternal age, adequacy of skin-to-skin contact protocol, and level of maternal education. The older mothers had a higher rate of recognition than the younger ones (adjusted odds ratio 1.115; 95% CI 1.013-1.227;  $p = 0.026$ ). Also, those who completed 15 minutes of skin-to-skin contact protocol had a higher rate of recognition (adjusted odds ratio 4.209; 95% CI 1.570-11.285;  $p = 0.004$ ). In addition, those who graduated from a secondary school or higher had a higher rate of recognition (adjusted odds ratio 5.518; 95% CI 1.490-20.433;  $p = 0.011$ ).

**Conclusion:** The newborn's face recognition by mother was imprecise accuracy. However, we suggest using this process for establishing mother-infant bonding rather than mother-newborn identification method.

**Keywords:** face recognition, memory, postpartum, newborn.

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## การศึกษาเรื่องความสามารถในการรับรู้และจดจำใบหน้าทารกแรกเกิดในมารดาหลังคลอดทันที

กมลพร เชาวีวัฒน์กุล, นพพร โรจน์เพ็ญเพียร, พรรณวรา ปรีตกุล

### บทคัดย่อ

**วัตถุประสงค์:** เพื่อทราบสัดส่วนมารดาที่จำใบหน้าทารกของตนเองได้หลังคลอด

**วัสดุและวิธีการ:** การสังเกตในกลุ่มมารดาและทารกที่คลอดทางช่องคลอด ไม่มีภาวะแทรกซ้อน ได้รับการดูแลโอบกอดแบบเนื้อแนบเนื้อเป็นเวลา 15 นาที ประเมินความสามารถในการจำใบหน้าทารกที่ส่องชั่วโมงหลังคลอด โดยการเลือกรูปภาพทารกของตนเองจากรูปภาพทารกอีก 5 ภาพที่แตกต่างกัน

**ผลการศึกษา:** ผู้เข้าร่วมวิจัย 88 คน 54 คน (61.4%) จำใบหน้าทารกของตนเองได้ และ 34 คน (38.6%) จำไม่ได้ เมื่อเปรียบเทียบข้อมูลระหว่างมารดาทั้งสองกลุ่ม พบว่า มีปัจจัยที่แตกต่างกันอย่างมีนัยสำคัญ คือ อายุ การโอบกอดแบบเนื้อแนบเนื้ออย่างเพียงพอ และระดับการศึกษาของมารดา โดยมารดาที่อายุมากจำใบหน้าทารกได้มากกว่ากลุ่มที่อายุน้อย (adjusted odds ratio 1.115; 95% CI, 1.013 to 1.227;  $p = 0.026$ ) มารดาที่ได้รับการโอบกอดแบบเนื้อแนบเนื้อครบ 15 นาที จำใบหน้าทารกของตนเองได้มากกว่า (adjusted odds ratio 4.209; 95% CI, 1.570 to 11.285;  $p = 0.004$ ) และมารดาที่จบการศึกษาชั้นมัธยมศึกษาหรือสูงกว่านั้นจำได้มากกว่า (adjusted odds ratio 5.518; 95% CI, 1.490 to 20.433;  $p = 0.011$ )

**สรุป:** ความถูกต้องในการจำใบหน้าทารกของมารดาไม่แน่นอน การโอบกอดแบบเนื้อแนบเนื้อ ควรปฏิบัติเพื่อเสริมสร้างสายสัมพันธ์ระหว่างมารดาและทารกมากกว่าใช้เป็นวิธีการระบุตัวตนระหว่างมารดาและทารก

**คำสำคัญ:** การจดจำใบหน้า, ความจำ, มารดาหลังคลอด, ทารก

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## Introduction

Facial recognition is imperative for the establishment and maintenance of social communication. It involves complex neuropsychological processes and is an exclusive ability of primates<sup>(1)</sup>. Humans are classified as face processing expertise, with abilities to remember and identify the faces of many different individuals. They are generally sensitive to subtle differences in facial features<sup>(2)</sup>. When a newborn is presented to a new mother immediately after delivery, a common practice is to reveal the face of the newborn along with the gender. There is a general presumption that this practice may play a role in the mother-newborn identification as the mother should be able to remember the face of her newborn. However, there is a lack of scientific evidence to support such practice. A study by Eidelman reported that only 37% of the new mothers correctly identified their newborns, which was a surprisingly low accuracy<sup>(3)</sup>. However, the study by Eidelman was conducted in 1987, when the intrapartum and postpartum care might be different from the present, especially in the aspect of early skin-to-skin contact and early bonding which was not widely practiced during the past decades<sup>(4)</sup>. Early skin-to-skin contact was known to correlate with the release of oxytocin during the immediate postpartum period<sup>(5)</sup>, and oxytocin had distinct effects on memory performance for facial identity<sup>(6)</sup>. Therefore, it is possible that the proportion of mothers who could directly identify their baby would be higher in contemporary postpartum care. The objective of this study was to determine the proportion of new mothers who could correctly recognize the faces of their newborns during the early postpartum period.

## Materials and Methods

We conducted a prospective observational study at HRH Princess Maha Jakri Sinrindhorn Medical Center, Nakorn Nayok, Thailand, during March to October 2018. The Human Research Ethics Committee at Srinakharinwirot University exempted this study from the full review (registration number SWUEC 352/60X). Healthy singleton pregnant women, who were 18 years old or above with gestational age of at least 37 weeks,

vaginally delivered a baby of 2,500 - 3,500 grams, and had a normal cognitive function, were recruited for the study. The study excluded those who had significant intrapartum and postpartum complications which may affect consciousness such as preeclampsia with severe features, eclampsia, abruptio placenta, placenta previa, prolapsed cord, ruptured vasa previa, and those who had postpartum hemorrhage. Newborns with Apgar score at 5 minutes after birth of less than 6 and who had noticeable facial marks (eg. birthmark, forceps mark) were also excluded from the study.

The consenting participants received standard intrapartum and postpartum care, including skin-to-skin contact of mother-infant pair for 15 minutes. However, in some mother-infant pairs, the duration for a skin-to-skin contact might be shorter than 15 minutes, depend on their maternal/infant mental and physical stability. The face recognition of newborn by mother was assessed two hours after delivery when the baby was brought back to the mother after initial assessment by a pediatrician. Each mother was tested her ability to recognize her newborn's face by picking the photo of her newborn's face among other five possible ones. The mother who could correctly identify the photo of her own baby from a pool of other 5 distractors was deemed as capable of recognizing hers.

All photos used in this research were in digital format taken with iPad Pro camera. The digital photos of five random babies were prepared in advance to be used as "distractors." Full face photos of each baby, which their skin tones were not detectably different, were taken with the baby facing directly to the camera, in neutral expression (eye opened, not crying). All five photos of different babies were taken on an identical background and clothing (by swaddling the baby with head covered). When preparing the photo of the participant's newborn, we used the identical process with the preparation of the distractors. The research assistants were clearly informed about the photos preparation procedure and were trained until the standard of the procedure was met. The photo of the correct newborn was mixed with other five distractors to form a digital album. All photos in the album were

presented to the mother and asked to choose the correct one of her newborn.

We assessed facial recognition at two hours after delivery, when the baby was back with the mother after initial physical examination and evaluation by a pediatrician. Before the baby was brought to the mother, the mother has chosen a photo on a tablet device which she believed to be her newborn from a pool of six different newborn's face photos. To ensure that the photo of the correct newborn was presented in the option of the six photos, the research assistant checked if the mother's last four digit of the hospital number corresponded with the code on one of the six photos in the album.

To ensure that the mother was in good consciousness, the recent memory of the mother was assessed using words recall test, modified from the Montreal Cognitive Assessment test (MoCA test)<sup>(7)</sup>, which required the mother to recall five words (face, velvet, church, daisy, red) within the next five minutes. The mother was informed about the instruction of choosing one of the photos which resembled her newborn in her opinion. However, in case that she felt none of the photos was her newborn, the "unable to recognize" was also an available option. She could spend as much time as she needs to make a decision without any rush. The mother who could correctly choose her newborn photo was categorized in "recognize" group. Meanwhile, the mothers who were unable to recognize any of the photo or chose the incorrect photo of distractors was categorized in "unrecognize" group.

With regard to sample size calculation, we estimated that 65% of the mothers would correctly recognize their newborns. With the population size of 100,000, 10% margin of error, and 95% confidence interval, the sample size of 88 participants were needed.

The statistical analysis was performed using SPSS version 25 (IBM Corp., Armonk, NY, USA). Kolmogorov–Smirnov test was used to test the normality of the distribution of data in ratio scale. The association between newborn's face recognition by mother and maternal & newborn characteristics and intrapartum factors were assessed by using chi square test, Mann-

Whitney U test, or t-test. Multivariate logistic regression analysis was used to evaluate the association between newborn's face recognition by mother and the factors which might have effects. Other statistical methods were used including percentage, mean, standard deviation, median, interquartile range, 95% confidence interval and odds ratio. The statistical significance was considered when  $p$  value < 0.05.

## Results

Among 139 eligible mothers, 94 consented to participate in the study. Six were excluded due to neonatal hypothermia and neonatal respiratory distress which could interfere the proceed of skin-to-skin contact of mother and infant. The remaining 88 participants were accounted for data analysis. Mean age of the mothers was  $27.17 \pm 5.60$  years. Seventy-three (83.0%) of the mothers graduated from a secondary school or higher, fifteen (17.0%) graduated from a primary school or lower. Twenty-one (23.9%) had incomes of less than 15,000 baht per month, while 67 (76.1%) earned more. Median time of skin-to-skin contact of maternal-newborn after the delivery was 15 minutes with interquartile range was 10 to 15 minutes. Demographic characteristics were showed in Table 1.

All participants passed the recent memory screening test using MoCA test before choosing the photos of their babies. In this study, we found that 54 mothers could correctly identify the photo of their newborns which equals to 61.4% and 34 mothers could not recognize their newborns at two hours after delivery which is 38.6%. Mean age of mother in recognized group was higher than unrecognized group ( $28.06 \pm 5.61$  vs  $25.76 \pm 5.35$  year-old, respectively). There were 57 (64.8%) mother-infant couples who completed the skin-to-skin contact protocol while other 31 mothers (35.2%) did not. In addition, there were 42 (73.7%) mothers who had completed the skin-to-skin contact protocol and could recognize their babies. However, there were 12 (38.7%) mothers who did not complete this protocol but could still recognize their babies. There were 49 (67.1%) mothers who graduated from a secondary school or higher that recognized their newborn's face. In contrast, 5 (33.3%) mothers who graduated from a primary

school or lower could correctly recognize her newborn's face. The data was shown in Table 2 (The factors that

were not a significant association did not show in the table).

**Table 1.** Demographic characteristics.

Characteristics	N
<b>Mothers factors</b>	
Age: mean $\pm$ SD (years)	27.2 $\pm$ 5.6
Education < secondary school (%)	15 (17.0%)
$\geq$ secondary school (%)	73 (83.0%)
Incomes < 15,000 baht (%)	21 (23.9%)
$\geq$ 15,000 baht (%)	67 (76.1%)
Gravid: median (IQR)	2 (1-3)
Parity: median (IQR)	2 (1-3)
Abortion: median (IQR)	0 (0-0)
<b>Newborn factors</b>	
Birth body weight: mean $\pm$ SD (grams)	3,016.7 $\pm$ 297.6
Apgar score at 1 minute: median (IQR)	9 (8-9)
<b>Intrapartum factors</b>	
Opioids use Yes (%)	2 (2.3%)
No (%)	86 (97.7%)
Oxytocin use Yes (%)	53 (60.2%)
No (%)	35 (39.8%)
Duration of labour: median (IQR), hrs	5.75 (4-8)
Duration of second stage: median (IQR), min	13 (7-19.75)
Estimated blood loss: median (IQR), ml	150 (100-250)
Mother-newborn STSC duration: median (IQR), min	15 (10-15)

SD: standard deviation, IQR: interquartile range, STSC: skin-to-skin contact

**Table 2.** The association of significant factors and newborn's face recognition by their mothers.

Factors	Newborn's face recognition by mothers	
	Recognized group N = 54	Unrecognized group N = 34
Maternal age: mean $\pm$ SD, years	28.1 $\pm$ 5.6	25.8 $\pm$ 5.4
Adequate STSC		
Yes, n (%)	42 (73.7%)	15 (26.3%)
No, n (%)	12 (38.7%)	19 (61.3%)
Maternal education		
$\geq$ secondary school, n (%)	49 (67.1%)	24 (32.9%)
< secondary school, n (%)	5 (33.3%)	10 (66.7%)

STSC: skin-to-skin contact, SD: standard deviation

We compared demographic data and intrapartum factors between two groups of mothers, those who could correctly recognize their newborns and those who could not. There were some statistical differences in the characteristics of the two groups by using multiple logistic regression analysis. This included maternal age, maternal educational level, and adequacy of skin-to-skin contact between the mother and the newborn. No statistical difference was observed in the characteristics of parity, baby birth weight, Apgar score, intrapartum opioid usage, intrapartum oxytocin usage, labor duration, second stage of labor duration and estimated blood loss.

In the detail of significant characteristics, the older mothers had a significant higher rate of newborn recognition than the younger mothers (adjusted odds ratio 1.115; 95% CI 1.013-1.227;  $p = 0.026$ ). The mothers who completed 15 minutes of skin-to-skin contact protocol had a statistically significant greater ability to recognize their babies (adjusted odds ratio 4.209; 95% CI 1.570-11.285;  $p = 0.004$ ). Concerning maternal education, those who graduated from at least a secondary school also had a statistically significant higher rate of newborn's face recognition (adjusted odds ratio 5.518; 95% CI 1.490-20.433;  $p = 0.011$ ) (Table 3).

**Table 3.** Factors influencing the face recognition of the newborns by their mothers.

Factors	Crude OR	95%CI	p value	Adjusted OR <sup>†</sup>	95%CI	p value
Maternal age (years)	1.080	0.996-1.171	0.064	1.115	1.013-1.227	0.026*
Adequate STSC						
Yes	4.433	1.745-11.266	0.002*	4.209	1.570-11.285	0.004*
No	1	-	-	1	-	-
Maternal education						
≥ secondary school	4.083	1.256-13.280	0.019*	5.518	1.490-20.433	0.011*
< secondary school	1	-	-	1	-	-

<sup>†</sup> Adjusted by maternal age, baby birth weight, estimated blood loss, adequacy of skin-to-skin contact, maternal educational level, and maternal incomes

OR: odds ratio, STSC: skin-to-skin contact, \* statistically significant, 95%CI: 95% confidence interval

## Discussion

Sixty-one percent of the mothers in the present study were able to accurately recognize their newborns. This was much higher than the previous study conducted by Eidelman et al in 1987, which reported only 37% of the mothers correctly recognized their newborns. The result of this study was contradictory to the general belief that mothers could accurately recall the faces of their own babies immediately after birth. It should be noted that the newborn is considered a face of a stranger according to the mother, and remembering unfamiliar faces is a great challenge to human perception and memory systems.

Previous research had shown that neural activity

used for remembering a familiar face differ from those of an unfamiliar face<sup>(8, 9)</sup>. When seeing a face of a stranger, the brain generally shows an activity in the lateral fusiform gyrus. On the other hand, when a familiar face is seen, the brain activity shows domination on the anterior temporal region<sup>(10)</sup>. According to previous studies, facial recognition was strikingly poor for unfamiliar faces<sup>(11)</sup> with 69.5% of correct identification of unfamiliar faces. Our current study reflected the mothers could correctly recognize their newborns' faces at such equivocal percentage. Also, changes of facial features of the newborn over time, due to tissue edema of the face which may be alleviated at later hours of life, could interfere with the recollection of the newborn's



face by the mother.

Maternal age, maternal educational level, and adequacy of skin-to-skin contact were statistically different between the “recognize” and the “unable to recognize” groups. According to Germine et al’s study in 2010, psychologists found that the ability to recognize and remember faces continually and slowly increased throughout the age of 20s and reached a peak at the age of 30 to 34 years old. After this, face recognition skills declined slowly<sup>(12)</sup>. For those with adequate skin-to-skin contact, the mothers were more likely to correctly recognize their babies. According to the study of Phillips in 2013, oxytocin was often referred as the “love hormone” that was shown to increase relaxation, attraction, facial recognition, and maternal caregiving behaviors<sup>(13)</sup>. Also, the mothers who graduated from a secondary school had a higher capacity to correctly recognize her newborn’s face. This was because the performance in reasoning domain of cognitive function was related to higher educational level<sup>(14)</sup>.

In contemporary medicine, many currently used mother-infant identification methods are effective enough to prevent baby mix-up in hospitals. At our hospital, the bracelet tag indicating maternal name and hospital number are placed on the newborn wrist and ankle. Biometrics data of the infant including palmprints, fingerprints and footprints may also be used as an identification procedure<sup>(15-17)</sup>. Despite the ongoing progress and widespread use of facial recognition technology, research on its use for newborns is still lacking. We, therefore, suggest that further research to explore the use of facial recognition technology for newborns, specifically in terms of its practicality and accuracy, should be undertaken.

There were some limitations in this study. First, the assessment of facial recognition by asking a mother to choose a photo of her newborn’s face might be lack of reality. It would be more appropriate to evaluate the ability to recognize the baby by using the selection of the actual newborn from the pool of other five newborns. However, considering the ethical issues, presenting other newborns as distracters were prohibited and not appropriate, so such an assessment method could not

be implemented. Second, there might be some specific characteristics that affect maternal recognition of her newborn’s face such as layer of eyelids, sex of the newborn which did not control in this study. Third, there was not a confirmative process whether the correctness of mother’s recognition of her newborn’s face was based on her memory or by accident. The last limitation was the duration of skin-to-skin contact was not controlled to archive 15 minutes as suggested in the hospital protocol. Although we strongly believed that the duration of skin-to-skin contact was an essential factor for boosting the rate of newborn facial recognition, controlling the duration may pose a challenge of not prioritizing the maternal need for how long she would like to hold her child. Some mothers might feel too exhausted to hold the child for the full 15 minutes and it was our responsibility to respect the patients’ decisions. However, when a subgroup analysis was done, the mothers who completed the 15-minute skin-to-skin contact could correctly recognize her baby at the higher rate than those with shorter duration. This finding supports our hypothesis that the longer the period of time mothers contact with newborns during the immediate postpartum is, the higher the rate of recognizing the newborns is.

In summary, given the equivocal accuracy of facial recognition of the newborns by their mothers presented in this study, we suggest that the practice of introducing the face of newborns at time of birth should not be viewed as a process for mother-infant identification but rather as an action to establish the bonding between them.

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## Potential conflicts of interest

The authors declare no conflict of interest.

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