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Oral Motor Stimulation, Feeding and Sucking Success in Preterm Infants

Pretem Bebeklerde Oral Motor Stimulasyon, Beslenme ve Emme Başarısı

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ABSTRACT

Objective: Sucking and swallow dysfunction are common complications in preterm infants that cause oral feeding difficulties. Achieving oral feeding as early as possible is beneficial for preterm infants. This study aimed to determine the effect of nutrition oral motor stimulation in preterm infants for successful feeding and sucking.

Methods: This study was conducted as an experimental trial at a neonatal intensive care unit between May 5, 2017, and March 19, 2018. The population of the study comprised preterm infants between the 29th and 34th weeks of gestation. Preterm infants in the experimental group (n = 39) were applied oral motor stimulation, preterm infants in the control group (n = 38) were only fed. These procedures were performed on each preterm infants in the experimental and control groups 3 times a day for 14 days.

Results: It was found that the time of transition to full oral feeding was shorter ($P = .010$) while the LATCH mean scores for the first ($P < .001$) and second ($P = .001$) measurements and average nutrient intake for the second ($P = .005$) measurements were higher in the experimental group. The preterm infants who received oral motor stimulation transited to full oral feeding earlier and showed a higher success in sucking.

Conclusion: Oral motor stimulation positively affects sucking skills in preterm infants and promotes their health. It is recommended to use international standard values for assessing the growth rate in preterm infants.

Keywords: Feeding, sucking success, oral motor stimulation, preterm infant, nurse

ÖZ

Amaç: Emme ve yutma yetersizliği, prematüre bebeklerin oral beslenme güçlüğüne neden olan yaygın komplikasyonlardır. Oral beslenmenin mümkün olduğu kadar erken başarılması premetüre bebekler için yararlıdır. Bu çalışmanın amacı preterm bebeklerde oral motor stimulasyonun başarılı beslenme ve emme üzerine etkisini belirlemektir.

Yöntemler: Bu çalışma, 5 Mayıs 2017-19 Mart 2018 tarihleri arasında bir yenidoğan yoğun bakım ünitesinde deneysel çalışma olarak yürütülmüştür. Araştırmanın evrenini 29. ve 34. gebelik haftaları arasındaki preterm bebekler oluşturmuştur. Deney grubundaki preterm bebeklere (n = 39) oral motor stimulasyon uygulanmıştır, kontrol grubundaki preterm bebekler (n = 38) sadece beslenmiştir. Bu işlemler deney ve kontrol grubundaki her preterm bebeğe 14 gün boyunca günde 3 kez uygulanmıştır.

Bulgular: Deney grubunda tam oral beslenmeye geçiş süresi daha kısa ($P = ,010$) iken birinci ($P < ,001$) ve ikinci ($P = ,001$) ölçümlerde LATCH ölçeği ortalama puanları ve ikinci ($P = ,005$) ölçüm besin alımı daha fazla bulunmuştur. Oral motor stimulasyon uygulanan preterm bebekler tam oral beslenmeye daha erken geçmiş ve daha ileri emme başarısı göstermiştir.

Sonuç: Oral motor stimülasyon, prematüre bebeklerde emme becerilerini olumlu yönde etkilemekte ve sağlıklarını desteklemektedir. Preterm bebeklerde büyüme oranını değerlendirmek için uluslararası standart değerlerin kullanılması önerilmektedir.

Anahtar Kelimeler: Beslenme, emme başarısı, oral motor stimulasyon, preterm bebek, hemşire

INTRODUCTION

In recent years, with advances in neonatal resuscitation and caring methods, the survival rate of preterm infants has gradually increased. Sucking, swallowing, and respiratory dysfunction are widespread complications in the preterm infants that reason oral feeding difficulties.[1,2] Safe and successful oral feeding requires proper maturation of sucking, swallowing, and respiration.[3] The development of behaviors necessary for safe and successful nutrition begins long before birth. Jaw movements begin to be seen in the intrauterine 11th week. But sucking–swallowing–respiratory coordination is not sufficiently developed before 34 weeks of gestation. For this reason, preterm babies at the greater gestational week usually show more developed and consistent feeding skills.[4-7] Maternal breast milk is best for neurodevelopment in preterm infants. Achieving oral nutrition as early as possible is beneficial for preterm infants.[8-10]

Oral motor stimulation (OMS) is defined as the sensorial stimulation of cheek, lip, jaw, upper-lower gum, internal cheek, tongue, and soft palate that affects the physiology of oropharyngeal mechanisms and develops feeding functions. Oral motor stimulation is used as an alternative or supplementary early intervention strategy to develop oral feeding skills in preterm infants.[11-13] Previous studies have indicated that the use of OMS during or before the transition to oral feeding may not only have positive effects on the preterm infants' feeding behaviors but also enhance their general clinical course. Preterm infants who suffer from oral feeding problems often experience long-term health problems and delayed discharge from the hospital. A more effective feeding decreases adverse outcomes by decreasing hospital stays.[14-16]

Preterm infants are required to long time neonatal intensive care unit (NICU) stay in order to stabilize, feed, and gain optimal weight.[17-19] In addition, all nutritional options except breast milk increase the cost.[20,21] Oral motor stimulation can develop sucking success and provide early oral feeding. Thus, nurse labor and hospital costs may decrease, and OMS can be a cost-effective application.

Therefore, the present study was conducted to assess the effect of OMS on the time of transition to full oral feeding, sucking success requiring infant's active effort, and anthropometric measurements in preterm infants having a gestational age of 29-34 weeks.

METHODS

Study Design

The study was conducted as the randomized controlled and double-blind experimental trial. This study was guided by the CONSORT checklist.[22]

Participants

The study was conducted at NICU of the university hospital located in eastern Turkey between May 5, 2017, and March 19, 2018. The preterm infants were randomly allocated to 2 groups, experimental group and control group, by a computer-generated number table. The sample consisted of 77 preterm infants (39 in the experimental group and 38 in the control group) who met the inclusion criteria. The gestational weeks when babies are born were grouped as follows: 29-30 weeks, 31-32 weeks, and 33-34 weeks. In this study, only 1 researcher (first author) who was not included in the intensive care team administered OMS to all the infants. Thus, the families and the NICU team were double blinded. The required sample size was determined according to the power analysis. The post-hoc power analysis performed for the sample size revealed that the power of the study was 97% on including 39 preterm infants in the experimental group and 38 preterm infants in the control group, at a significance level of 0.05 and CI of 95% (Figure 1).[23]

The inclusion criteria of the study were as follows:

(a) have born between the 29th and 34th gestational weeks,
(b) have height and weight appropriate for their gestational week,
(c) have stable vital signs,
(d) have APGAR scores between 4 and 10 in the first and fifth minutes, The Apgar score is a measure of an infant's condition after birth. It helps decide if an infant needs immediate treatment or monitoring.
(e) has passed 48 hours after having received mechanical ventilation and/or continuous positive airway pressure.

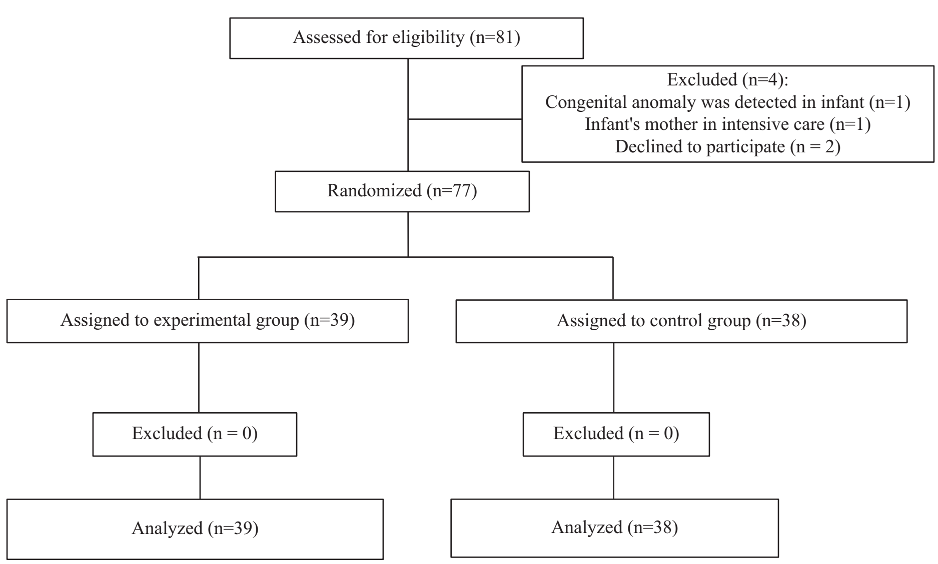

Figure 1. CONSORT flow diagram.

The exclusion criteria of the study were as follows:

(a) have asphyxia,
(b) have intraventricular bleeding,
(c) have a congenital anomaly,
(d) have being unable to breastfeed for any reason,
(e) infants without their mothers.

Data Collection

The preterm infants in the experimental and control groups received similar care at the same NICU, and all patients were monitored. The researcher participated in an individualized developmental care and massage course at the NICU and consulted with a specialist physiotherapist about oral structures and swallowing. The feeding plan was established in line with the NICU's feeding protocol for all the infants included in the study. Traditional feeding, which is also known as volume-driven feeding, was used in the NICU. The decision to change to paranteral, enteral, or oral feeding was made by the neonatologist and neonatal nurse. According to the aforementioned protocol, mothers of all babies hospitalized in the NICU were trained by the intensive care nurses on spoon-feeding. Oral feeding for the infants in the NICU was supplemented by spoon-feeding when necessary, never by bottle feeding. The researchers made no changes to this protocol.

After the infants were assessed by a neonatologist, OMS was administered to the experimental group thrice a day (at 9:00 AM, 12:00 noon, and 3:00 PM) for 15 minutes right before feeding, over a 14-day period. It took 15 minutes to apply the OMS by lightly touching their cheeks, lips, gums, and tongue with fingertips for the first 12 minutes, followed by letting the infant suck on a pacifier for the remaining 3 minutes. The preterm infants in the control group were only fed by the researcher thrice a day (at 9:00 AM, 12:00 noon, and 3:00 PM) over a 14-day period. Thus, the health team taking care of the preterm infant was blinded. In case conditions such as decrease in oxygen saturation, apnea, or bradycardia were observed during the use of OMS, the procedure was either stopped entirely or postponed until the infant re-stabilized. During the use of OMS, different pacifiers were employed for each infant, and they were sterilized after every use. The neonatologist made the decision regarding discharge of the infants. The infants in both groups were followed up until they were discharged from the hospital.

The "Preterm Infant Data Collection Form" used in the study had 4 sections and was prepared by the researchers in line with the literature.[12,25,26] The first section contained questions asking the descriptive details about the mother and infant, the second contained questions about anthropometric measurements, the third addressed parenteral and oral feeding times, and fourth included information with regard to hospitalization and discharge.

Instruments

The "LATCH Breastfeeding Assessment Tool" was developed by Jensen et al.[27] Demirhan[28-31] conducted its Turkish validity test and revealed that it is a reliable and easy-to-use scale. Each criterion is rated in the point range of 0-2 points. LATCH acronym is composed of the initial letters L: Latch on breast, A: Audible swallowing, T: Type of nipple, C: Confort nipple, and H: Hold. Breastfeeding is then assessed based on the sum of these scores. The highest and lowest scores of the tool are 10 and 0, respectively, and higher scores signify the breastfeeding/sucking success. In the present study, this tool's Cronbach's α value was 0.74. Since the tool is an observational form, it was filled out by the researcher and an observing nurse. The observer was the executive nurse who did not provide primary care to the preterm infants included in the study. The researcher and observer both filled out the form simultaneously and independently at 2 breastfeeding periods for every preterm infant. The observer was double blinded while filling the form. The Cohen's kappa coefficient was examined to assess the agreement between the researcher and observer. The first evaluation of the LATCH breastfeeding assessment form ($K=0.938$) and its second evaluation during the discharge ($K=0.964$) revealed that there was a good level of agreement between the 2 assessments.

The time of transition to full enteral feeding refers to the period from the first hospitalization day to the day when parenteral feeding was terminated and full enteral feeding was started. This time was assessed as the number of days in the present study.

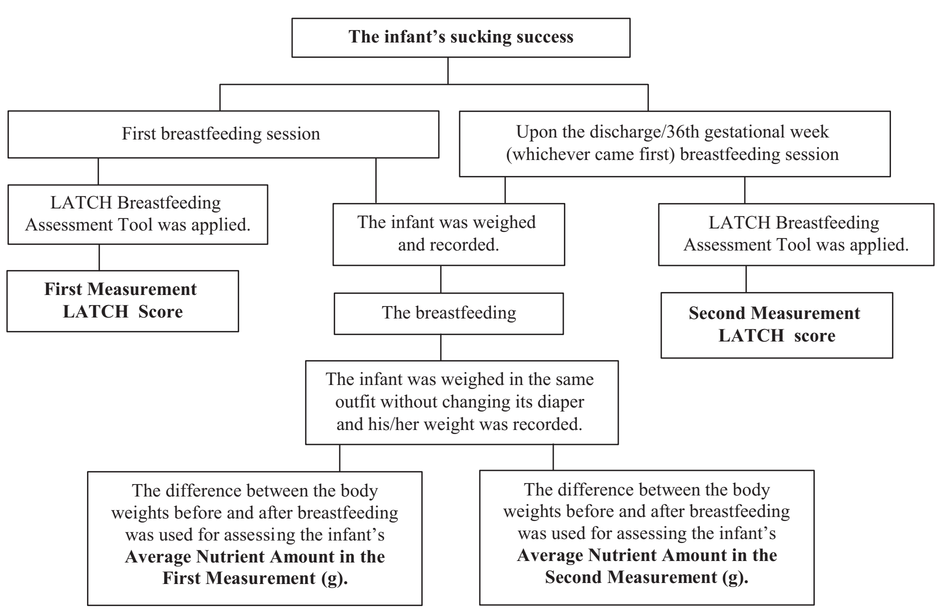

Figure 2. The process of evaluating the feeding success in a preterm infant.

The preterm infant was said to have achieved full oral feeding on accomplishing 4 successive oral feedings without any decrease in oxygen saturation (SpO_2 <85%) or developing any apnea and bradycardia throughout feeding after the orogastric catheter was completely removed. This transition period from first hospitalization to full oral feeding was calculated in days. The preterm infant's body weight, length, and head circumference measurements during birth, at 1 week after birth (physiological weight loss), and at either the 36th gestational week or upon discharge (whichever came first) were measured. Likewise, *Z*-scores as well as the infant's growth rate, body weight, length, and head circumference were assessed.[32] The success in sucking was evaluated based on the LATCH mean scores and average nutrient intakes of the first and second measurements (Figure 2). The first breastfeeding session was taken as the first measurement (for once). The second measurement was done at 36 weeks of gestation (for once). Preterm infants discharged before the 36th gestational week were evaluated just before discharge.

The length of hospital stay was calculated as the period from hospital admission to the discharge date. The discharge week was accepted as the gestational week covering the date of the discharge.

Ethical Consideration

Prior to commencing the study, an ethical approval (dated 05.05.2017, numbered: B.30.2.ATA.0.01.00/42) from the Ataturk University Medical Faculty Clinical Trials Ethics Committee and permission from the relevant institution were obtained.

Statistical Analysis

The data were analyzed using the Statistical Package for the Social Sciences version 22.0 (IBM SPSS Corp., Armonk, NY, USA). The chi-square test (for non-normal distributions) was used for categorical variables, while independent group *t*-test (for normal distributions) and Mann–Whitney *U*-test (for non-normal distributions) were used for continuous measurements. In addition, descriptive characteristics were analyzed using arithmetic mean, SD, and percentage. For the comparison of time of transition to full enteral feeding (day), time of transition to full oral feeding (day), LATCH mean score of the first measurement, LATCH mean score of the second measurement, length of stay in hospital (days), body weight (g), bodyweight *Z*-score, height (cm), height *Z*-score, head circumference (cm), and head circumference *Z*-score parameters between the intervention and the control group, independent group *t*-test (for normal distributions) were used. For the average nutrient amount of the first measurement (g), average nutrient amount of the second measurement (g), and discharge/gestational week parameters between the intervention and the control group, independent group Mann–Whitney *U*-test (for non-normal distributions) was used. Skewness and kurtosis factors were used in the normality distribution of data, while Cronbach's α coefficient was used for internal consistency. For all the analyses, the value of $P < .05$ was accepted as significant.

RESULTS

Thirty-nine preterm infants were assigned to the intervention group and 38 preterm infants were assigned to the control group. There were no significant differences in demographics between the 2 groups (Table 1).

The LATCH mean scores for the first ($P < .001$) and second ($P = .001$) measurements and average nutrient intake for the second ($P = .005$) measurements were significantly higher in the experimental group. On the other hand, the length of stay in hospital in the experimental group (23.64 ± 12.00) was shorter than that of the control group (29.15 ± 13.50), and this was not statistically significant ($P = .062$) (Table 2).

Table 1. Comparison of Descriptive Characteristics of Experimental and Control Groups

	Experimental Group		Control Group			
Characteristics	Mean	%	Mean	%	Test	*P*
Gender						
Girl	14	35.9	12	31.6	$\chi^2 = 0.160$	.689
Boy	25	64.1	26	68.4		
Gestational age week						
29-30	14	35.9	12	31.6	$\chi^2 = 0.169$	.919
31-32	17	43.6	18	47.4		
32-33	8	20.5	8	21.1		
Mother's pregnancy number						
Primiparous	18	46.2	16	42.1	$\chi^2 = 0.128$	.721
Multiparous	21	53.8	22	57.9		
	Mean ± SD		Mean ± SD			
Gestational week	31.33 ± 1.56		31.26 ± 1.60		$t = 0.194$	.846
Birth weight (g)	1595.56 ± 302.27		1605.68 ± 338.96		$t = 0.138$	.890
Birth weight *Z*-score	−0.04 ± −0.85		−0.00 ± −0.66		$t = -0.251$	.803
Birth height (cm)	40.91 ± 3.20		41.18 ± 3.62		$t = -0.352$	.726
Birth height *Z*-score	−0.37 ± 0.94		−0.77 ± 1.15		$t = 0.919$	.104
Birth head circumference (cm)	29.09 ± 2.04		29.15 ± 2.07		$t = -0.145$	.885
Birth head circumference *Z*-score	0.33 ± 1.13		0.41 ± 1.02		$t = -0.307$	.759
First-minute APGAR	6.23 ± 1.40		5.57 ± 1.68		$t = 1.845$	.069
Fifth-minute APGAR	7.87 ± 1.23		7.71 ± 1.22		$t = 0.573$	.568
Length of stay in mechanical ventilator	0.07 ± 0.26		1.02 ± 1.02		$Z = -0.866$	.386
Length of stay in CPAP	3.12 ± 5.55		2.92 ± 5.03		$t = 0.171$	.865
Mother's age	30.00 ± 6.24		29.39 ± 5.86		$t = 0.438$	.662
Physiological weight loss (g)	−51.02 ± 91.29		−21.42 ± 78.30		$t = -1.526$	.131

CPAP, continuous positive airway pressure; SD, standard deviation.

DISCUSSION

In the present study, only 1 researcher who was not included in the intensive care team administered OMS to all the infants. The sample size of the study was sufficient, as determined by the power analysis. The descriptive characteristics of the experimental and control groups were similar.

In this study, the time of transition to full enteral feeding was similar in both groups. Ghomi et al[33] and Thakkar et al[34] had obtained

Table 2. Data Concerning Transition to Enteral and Oral Feeding, Latch Score, Discharge Day and Week, and Anthropometric Values in the Discharge/36th Gestational Week

	Experimental Group		Control Group			
Characteristics	**Mean**	**SD**	**Mean**	**SD**	**Test**	***P***
Time of transition to full enteral feeding (day)	4.64	4.53	5.50	10.96	$t=-0.909$	.366
Time of transition to full oral feeding (day)	16.76	10.96	24.05	13.25	$t=-2.630$	.010
LATCH of the first measurement	7.23	1.54	5.84	1.48	$t=4.023$	< .001
Nutrient amount of the first measurement (g)	4.74	7.94	1.84	4.71	$Z=-2.152$	.031
LATCH of the second measurement	9.25	1.27	8.15	1.44	$t=3.547$	.001
Nutrient amount of the second measurement (g)	18.43	18.03	8.15	11.64	$Z=-2.801$	.005
Length of stay in hospital (days)	23.64	12.00	29.15	13.50	$t=1.896$	.062
Discharge/ gestational week	34.48	1.02	35.39	1.34	$Z=-3.044$	.002
Body weight (g)	1919.48	171.93	2049.21	199.07	$t=3.063$	.030
Body weight *Z*-score	−1.06	0.72	−1.10	0.60	$t=0.297$	.767
Height (cm)	44.25	1.88	44.02	2.57	$t=0.448$	.655
Height *Z*-score	−0.37	0.94	−0.77	1.15	$t=0.919$	.104
Head circumference (cm)	31.33	1.38	31.61	1.14	$t=0.983$	.329
Head circumference *Z*-score	−0.13	0.96	−0.39	0.80	$t=1.305$	.196

similar results as well. The time of transition to full enteral feeding approximately corresponded to the fourth hospitalization day in the experimental group and the fifth hospitalization day in the control group. Preterm infants face respiratory problems more frequently in the initial days of life, which means that they are in greater need of respiration support. The fourth/fifth hospitalization days may coincide with times when the preterm infant tries to adapt to extrauterine life, and some parameters like respiration fail to stabilize. The failure to provide stability to the infants' overall condition had hindered the use of OMS. Considering that infants adapt to extrauterine life quickly and successfully, the time of transition to full enteral feeding corresponds with the early periods of OMS. At least 10 OMS sessions are required for an effective oral feeding performance.[7,35,36] In the early periods, OMS has a short-term and temporary effect.[37] Since the baseline characteristics of the groups were also similar, it was expected that there was no difference between the experimental and control groups with respect to the transition time to full enteral feeding.

In the present study, the transition time to full oral feeding was approximately 8 days less in the experimental group than in the control group. Similarly, Fucile et al[12] found that preterm infants receiving OMS transitioned to full oral feeding approximately 7 days earlier, and Fucile et al[38] found that such preterm infants started full oral feeding 9 days earlier; thus indicating a significant result.[12,38] Although some studies have reported that the group receiving OMS has an earlier transition to oral feeding,[16,25,26,34,39-42] others have suggested that there is no difference between the experimental and control groups in terms of the transition time to full oral feeding.[14,43-45]

The results of the present study support the view that the preterm infants receiving OMS had better sucking success. Lyu et al.[25] indicated that the feeding period was shorter in the preterm infants receiving OMS, while Bala et al.[40] reported that OMS improved the oral feeding skills of preterm infants. Moreover, Li et al[41] revealed that OMS significantly improved the non-nutritive sucking and feeding parameters (e.g., oral posture, oral reflexes, and behavioral organization) in preterm infants. These studies have indicated that development of sucking is not only an innate reflex depending on neurophysiological maturity but also a skill that can be improved with OMS.[46] Moreover, the results of our study support the results of the aforementioned studies.

The body weight (g) of the preterm infants in the control group during discharge/36th (discharged before the 36th gestational week was evaluated just before discharge) gestational week was found to be higher than those receiving OMS. The studies by Lyu et al[25] and Rocha et al.[26] assessed the body weight in grams and found that body weight of the preterm infants in the control group during discharge was higher, which corroborated with our study results. Coker-Bolt et al[16], Costa et al[33], Ghomi et al[44], and Younesian et al[45] assessed body weight in grams and found no difference in the body weight during discharge. Lack of standard methods for calculating the growth rate in preterm infants makes the comparison between the studies difficult and hinders the transfer of the study results into clinical practice.[24] In order to minimize this problem, the body weight, length, and head circumference Z-score assessments standardizing the growth rate in preterm infants are used by considering variables such as gender differences.[32] In the present study, there were no differences between the infants receiving and not receiving OMS in terms of the body weight *Z*-scores during the discharge/36th (discharged before the 36th gestational week was evaluated just before discharge) gestational week Upon review, no study assessing body weight with *Z*-scoring was found. In this study, there was a significant difference in the body weight measured in grams; however, there was no difference in body weight assessed with *Z*-scoring. This data emphasizes the necessity of using standardized assessments and explains the conflicting result.

In the present study, the preterm infants in the experimental group were discharged approximately 6 days earlier than the control group, but this difference was not statistically significant. Similarly, there are studies suggesting that there is no significant difference between preterm infants receiving and not receiving OMS in terms of the duration of hospitalization.[12,14,25,38]

Aguilar-Rodrıguez et al[16], Ghomi et al[33], Mahmoodi et al[39], and Younesian et al[42] stated that the preterm infants receiving OMS were discharged significantly earlier. Coker-Bolt et al[44] stated that the preterm infants receiving OMS following a cardiac operation were discharged significantly earlier. Treatment and care of preterm infants are a great burden for healthcare professionals. As the gestational week decreases in preterm infants, the treatment and care costs increase.[47] Although the discharge of 6 days in the present study was not statistically significant, this supports the view that OMS is a cost-effective option.

The preterm infants receiving OMS were discharged in earlier gestational weeks, and Rocha et al[26] showed similar results. The most important criteria for discharge are weight gain and ability to feed orally. Moreover, feeding problems are the most common reason for prolonged hospitalization period.[8,9] Because the preterm infants receiving OMS started oral feeding earlier and had more advanced feeding skills in this study, they may have been discharged in earlier gestational weeks.

Based on the results of this study, OMS is recommended in NICUs to support and develop the sucking and feeding skills of preterm infants transitioning from enteral feeding to oral feeding and utilize international standard values to assess the growth rate of preterm infants.

Study Limitations

The results cannot be generalized to preterm infants in other countries but can be generalized to the infants participating in the study.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Atatürk University (Date: May 5, 2017, Number: B.30.2.ATA.0.01.00/42).

Informed Consent: All of the parents of the infants who were included in the study were informed about the purpose of the study and were allowed to participate upon obtaining written consent.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – Ş.A.D., A.Ç.; Design – Ş.A.D., A.Ç., A.A.Ö.; Supervision – A.Ç., A.A.Ö.; Resources – Ş.A.D., K.Ş.T.; Materials – Ş.A.D.; Data Collection and/or Processing – Ş.A.D., K.Ş.T.; Analysis and/or Interpretation – Ş.A.D., A.A.Ö.; Literature Search – Ş.A.D., A.Ç.; Writing Manuscript – Ş.A.D., A.Ç., A.A.Ö.; Critical Review – A.Ç., A.A.Ö., K.Ş.T.

Declaration of Interests: The authors declare that they have no competing interest.

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Hasta Onamı: Çalışmaya alınan tüm preterm bebeklerin ebeveynlerine çalışmanın amacı anlatıldı ve sözlü-yazılı onamları alındı.

Hakem Değerlendirmesi: Dış bağımsız.

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