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Effects of newborn intraoral pressure on colostrum intake

Efeito da pressão intraoral de recém-nascidos na ingestão de colostro

Feng ZHANG[1] 0000-0003-4798-5145
Ting BAI[1] 0000-0002-1604-7896
Fan WU[1] 0000-0003-1754-1690

ABSTRACT

Objective

To explore the effects of intraoral pressure on colostrum intake.

Methods

Healthy women with full-term infants were admitted in the study after birth. Intraoral pressure was detected before and after the mothers' onset of lactation by a pressure sensor during a breastfeeding session. Colostrum intake was measured by weighting the infant before and after breastfeeding. The onset of lactation was confirmed by the mothers' perceptions of sudden breast fullness.

Results

The newborns' peak sucking pressure was 19.89±7.67kPa before the onset of lactation, dropping to 11.54±4.49kPa after mothers' onset of lactation (*p*<0.01). The colostrum intake was 4.02±4.26g before the onset of lactation, and 11.09±9.43g after the onset of lactation. Sucking pressure was correlated with the amount of colostrum intake before and after the onset of lactation after adjusting the confounding factors.

Conclusion

The newborns' intraoral pressure at early stage played a predominant role in colostrum intake. It is recommended to initiate breastfeeding immediately after the birth to take advantages of the active and robust sucking response. It is valuable to understand the importance that the sucking pressure plays in the colostrum intake and active immunity achievement during the first several days after birth.

Keywords: Colostrum. Lactation. Newborn. Suction.

[1] Nantong University, Medical College, Clinical Nursing Department. Qixiu Road, n. 19, 226001, Nantong, Jiangsu Sheng, China. Correspondence to: F. ZHANG. E-mail: <zhangfeng820909@163.com>.

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RESUMO

Objetivo

Explorar o efeito das pressões intraorais na ingestão de colostro.

Métodos

Mulheres saudáveis com bebês a termo foram matriculadas após o nascimento. As pressões intraorais foram detectadas antes e após o início da lactação pelas mães através de um sensor de pressão durante uma sessão de amamentação. A ingestão de colostro foi mensurada pelo peso da criança antes e após a amamentação. O início da lactação foi confirmado pela percepção das mães de plenitude súbita da mama.

Resultados

O pico de pressão de sucção dos recém-nascidos foi de 19,89±7,67kPa antes do início da lactação e caiu para 11,54±4,49kPa após o início da lactação (p<0,01). A ingestão de colostro foi de 4,02±4,26g antes do início da lactação e 11,09±9,43g após o início da lactação. A pressão de sucção foi correlacionada com a quantidade de ingestão de colostro antes e após o início da lactação depois de terem sido feitos ajustes dos fatores de confusão.

Conclusão

A pressão intraoral dos recém-nascidos no estágio inicial teve um papel predominante na ingestão de colostro. Recomenda-se iniciar a amamentação imediatamente após o nascimento para aproveitar as vantagens da resposta ativa e robusta à sucção. É importante entender a importância que a pressão de sucção desempenha na ingestão de colostro e na conquista da imunidade ativa durante os primeiros dias após o nascimento.

Palavras-chave: *Colostro. Lactação. Recém-nascido. Sucção.*

INTRODUCTION

Negative intraoral pressure is the main driving force in drawing milk out of the breast during breastfeeding in the infant with maturation. It is generated by the combination of the tongue's peristaltic movements and facial muscles contracting around the nipple during breastfeeding [1]. The tongue surrounds the nipple and forms an airtight space during the suction. As the infant lowers the jaw and moves the tongue backwards, a larger area is created inside the oral cavity. This enlarged space in the oral cavity results in increased pressure in the mouth, thus prompting milk to flow out from the breast into the infant's mouth [2].

Previous studies have explored the effects of intraoral pressure during breastfeeding. It was demonstrated that milk flows from the nipple into the infant's mouth coincided with the peak of intraoral pressure by approaches of ultrasound detection and pressure sensor measurement [3]. Cannon *et al.* [2] addressed the correlation between the volumes of milk transfer and intraoral pressure application in infants with maturation. Baseline pressures are responsible for holding the nipple during suction, while the peak pressures occur as the tongue moves downward to the lowest position for milk removal. Additionally, intraoral pressure reduction supports the larynx elevation by palatal fixation of the tongue during swallowing [4]. Therefore, intraoral pressure is integral to adequate milk intake and successful breastfeeding outcomes [5]. However, most recent studies focused on the infant with maturation. Little is known about the role of intraoral pressure in newborns during the first several days after birth.

In mammals, sufficient colostrum intake is necessary for the survival of the cubs [6]. Colostrum consumption is determinant for successful breastfeeding [7]. The onset of lactation is the onset of copious milk production after the delivery. Though little colostrum is acquired before the mothers' onset of lactation, active suckle response after the birth is essential for cubs to acquire energy and immunological substances during the first several days after birth. In human beings, early initiation of breastfeeding has been proven to decrease neonatal death [8-10]. However, it is not clear if negative intraoral pressure plays a role in colostrum intake during early breastfeeding. Therefore, this study compared infant negative intraoral pressures before and after the onset of lactation, and further explored the role of intraoral pressures in colostrum intake in early breastfeeding.

METHODS

This study was carried out in the Affiliated Hospital of Nantong University from October 2014 to August 2019. Healthy single-birth primiparas aged from 20 to 35 were recruited after vaginal delivery. They delivered full-term newborns with Apgar scores above 7, and initiated breastfeeding. Women presenting the following conditions were excluded: (1) breastfeeding contraindication; (2) infant was transferred to newborn intensive care unit; (3) breast surgery/injury history; (4) flat nipple; (5) maternal smoking; (6) pre-gestational Body Mass Index (BMI)>27kg/m^2; (7) cesarean section or vaginal delivery by obstetric forceps or vacuum extractor; or (8) other conditions impeded the normal onset of lactation, such as diabetes, hypertension, hypothyroidism, hypopituitarism, and postpartum haemorrhage. This protocol was proved by the Ethics Committee of Nantong University (n. 2014-069) and registered in the Chinese Clinical Trial Registry (n. ChiCTR-OOC-14005294).

Infant negative intraoral pressure was measured by Geddes's methods [3]. The measurements were performed two hours after the preceding breastfeeding session to capture the pressure when the baby was hungry. The measurement of intraoral pressure was described in detail in our previous research [11]. A soft tube with a 2.7mm external diameter was placed alongside the nipple and contained by the infant's mouth while breastfeeding. The other side of the tube was connected to a negative pressure sensor (TCT-1202; Lenosensor Co., Ltd, Beijing, China). There is a 0.02% repeatability error and 0.5% (full scale) precision for the pressure sensor.

The detection of intraoral pressure fluctuations lasted for 30 seconds in consideration of the potential risk to newborn suction. Measurements began when the baby had a regular and stable sucking rhythm. Newborns typically suck 1.7±0.2 times/second [12]. Thirty-second measurements could detect about 50 sucks. The peak intraoral pressure was -199mmHg for the first breast; then weakened to -187mmHg finally through continued measurement of the whole breastfeeding period [13]. Therefore, thirty-second measurements may generate a 10% detection error.

The data of each measurement was analyzed by a data collection management software (M400, Lenosensor Co., Ltd, Beijing, China). The assessor who abstracted the data was not informed of the study's objective. The peak, mean, and baseline intraoral pressures were automatedly provided by this software. We detected the intraoral pressure on the first day of birth and the day after the onset of lactation.

Each time the intraoral pressure was measured, colostrum intake was determined by weighing the infant before and after breastfeeding using an electronic infant scale with an accuracy of 2g. Changing the infant's diaper or clothes during the breastfeeding was not allowed. Colostrum intake was calculated as infant weight gain after breastfeeding. Because of the insensible water loss from breathing and through the skin (1.29g/kg/hour), the infants' weight after breastfeeding may be lighter than before [14]. Therefore, the data of colostrum intake was adjusted for insensible water loss according to net infant weight (weight without clothes and diaper, and no breastfeeding within 1 hour) and breastfeeding duration (Adjusted colostrum intake=infant weight after breastfeeding-infant weight before breastfeeding+1.29g/kg/hour*net infant weight*breastfeeding duration).

The timing of the onset of lactation was assessed by the mothers' perceptions of fullness in breasts. Starting after the birth, every four hours our staff nurse asked the mothers if and when they felt a sudden fullness in breasts to confirm the onset of lactation [15]. Maternal perceived breast fullness has been verified in its sensitivity and specificity in confirming the onset of lactation by a high correlation with the test-weighing milk volume and breast milk biomarkers [16].

Confounding factors of colostrum intake and the onset of lactation were explored. Data on socioeconomic status, maternal pre-gestational Body Mass Index (BMI), BMI gain during pregnancy, duration of labor, oxytocin administration, episiotomy, newborn birth weight, gender, gestational age, first breastfeed, sucking frequency, sucking duration, infant breastfeeding performance (Infant Breastfeeding Assessment Tool, IBAT), formula supplement, pacifier usage, time from birth to first intraoral pressure measurement, maternal pain, fatigue, and EPDS (a Chinese version of the Edinburgh Postnatal Depression Scale) scores were collected through medical records or face-to-face interviews carried out by our trained nursing staff [17,18].

The sample size was estimated by continuous variable intraoral pressure from matched pairs of study subjects. Our preliminary experiment indicated that the difference in intraoral pressure before and after the onset of lactation was 16mmHg with a standard deviation of 27.5. A two-sided level of significance of 0.05 and power of 0.8 was set. Factoring in a 20% increase in sample size to account for dropout, 30 subjects were needed.

The data was imported into Epidata 3.1 and analyzed with Stata 10.0. Data were tested for normal distribution with the Shapiro-Wilk test and for homogeneity of variances by Levene's test. Normally distributed data were expressed by mean and standard deviation. The paired *t* test was conducted to analyze the difference of intraoral pressure before and after the onset of lactation. The Pearson correlation method was used to explore the relationship between the intraoral pressure and colostrum intake. Their correlation was expressed with correlation coefficient r. Non-normally distributed data were expressed by median (interquartile range). Wilcoxon test and Spearman's correlation coefficient were adopted. Multivariate regression was followed to control the confounding factors. In multivariate regression, breastfeeding frequency, sucking duration, IBAT score, maternal age, and newborn gender were taken as confounding variables.

RESULTS

Among the 34 participants enrolled, two infants were transferred to the neonatal department after enrollment and one mother required an early discharge. Therefore, the data on intraoral pressure of three infants were incomplete.

On average, the timing of the onset of lactation was 52.94±16.80 hours after birth. Before the onset of lactation, the peak intraoral pressure was 19.89±7.67kPa for those infants after normal vaginal birth. However, after the onset of lactation, the peak intraoral pressure dropped to 11.54±4.49kPa. (Table 1) The colostrum intake was 4.02±4.26g before the onset of lactation, and 11.09±9.43g after the onset of lactation.

Before the onset of lactation, the correlation coefficient r was 0.47 between colostrum intake and peak intraoral pressure ($p<0.01$). After the onset of lactation, the correlation between the two was still significant ($r=0.54$, $p<0.01$) (Table 2).

Potential confounders were pre-gestational BMI ($p=0.01$) and sucking duration ($p=0.045$) to colostrum intake before the onset of lactation, and maternal age ($p=0.048$), newborn gender ($p=0.02$), breastfeeding frequency ($p=0.04$), sucking duration ($p=0.04$), and IBAT ($p=0.03$) to colostrum intake after the onset of lactation (Table 3).

Table 1 – Sucking pressure before and after the onset of lactation (kPa). Affiliated Hospital of Nantong University from 2014 to 2019.

Variables	Peak sucking pressure		Mean sucking pressure		Baseline sucking pressure	
	Mean	SD	Median	IQR	Median	IQR
Before onset of lactation	19.89	7.67	9.55	6.90	2.10	1.20
After onset of lactation	11.53	4.49	6.00	4.60	1.3	1.10
t/Z	16.40*		-3.00**		-1.37**	
p	<0.01		<0.01		0.17	

Note: n=34; *Paired t test was conducted; **Wilcoxon test was conducted. Three infants had incomplete data; IQR: Interquartile Range.

Table 2 – Bivariate correlation between the colostrum intake and sucking pressure. Affiliated Hospital of Nantong University from 2014 to 2019.

Variables	Colostrum Intake	
	r	*p*
Before onset of lactation		
Peak sucking pressure BOL	0.47*	<0.01
Mean sucking pressure BOL	0.36**	0.04
Baseline sucking pressure BOL	0.37**	0.03
After onset of lactation		
Peak sucking pressure AOL	0.54*	<0.01
Mean sucking pressure AOL	0.40**	0.03
Baseline sucking pressure AOL	0.47**	<0.01

Note: *Pearson Correlation; **Spearman's Correlation. AOL: After the Onset of Lactation. BOL: Before the Onset of Lactation

Table 3 – Potential variables to colostrum intake by bivariate correlation. Affiliated Hospital of Nantong University from 2014 to 2019.

1 of 2

Variables	Descriptives of each variable			Colostrum Intake BOL		Colostrum Intake AOL	
	Mean±SD	Mean (IQR)	N (%)	X^2/t	*p*	χ^2/t	*p*
Maternal age (years)	25.91±1.85			-0.53	0.19	-2.07	0.48
Race				0.62	0.54	0.38	0.71
Han			33 (97.06)				
Minority			1 (2.94)				
Residence				0.13	0.89	1.65	0.11
Native			26 (76.47)				
Immigrant			8 (23.53				
Household income (10,000CNY/per year)	8.00±4.04			-0.20	0.84	-0.78	0.44
Maternal education(year)				0.69	0.49	-1.13	0.27
<9			3 (8.82)				
9-11			3 (8.82)				
11-15			25 (73.54)				
>15			3 (8.82)				
Employment status				0.35	0.73	-0.38	0.70
Employed			14 (41.18)				
Unemployed			20 (59.82)				
Marriage							
Unmarried			0 (0)				
Married			34 (100)				
Frequencies of antenatal care	9.97±1.27			-1.00	0.33	-1.23	0.23
Pre-gestational BMI(kg/m²)	20.18±2.16			-2.61	0.01	0.40	0.69
Gestational BMI gain (kg/m²)	5.36±1.40			0.72	0.48	0.81	0.42
Gestational age (week)	39.64±1.51			-0.72	0.48	1.39	0.17
Birth weight (g)	3,292.65±304.30			0.46	0.65	0.85	0.40

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Table 3 – Potential variables to colostrum intake by bivariate correlation. Affiliated Hospital of Nantong University from 2014 to 2019.

2 of 2

Variables	Descriptives of each variable			Colostrum Intake BOL		Colostrum Intake AOL	
	Mean±SD	Mean (IQR)	N (%)	X^2/t	*p*	χ^2/t	*p*
Newborn gender				-0.70	0.49	-2.43	0.02
Male			13(38.24)				
Female			21(61.76)				
Time of first breastfeeding (min)		37.00 (29.00)		-1.22	0.23	-1.31	0.20
Time of first breastfeeding (min)		10.00 (15.00)		-0.19	0.85	0.23	0.82
Breastfeeding frequency (times/24h)	8.81±1.50			1.51	0.14	2.20	0.04
Sucking duration (min/24h)	180.61±71.32			2.08	0.45	2.16	0.04
Frequency of giving formula (times/24h)	2.91±1.86			-1.33	0.19	-0.42	0.68
Volume of formula within (ml/24h)	58.19±43.46			-0.74	0.46	-0.58	0.57
Pacifier usage				0.90	0.38	0.48	0.63
Yes			22 (64.71)				
No			12 (35.29)				
IBAT	10.73±2.25			1.74	0.09	2.23	0.03
EPDS	4.74±2.62			0.30	0.77	1.17	0.25
Episiotomy				0.58	0.56	0.98	0.33
Yes			18 (52.94)				
No			16 (47.06)				
Duration of Labor (h)	7.78±2.89			0.24	0.81	1.27	0.21
Oxytocin during labor				1.38	0.18	1.28	0.21
Yes			12 (35.29)				
No			22 (64.71)				

Note: N=34; BMI: Body Mass Index; IBAT: Infant Breastfeeding Assessment Tool; EPDS: Edinburgh Postnatal Depression Scale.

After controlling the above confounders, peak intraoral pressure was a significant factor to colostrum intake before and after the onset of lactation. Peak intraoral pressure before the onset of lactation and pre-gestational BMI accounted for 23% of colostrum intake before the onset of lactation. After the onset of lactation, variables of peak sucking pressure, newborn gender, and IBAT contributed with 47% of the colostrum intake (Table 4).

Table 4 – Relationship of sucking pressure to colostrum intake by multivariate regression. Affiliated Hospital of Nantong University from 2014 to 2019.

	Factors of Colostrum intake BOL				
	Coef.	t	*p*	95%CI	
Peak sucking pressure BOL	0.24	2.99	<0.01	0.08	0.40
Pre-gestational BMI	-0.74	-2.59	0.01	-1.31	-0.16
F=8.71 *p*=0.00 R^2=0.36 Adjust R^2=0.32					
	Factors of Colostrum intake AOL				
	Coef.	t	*p*	95%CI	
Peak sucking pressure AOL	0.78	2.52	0.02	0.14	1.42
IBAT scores	1.56	2.31	0.03	0.17	2.95
Newborn gender	-8.78	-3.19	<0.01	-14.45	-3.13
F=9.58 *p*=0.00 R^2=0.53 Adjust R^2=0.47					

Note: Variables that were related to Colostrum intake BOL by bivariate correlation (*p*<0.05, peak sucking pressure BOL, Pre-gestational BMI, and Sucking duration) were taken as confounding factors in Model of Factors of Colostrum intake BOL by Multivariate Regression Analysis. Variables that were related to Colostrum intake AOL by bivariate correlation (*p*<0.05, peak sucking pressure AOL, maternal age, newborn gender, Breastfeeding frequency, Sucking duration, and IBAT) were taken as confounding factors in Model of factors of Colostrum intake AOL. AOL: After the Onset of Lactation. BOL: Before the Onset of Lactation.

DISCUSSION

This study compared infant negative intraoral pressures before and after the onset of lactation, and explored the role of intraoral pressures in colostrum intake in early breastfeeding. A new finding is that the peak intraoral pressure before the onset of lactation was much higher than that after the onset of lactation. A higher intraoral pressure presented advantages for colostrum intake.

In the present study, the correlation between peak intraoral pressure and colostrum intake before the onset of lactation was 0.47. Their relationship was still significant after controlling the confounders. Literature has proven the relationship between the volumes of milk flow and intraoral pressure [2,19]. Our result regarding the correlation between the suction pressure and colostrum intake after the onset of lactation supported this point again.

However, few articles reported the suction and colostrum intake during the first day after birth. Sucking is a natural reflex mastered by newborns [20]. This inherent sucking response is the most activated in the first several days, and it is necessary for colostrum intake. Thought no direct evidence has been collected from human beings, it is reported that newborn calves have their strongest suckle response during the first eight hours after birth. The vigour of the suckle response is considered a vital survival feature, promoting the timely consumption of colostrum. On the contrary, insufficient colostrum intake leads to lower odds of acquiring optimal passive immunity because of lower IgG absorption from colostrum [7]. The level of immunoglobulin in colostrum declined remarkably over the two first days of life, and the selective transfer of Ig G1 ends at 12-16 hour after birth [21]. Accordingly, an active suckle response is the primary determinant of survival in mammals through the provision of energy and immune protection [9]. Colostrum has shown clinical benefits in preterm infants' recovery by increasing their intake of enteral protein [22].

A 2017 systematic review stated that the mortality risk increased 1.19 times for neonates with delays in breastfeeding initiation of over 24 hours after birth [10]. Therefore, higher intraoral pressure before the onset of lactation provided new evidence to confirm the benefit of early, active, and enough suction during the first several days.

Another possible explanation of our data is related to hormone secretion. Intraoral pressure is the main stimulus to oxytocin and prolactin secretion [23]. The nipple is the most sensitive area during the first several days postpartum [24]. This sensitivity is the determinant event activating the suckling-induced release of oxytocin and prolactin [25]. Prolactin is necessary for the initiation and maintenance of lactation in the first postpartum weeks [26]. Oxytocin acts on myoepithelial cells of lactiferous ducts for their contraction, which pushes milk toward the nipple for infants to acquire the milk by sucking activity [27].

As to the reason why infants applied a higher suction pressure before the onset of lactation than that after the onset of lactation, we attribute it to infants' ability to adjust the milk flow by intraoral pressures. Before the onset of lactation, less milk is stored in the breast and the ejection response comes slowly [28]. Therefore, a relatively higher intraoral pressure is provided aimed to acquire sufficient colostrum for survival. After the onset of lactation, copious milk production forces the infant to make accommodating changes in milk flow by modulating the amplitude of intraoral pressures. Therefore, the control of suction is considered the earliest purposeful motor skill of the infant's movement behaviors [29,30].

Implied by our findings, higher peak intraoral pressure before the onset of lactation may be an innate response for optimal colostrum intake. Thus, it is a survival ability for the full-term infant to achieve active immunity and sufficient colostrum as early as possible. Clinicians and mothers are recommended to initiate breastfeeding immediately after birth to take advantages of the active and robust sucking response. Additionally, peak intraoral pressure is related to colostrum transfer. Therefore, maintaining enough sucking strength stimulation may be an effective way to promote sufficient colostrum intake.

The main limitation of the study was the small sample size and the restriction of data collection to one center, which limited the application of our results. In addition, this study focused on full-term newborns via normal delivery. In the future, infants with breastfeeding difficulties, including preterm neonates or newborns by cesarean section, could be assessed to analyze the relationship between the suction pressure and colostrum intake.

CONCLUSION

Newborns' intraoral pressure at early stage played a predominant role in colostrum intake. It is recommended to initiate breastfeeding immediately after the birth to take advantages of the active and robust sucking response. It is valuable to understand the importance that the sucking pressure plays in the colostrum intake and active immunity achievement during the first several days after birth.

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CONTRIBUTORS

F. ZHANG participated on conceptualization, data curation, investigation, formal analysis, original draft, review and editing, validation, visualization, funding acquisition. T. BAI participated on formal analysis, investigation, methodology, validation, visualization, review and editing. F. WU participated on formal analysis, investigation, methodology, software, validation, visualization, review and editing.

REFERENCIAS

1. Samson N, Praud JP, Quenet B, Similowski T, Straus C. New insights into sucking, swallowing and breathing central generators: a complexity analysis of rhythmic motor behaviors. Neurosci Lett. 2017;638:90-5. https://doi.org/10.1016/j.neulet.2016.12.016
2. Cannon AM, Sakalidis VS, Lai CT, Perrella SL, Geddes DT. Vacuum characteristics of the sucking cycle and relationships with milk removal from the breast in term Infants. Early Hum Dev. 2016;96:1-6. https://doi.org/10.1016/j.earlhumdev.2016.02.003
3. Geddes DT, Kent JC, Mitoulas LR, Hartmann PE. Tongue movement and intra-oral vacuum in breastfeeding infants. Early Hum Dev. 2008;84:471-7. https://doi.org/10.1016/j.earlhumdev.2007.12.008
4. Olthoff A, Joseph AA, Weidenmuller M, Riley B, Frahm J. Real-time MRI of swallowing: intraoral pressure reduction supports larynx elevation. Nmr Biomed. 2016;29:1618-23. https://doi.org/10.1002/nbm.3621
5. Perrella SL, Lai CT, Geddes DT. Case report of nipple shield trauma associated with breastfeeding an infant with high intra-oral vacuum. Bmc Pregnancy Childbirth. 2015;15:155. https://doi.org/10.1186/s12884-015-0593-1
6. Quesnel H, Farmer C. Review: nutritional and endocrine control of colostrogenesis in swine. Animal. 2019;13:s26-34. https://doi.org/10.1017/S1751731118003555
7. Homerosky ER, Timsit E, Pajor EA, Kastelic JP, Windeyer MC. Predictors and impacts of colostrum consumption by 4h after birth in newborn beef calves. Vet J. 2017;228:1-6. https://doi.org/10.1016/j.tvjl.2017.09.003
8. Fok D, Aris IM, Ho J, Chan YH, Rauff M, Lui JK, *et al*. Early initiation and regular breast milk expression reduces risk of lactogenesis II delay in at-risk Singaporean mothers in a randomised trial. Singapore Med J. 2019;60:80-8. https://doi.org/10.11622/smedj.2018067
9. Puppel K, Golebiewski M, Grodkowski G, Slosarz J, Kunowska-Slosarz M, Solarczyk P, *et al.* Composition and factors affecting quality of bovine colostrum: a review. Animals (Basel). 2019;9:e1070. https://doi.org/10.3390/ani9121070

10. Smith ER, Hurt L, Chowdhury R, Sinha B, Fawzi W, Edmond KM. Delayed breastfeeding initiation and infant survival: a systematic review and meta-analysis. Plos One. 2017;12:e180722. https://doi.org/10.1371/journal.pone.0180722
11. Zhang F, Xia H, Li X, Qin L, Gu H, Xu X, *et al.* Intraoral vacuum of breast-feeding newborns within the first 24h: cesarean section versus vaginal delivery. Biol Res Nurs. 2016;18:445-53. https://doi.org/10.1177/1099800416636687
12. Lindner A. Measurement of intra-oral negative air pressure during dummy sucking in human newborn. Eur J Orthod. 1991;13:317-21. https://doi.org/10.1093/ejo/13.4.317
13. Prieto CR, Cardenas H, Salvatierra AM, Boza C, Montes CG, Croxatto HB. Sucking pressure and its relationship to milk transfer during breastfeeding in humans. J Reprod Fertil. 1996;108(1):69-74. https://doi.org/10.1530/jrf.0.1080069
14. Nangia S, Paul VK, Deorari AK, Sreenivas V, Agarwal R, Chawla D. Topical oil application and trans-epidermal water loss in preterm very low birth weight infants-a randomized trial. J Trop Pediatr. 2015;61:414-20. https://doi.org/10.1093/tropej/fmv049
15. He S, Xia H. The relationship between neutrophil-lymphocyte ratio and onset of lactation among postpartum women: a prospective observational cohort study. Int J Nurs Stud. 2019;97:55-62. https://doi.org/10.1016/j.ijnurstu.2019.05.005
16. Haile ZT, Chavan BB, Teweldeberhan A, Chertok IR. Association between gestational weight gain and delayed onset of lactation: the moderating effects of race/ethnicity. Breastfeed Med. 2017;12:79-85. https://doi.org/10.1089/bfm.2016.0134
17. Chapman DJ, Doughty K, Mullin EM, Perez-Escamilla R. Reliability of lactation assessment tools applied to overweight and obese women. J Hum Lact. 2016;32:269-76. https://doi.org/10.1177/0890334415597903
18. Navaratne P, Foo XY, Kumar S. Impact of a high edinburgh postnatal depression scale score on obstetric and perinatal outcomes. Sci Rep. 2016;6:e33544. https://doi.org/10.1038/srep33544
19. Besier J, Bruckmaier RM. Vacuum levels and milk-flow-dependent vacuum drops affect machine milking performance and teat condition in dairy cows. J Dairy Sci. 2016;99:3096-102. https://doi.org/10.3168/jds.2015-10340
20. Sakalidis VS, Geddes DT. Suck-swallow-breathe dynamics in breastfed infants. J Hum Lact. 2016;32:201-11. https://doi.org/10.1177/0890334415601093
21. Chastant-Maillard S, Aggouni C, Albaret A, Fournier A, Mila H. Canine and feline colostrum. reprod domest anim. 2017;52(Suppl2):148-52. https://doi.org/10.1111/rda.12830
22. Juhl SM, Ye X, Zhou P, Li Y, Iyore EO, Zhang L, *et al.* Bovine colostrum for preterm infants in the first days of life: a randomized controlled pilot trial. J Pediatr Gastroenterol Nutr. 2018;66:471-8. https://doi.org/10.1097/MPG.0000000000001774
23. Zhang F, Xia H, Shen M, Li X, Qin L, Gu H, *et al.* Are prolactin levels linked to suction pressure? Breastfeed Med. 2016;9:461-8. https://doi.org/10.1089/bfm.2015.0083
24. Abedi P, Jahanfar S, Namvar F, Lee J. Breastfeeding or nipple stimulation for reducing postpartum haemorrhage in the third stage of labour. Cochrane Database Syst Rev. 2016;1:CD010845. https://doi.org/10.1002/14651858.CD010845.pub2
25. Yoshihara C, Numan M, Kuroda KO. Oxytocin and parental behaviors. Curr Top Behav Neurosci. 2018;35:119-53. https://doi.org/10.1007/7854_2017_11
26. Saleem M, Martin H, Coates P. Prolactin biology and laboratory measurement: an update on physiology and current analytical issues. Clin Biochem Rev. 2018;39:3-16.
27. Segami Y, Mizuno K, Taki M, Itabashi K. Perioral movements and sucking pattern during bottle feeding with a novel, experimental teat are similar to breastfeeding. J Perinatol. 2013;33:319-23. https://doi.org/10.1038/jp.2012.113
28. Akers RM. A 100-year review: mammary development and lactation. J Dairy Sci. 2017;100:10332-52. https://doi.org/10.3168/jds.2017-12983
29. Ilhan G, Atmaca FV, Cumen A, Zebitay AG, Gungor ES, Karasu A. Effects of daytime versus night-time cesarean deliveries on stage II lactogenesis. J Obstet Gynaecol Res. 2018;44:717-22. https://doi.org/10.1111/jog.13562
30. Michels KA, Ghassabian A, Mumford SL, Sundaram R, Bell EM, Bello SC, *et al.* Breastfeeding and motor development in term and preterm infants in a longitudinal US Cohort. Am J Clin Nutr. 2017;106:1456-62. https://doi.org/10.3945/ajcn.116.144279

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