

Association Between Breastfeeding Success Rate and Nipple Length and Diameter in Thai Pregnant Women

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ABSTRACT

Objective: To demonstrate the average value of nipple length and diameter during the first and second half of gestation in Thai pregnant women, as well as its association with breastfeeding success rate.

Methods: A total of 140 pregnant women attending the ANC unit at Siriraj Hospital were enrolled into this study during April to July 2008. They were divided equally into 2 groups by gestational age of less than 20 weeks and between 20-40 weeks, respectively. Demographic data, nipple length and width, areola width and breastfeeding success rate of each participant was retrieved for statistical analysis.

Results: The mean nipple lengths of the first and second half of pregnancy were 0.79 ± 0.20 cm and 0.80 ± 0.18 cm, respectively, which were not statistically different. There was also no difference between the left and right side. The nipple width was 1.11 ± 0.27 cm. by average which did not change between gestations. The areola width increased significantly by gestational age but there was no difference between both sides. Breastfeeding success rate in mothers with nipple length of ≥ 0.7 cm of at least one side was greater than those with short nipples at both sides (86.6% and 58.8%, respectively). Forty four neonates (38.60%) with tongue tie were observed with 25 cases undergoing frenulotomy (56.81%). The breastfeeding success rate of newborns, tongue-tied newborns who underwent frenulotomy, and tongue-tied newborns without frenulotomy was 84.3%, 84% and 73.7 %, respectively.

Conclusion: Both nipple length and width did not increase along with gestation. Mothers with nipple length of 0.7 cm or more of at least one side could succeed in breastfeeding of 4.38 times greater than those with shorter nipple.

Keywords: Breastfeeding success rate, nipple length, nipple width, areolar width

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INTRODUCTION

Breastfeeding has many advantages for both mothers and children. Breast milk is the best food for children because it contains the major nutrition that is necessary for the children's development.¹ For example, some lipids can promote the development of brain and nervous system and some proteins can promote a child's immunity. Therefore the incidence of allergy and infection could be decreased.²⁻⁴ In the maternal aspect, breastfeeding is beneficial in promoting postpartum physiological change including uterine contraction stimulation.⁵ Most importantly, breastfeeding can enhance the great bonding between mother and child.^{6,7}

However the success of breastfeeding depends on many factors. It is well known that the anatomy of maternal breasts and nipples are the most important one. Other factors such as experience in breastfeeding of the mother and the posture when feeding can also influence the results. In addition to the maternal factors, tongue tie is the most common problem in the newborns which can surely affect breastfeeding.

In Siriraj Hospital, there is a great concern of the importance of breastfeeding. Thus the breastfeeding team was set up to prepare and support pregnant women to get success in breastfeeding. Education of breastfeeding is given and the breasts of all the mothers are examined at the first time of antenatal care for early detection of any abnormality of both nipples and areolas. The most common problems of breasts were inverted nipples or nonprotractile nipples (short nipples). Our previous data observed by experienced medical staff showed that the mothers with nipple length less than 0.7 cm. usually had breastfeeding problems. Therefore, we have developed the Siriraj Areola and Nipple Assessment (SANA)

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based on our expert's opinion as a tool to evaluate maternal nipples and areolas systematically. Every pregnant woman who had short nipple (length <0.7 cm) or nonflexible areola (hard to be compressed) according to SANA in all gestational ages was invited for the early correction at the time of antenatal care. There were several methods and/or some special equipment, for example, Hoffman's exercise^{8,9}, nipple puller¹⁰ and breast cup¹¹ used for the corrections. However the SANA was just the expert's opinion. After extensive literature review of normal anatomy and physio-logical change of nipple and breast during pregnancy, there was no report of the normal nipple length in pregnant women. The main objective of this study was to demonstrate the normal value of nipple length and diameter and to evaluate the difference of nipple length in the first and second half of gestation in Thai pregnant women. The secondary objective were to discover the average width of the alveolar diameter in the two periods of pregnancy and to find out the possible difference of clinical breastfeeding success rate in mothers with nipple length no less than 0.7 cm and those less than 0.7 cm.

MATERIALS AND METHODS

The study was conducted at Siriraj Hospital with approval from the Siriraj Institutional Review Board (Si.451/2008). The medical records of 140 pregnant women who had their breasts examined by experienced staffs using the SANA technique at the Antenatal Care Division, Department of Obstetrics and Gynecology, Siriraj Hospital were reviewed. All of the records were approved to match with the criteria of this study. The inclusion criteria were first gravid Thai pregnant women with confirmed gestational age and never have nipple correction. Seventy cases of gestational age between 8 and 20 weeks (Group 1) and another 70 cases of gestational age between 20 and 40 weeks (Group 2) were enrolled. The exclusion criteria included past history of breast disease, breast surgery, breast trauma and abnormal nipple appearance (inverted or pseudoinverted nipples with Pinch test). Patient's demographic data, such as gestational age, nipple length, as well as nipple and areola width were retrieved and statistically analyzed.

Siriraj Areola and Nipple Assessment (SANA) Technique

SANA was performed at the first visit of each pregnant woman by the experienced nurses who have been working as the breastfeeding consultants for at least 10 years. Prior to each evaluation, nipple rolling was applied for 5 seconds. By using a standard caliper, the nipple length was measured

TABLE 1. Dermographic characteristics.

Characteristics	Group 1 (GA 8-20 wks) (n = 70)	Group 2 (GA >20-40 wks) (n = 70)	p-value
Age (years): mean ± SD	25.99 ± 5.74	24.46 ± 5.54	0.111 ^a
Gestational age at delivery (weeks): mean ± SD	38.78 ± 2.29	39.11 ± 1.85	0.174 ^a
Route of delivery (N=116)	(n = 54)	(n = 62)	
Cesarean section (%)	19 (35.19%)	27 (43.55%)	
Vaginal delivery (%)	35 (64.81%)	35 (56.45%)	0.447 ^b

Note : ^aData was analyzed by independent samples T-test. ^bData was analyzed by chi-square test. p<0.05 was considered as statistical significance.

TABLE 2. The average value of nipple length and width and areola width of both sides.

Mean ± SD (cm)				
Data	Left side	Right side	Both sides	p-value
Nipple length	0.79 ± 0.20	0.80 ± 0.20	0.79 ± 0.19	0.769
Nipple width	1.11 ± 0.27	1.10 ± 0.27	1.11 ± 0.27	0.762
Areola width	3.40 ± 0.60	3.38 ± 0.62	3.48 ± 0.78	0.734

Note: Data was analyzed by independent samples T-test. p<0.05 was considered as statistical significance.

perpendicularly from the base to the top while the nipple and the areola width were assessed from the largest diameter, respectively. The success of breastfeeding during the first week of postpartum was determined by using the LATCH technique as described by Jensen et al.¹² The LATCH score of 7 or higher was considered as successful.

Statistic analysis

Unpaired t tests and χ^2 tests were used to compare clinical characteristics between pregnant women in group 1 and group 2. Association of the result of breastfeeding, success or failure, with nipple length was evaluated using logistic regression, with adjustment for frenulotomy of fetal tongue tie.

RESULTS

The 140 subjects were divided equally into the first half pregnancy group (Group 1) and the second half of pregnancy (Group 2) with similar distribution of gestation age in each group. In this study, only 116 women (82.85%) delivered in our hospital. There were 3 cases of abortion and 21 cases that were lost to follow up. However, there was no statistical difference in delivery route between the 2 groups. All demographic characteristics were displayed in Table 1.

Our findings showed that the average length of the left, the right and both nipples were 0.79±0.20 cm, 0.80±0.20 cm and 0.79±0.19 cm, respectively (Table 2 and Table 3). No significant difference of nipple length has been observed between the left and the right side in each gestational age. Comparing the first and the second half of pregnancy, the data showed no difference of nipple length between two groups (0.79±0.20 cm and 0.80±0.18 cm, respectively). Regarding the nipple width, the average width of the left, the right and both nipples were 1.11±0.27 cm, 1.10±0.27 cm and 1.11±0.27 cm, respectively. Similar to the nipple length, no significant difference of nipple width was detected between the two groups of gestational age (1.08±0.28 cm. and 1.14±0.26 cm, respectively).

However, the difference of areola width between the two groups was clearly observed (Table 3). It did enlarge with the increasing gestational age. The average width of areola

TABLE 3. The average value of nipple length and width and areola width of both groups.

Mean ± SD (cm)			
Data	Group 1 (GA 8-20 wk)	Group 2 (GA >20-40 wk)	p-value
Nipple length	0.79 ± 0.20	0.80 ± 0.18	0.729
Nipple width	1.08 ± 0.28	1.14 ± 0.26	0.233
Areola width	3.22 ± 0.60	3.75 ± 0.86	0.00

Note: Data was analyzed by independent samples T-test. p<0.05 was considered as statistical significance.

TABLE 4. Impact factors on breastfeeding success rate.

Data	Breastfeeding (N = 114)	
	Success	Failure
Women with nipple length of 0.7 cm or more on at least one side (n = 97)	84 (86.60%)	13 (13.40%)
Women with short nipple of both sides (n = 17)	10 (58.82%)	7 (41.18%)
Newborns without tongue tie (n = 70)	59 (84.29%)	11 (15.71%)
Newborns with tongue tie (n = 44)		
Frenulotomy	21 (84%)	4 (16%)
No frenulotomy	14 (73.68%)	5 (26.32%)

in the first and the second half of pregnancy was 3.22 ± 0.60 cm and 3.75 ± 0.86 cm, correspondingly. Nevertheless, the areola width of the left and the right areola were almost the same (3.40 ± 0.60 cm and 3.38 ± 0.62 cm, respectively).

Breastfeeding success rate was explored among 116 women who delivered in this hospital. However, there were only 114 patients eligible to be evaluated due to one case of maternal HIV infection and another case of neonatal death. From Table 4, it revealed that the success rate of breastfeeding in the mother with 0.7 cm or more of nipple length of at least one side was greater than the mother with short nipple of both sides (86.60% and 58.82%, respectively). In this study, there were 44 newborns (38.60%) having tongue tie which was one of the important factors which influence the result of breastfeeding. Frenulotomy was performed in 25 out of 44 cases (56.81%) to release tongue tie. The success rate of breastfeeding among normal newborns, tongue-tied newborns who underwent frenulotomy and tongue-tied newborns without frenulotomy was 84.3%, 84% and 73.7%, respectively.

By using logistic regression analysis, short nipple length was found to be the only significant factor that affected breastfeeding success with the adjusted odds ratio of 4.38 (1.40, 13.63) (Table 5). Frenulotomy in tongue-tied neonates also played a plausible important role in breastfeeding as shown by the adjusted ratio of 1.74 (0.52, 5.58). However, the statistical analysis showed no significant difference ($p > 0.05$).

DISCUSSION

Breast milk has a lot of essential nutrition required by babies during their early age of life. Maternal advocacy both physically and mentally is the key to successful breastfeeding. At Siriraj Hospital, not only obstetricians but also nurses can support and encourage the achievement of breastfeeding by early detection and correction of the abnormality of maternal nipples during antenatal care. However, the success of breastfeeding depends on many factors beyond the maternal breast anatomy such as fetal tongue tie, breastfeeding position, areolar elasticity, maternal and fetal stress, parity, delivery mode, duration of labor and labor medications.^{13,14}

The main objective of this study was to demonstrate the average length of nipple as a baseline data for Thai pregnant women. The result showed that nipple length and width as well as areola width were not different between both sides. The length and width of nipple did not increase in relation

to the gestational age. This differs from areola width which significantly increased in association with gestational age. The difference may be caused by distinct tissue composition between nipples and areolas. The nipple consists of mainly dense connective tissue and lactiferous ducts surrounded by smooth muscle which is not altered by gestational age. Whereas underneath the areola contains fat, lobules and alveoli to keep the colostrums, so the areola can be expanded.

In this study, the nipple length was found to be a strong predictor to determine the successful achievement of breastfeeding. Our data revealed that mothers with nipple length of 0.7 cm or more on at least one side could achieve a breastfeeding success rate of 4.38 times greater than those with shorter nipple. Therefore, the length of 0.7 cm may be reasonably used as a cut off point for normal nipple length in the Thai population.

Interestingly, we found that the areolar width had significantly increased with gestational age. This could be explained by breast tissue enlargement and congestion as a result of rising progesterone and estrogen level during pregnancy. The influence of wider areolar on breastfeeding success should be further explored in future study. Theoretically, areolar elasticity as well as areolar width are essential for a teat formation and fundamental for the neonate's ability to latch onto the breast. The elasticity of the areola can be simply tested by placing the thumb above the nipple and the index finger below the nipple then applying the steady pressure between both fingers.¹⁵

Ankyloglossia or tongue tie is one of the neonatal risk factors that cause poor latch on.¹⁶ It is characterized by the abnormal insertion of the lingual frenulum due to short and thick frenulum and resulting in impeding tongue protrusion. This study also showed a statistically insignificant yet promising result for improvement of breastfeeding success rate in tongue-tied neonate who undergo frenulotomy as shown by previous studies.^{17,18}

Due to the cross-sectional nature of this study, the data was collected from different subjects at a certain time. Therefore, the retrieved data may not entirely represent the data of each group. Hence, a prospective study should be conducted to observe the physiological change of nipple and areola during pregnancy with a larger number of patients.

CONCLUSION

Both nipple length and width did not increase along with gestation. Mothers with nipple length longer than 0.7

TABLE 5. Logistic regression analysis of each impact factor on breastfeeding success rate.

Data	Regression coefficient (b)	SE (b)	p-value	Adj OR	95% CI for OR	
					Lower	Upper
Nipple length	1.476	0.580	0.011	4.38	1.40	13.63
Frenulotomy	0.554	0.618	0.370	1.74	0.52	5.85

cm on at least one side could succeed in breastfeeding 4.38 times greater than those with shorter nipple length.

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REFERENCES

1. Fanaro S. The biological specificity and superiority of human milk. Scientific basis, guarantees and safety controls. *Minerva Pediatr.* 2002 Apr;54(2):113-29.
2. Oddy WH. Breastfeeding protects against illness and infection in infants and children: a review of the evidence. *Breastfeed Rev.* 2001 Jul;9(2):11-8.
3. Oddy WH. A review of the effects of breastfeeding on respiratory infections, atopy, and childhood asthma. *J Asthma.* 2004 Sep;41(6):605-21.
4. Oddy WH, de Klerk NH, Sly PD, Holt PG. The effects of respiratory infections, atopy, and breastfeeding on childhood asthma. *Eur Respir J.* 2002 May;19(5):899-905.
5. Chua S, Arulkumaran S, Lim I, Selamat N, Ratnam SS. Influence of breastfeeding and nipple stimulation on postpartum uterine activity. *Br J Obstet Gynaecol.* 1994 Sep;101(9):804-5.
6. Carter CS, Altemus M. Integrative functions of lactational hormones in social behavior and stress management. *Ann NY Acad Sci.* 1997 Jan 15;807:164-74.
7. Kennell J, McGrath S. Starting the process of mother-infant bonding. *Acta Paediatr.* 2005 Jun;94(6):775-7.
8. Hoffman JB. A suggested treatment for inverted nipples. *Am J Obstet Gynecol.* 1953 Aug;66(2):346-8.
9. Hoffmann KF. Johann Baptista van Helmont (1577-1644). *Med Monatsschr.* 1953 Jul;7(7):453-5.
10. Kesaree N, Banapurmath CR, Banapurmath S, Shamanur K. Treatment of inverted nipples using a disposable syringe. *J Hum Lact.* 1993 Mar;9(1):27-9.
11. Lawrence RA. Management of the mother-infant nursing couple. In: Craven L, editor. *Breastfeeding: A Guide for the Medical Profession.* 4th ed. St Louis: Mosby-Year Book; 1994. p. 260-4.
12. Jensen D, Wallace S, Kelsay P. LATCH: a breastfeeding charting system and documentation tool. *J Obstet Gynecol Neonatal Nurs.* 1994 Jan;23(1):27-32.
13. Dewey KG. Maternal and fetal stress are associated with impaired lactogenesis in humans. *J Nutr.* 2001 Nov;131(11):3012S-5S.
14. Dewey KG, Nommsen-Rivers LA, Heinig MJ, Cohen RJ. Risk factors for suboptimal infant breastfeeding behavior, delayed onset of lactation, and excess neonatal weight loss. *Pediatrics.* 2003 Sep;112(3 Pt 1):607-19.
15. Miller V, Riordan J. Treating postpartum breast edema with areolar compression. *J Hum Lact.* 2004 May;20(2):223-6.
16. Karabulut R, Sonmez K, Turkyilmaz Z, Demirogullari B, Ozen IO, Bagbanci B, et al. Ankyloglossia and effects on breast-feeding, speech problems and mechanical/social issues in children. *B-ENT.* 2008;4(2):81-5.
17. Segal LM, Stephenson R, Dawes M, Feldman P. Prevalence, diagnosis, and treatment of ankyloglossia: methodologic review. *Can Fam Physician.* 2007 Jun;53(6):1027-33.
18. Suter VG, Bornstein MM. Ankyloglossia: facts and myths in diagnosis and treatment. *J Periodontol.* 2009 Aug;80(8):1204-19.