Original Article

The Effects of "Oral Administration of Breast Milk Droplets" and "Palatal Stimulation with a Finger" Methods on Feed Tolerance in Preterm Newborns Fed via an Orogastric Tube: Randomized Controlled Trial

C Tunç, A Kokcu Dogan

Istanbul Medipol University, Institute of Health Science, Istanbul Turkey

Abstract

Background: Infants should be provided with effective feeding skills with evidence-based care practices to ensure nutritional tolerance and maximize the growth and development in preterm infants. **Aim:** This study aimed to examine the effects of "oral administration of breast milk droplets" and "palatal stimulation with a finger" methods on feed tolerance in preterm newborns fed via an orogastric tube. **Methods:** This randomized controlled trial was conducted in the neonatal intensive care unit of a private hospital. The study included 90 premature newborns born at the 28th–36th gestational weeks and admitted to intensive care. We applied breast milk droplets inside the oral cavity of newborns (30) in one of the intervention groups and stimulated the palate of newborns (30) by using a finger in the other. We performed these interventions every 3 hours for 5 minutes at the feeding times of the newborns for 7 days. Babies in the control group were not applied any intervention. We used SPSS (Statistical Package for Social Sciences) 22.0 for Windows software for statistical analyses. **Results:** The number of defecations, frequencies of residuals, body weight, and abdominal circumference were significantly different between the groups ($P < 0.05$). The increments in body weight and reductions in abdominal circumference were significantly different between the groups in the study ($P < 0.05$). **Conclusion:** Palatal stimulation with a finger acted on feed tolerance more favorably than the oral administration of breast milk droplets or no intervention in preterm infants fed via OGT. We suggest primarily that palatal stimulation with a finger and secondarily the oral administration of breast milk droplets as the two methods to be employed to overcome feeding intolerance, which is a significant problem in premature infants.

Keywords: *Breast milk, enteral nutrition, oral feeding, palate stimulation, preterm newborn*

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Introduction

The World Health Organization (WHO)[1] describes infants born alive before the 37th week of gestation as "premature." Premature newborns are born with immature body systems due to the failure of the completion of full intrauterine development. Therefore, earlier gestational age at birth is associated with significant nutritional or feeding-related health problems in premature infants. Feeding intolerance (FI) is common in preterm infants, but criteria to define this problem have not been established yet.[2,3] As there are no clinical definitions for FI, clinical findings, stomach content, and laboratory and radiological tests

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Address for Correspondence: Dr. A Kokcu Dogan, Ph.d, Istanbul Medipol University, Faculty of Health Science, Istanbul 34815, Turkey.
E-mail: akdogan@medipol.edu.tr

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are commonly used in diagnosis.[4] Total parenteral, enteral, or oral feeding methods are employed to solve the nutritional and feeding problems of infants, based on the infants' clinical condition. Enteral feeding refers to food intake via an orogastric (OG), nasogastric (NG), or a transpyloric tube. When oral feeding is not possible in premature infants obligated to nose breathers, orogastric tube (OGT) feeding is preferred to avoid obstruction of the nostrils.[5,6] However, OGT insertion is among the stressful and painful interventions for premature infants.[7,8] In clinical practice, the aim is minimizing such painful interventions in neonatal intensive care units (NICU) by employing non-pharmacological methods. Non-nutritive oral administration of breast milk droplets and oral stimulation with a finger are among such non-pharmacological methods to minimize the painful interventions.[9-11]

Breast milk contains essential nutrients and bioactive components supporting growth and immune system development during infancy.[12] Breast milk can be given to the baby using various methods. These methods include breastfeeding, cup feeding, feeding through orogastric tube, nasogastric tube, syringe, feeding using a gauze swab or cotton swab soaked in breast milk, and dripping breast milk into the baby's mouth.[13] In the dripping method, expressed breast milk or formula is dripped close to the newborn's mouth to ensure that he/she takes it.[14]

Breastfeeding is an effective way of exposing the oral mucosa of preterm infants to immunoglobulins in breast milk.[15] Protective biological factors in breast milk, such as sIgA, lactoferrin, and oligosaccharides, can induce local maturation on mucosal surfaces and protect against necrotizing enterocolitis (NEC) by preventing the adhesion and migration of pathogenic bacteria to the intestinal mucosa. Breast milk intake can spread growth factors to the gastrointestinal tract, increase intestinal motility, and relieve FI.[16,17] Therefore, it is important to give breast milk orally in preterms.

Oral stimulation includes applying gentle pressure to the cheeks, lips, tongue, gums, jaw, and palate. It also improves sucking skills, oral-mandibular movements, and relevant muscle strength, and maintains the sensory responses of the infant.[11] It is suggested that oral motor stimuli enhance the development of central and peripheral structures.[18] Through oral stimulation, saliva is secreted, and swallowing saliva activates the gastrointestinal system (GIS). Non-nutritive sucking accelerates the transition to full oral feeding, minimizes the energy needed for feeding, and promotes the digestion and reabsorption of nutrients.[19] Studies on this subject matter report that in the long term, non-nutritive sucking leads to increments in calorie intake and body weight and a shortened hospital stay.[20] However, no studies exist in the literature examining the effects of non-nutritive sucking on feed tolerance. We believe that the results of this study will shed light on evidence-based nursing practices.

In the literature, it has been reported that breast milk dripping and finger palate stimulation methods improve sucking, swallowing, and respiratory coordination in preterm infants; Support transition to full oral feeding in a shorter time; and provide earlier discharge.[11,18-20]

However, no study was found in which feeding tolerance was investigated using breast milk dripping into the mouth and stimulation of the palate with the finger. The aim of this study was to investigate the effects of "dripping breast milk into the mouth" and "stimulating the baby's palate with a finger." The study also aimed to shed light on methods on feeding tolerance in preterm newborns fed with orogastric tube and evidence-based care practices.

Method

Purpose and study type

This study, a randomized controlled trial, was conducted to investigate the effects of "dripping breast milk into the mouth" and "stimulating the baby's palate with a finger" on feeding tolerance in infants fed with an orogastric tube.

Hypotheses of the study

Hypothesis H1: The method of oral administration of breast milk droplets acts on feed tolerance favorably in preterm infants fed via an OG tube.

Hypothesis H2: The method of palatal stimulation with a finger acts favorably on feed tolerance in preterm infants fed via an OG tube.

Study setting and period

This study was conducted between December 2021 and October 2022 in the neonatal intensive care unit (NICU) of a private hospital in Batman/Turkey.

Study sample

The sample of the study consisted of 90 premature infants (60 in intervention (Intervention 1 and Intervention 2) and 30 in the control group) who were hospitalized in the NICU at 28–36 weeks of age and whose parents approved their participation in the study.

We used the G*Power 3.1 software to calculate the number of premature infants to be included in the study and the power of the test. In a similar study, Mohammed and Ahmed[21] calculated the effect size of the difference

in abdominal circumference between groups as 1.123. We calculated it for 42 subjects, 14 per group, would be required to exceed the 99% power at the 5% significance level for an effect size of 1.123 ($df = 13$; $t = 1.771$).

The high number of patients in the unit where the study was conducted allowed more premature infants to be included in the study. Therefore, to keep the power of the study high, we aimed to reach a total of 90 premature infants, 30 in each group, taking into account the exclusion criteria.

The researcher developed the study flowchart based on the Consolidated Standards for Reporting Trials checklist [Figure 1].

Inclusion criteria

- Babies born at 28–36 weeks of gestation
- Premature infants with stable vital signs
- Babies with parental consent to study.

Exclusion criteria (added)

- Premature infants with major congenital anomaly, severe systemic disease, NEC, suspected or confirmed sepsis
- Intubated infants at the time of the study.

Randomization

The infants were randomized according to the rank of hospitalization to prevent bias throughout the study. The randomization table was created according to the instructions at the link: "https://www.calculatorsoup." We listed three groups in the table, namely Intervention 1, Intervention 2, and Control. We randomly assigned the subjects to groups according to patient registration numbers, matching them against the randomization table. With 60 in the intervention groups and 30 in the control group, the study was completed with 90 newborns meeting the inclusion criteria whose parents consented to their participation.

Data collection tools

Data were collected through the "Demographic Information Form" and "Patient Follow-up Form" developed by the researcher in line with the literature.

Demographic Information Form: It consisted of six questions about the newborn, concerning gender, gestational week, birth weight, head circumference, and height.

Patient Follow-up Form: It included the parameters to be measured on infants for the study during 7 days. We developed this form through information obtained from several studies and experts' opinions to further contribute to this study.[22,23] We proceeded with study procedures and assessment results of the parameters for 7 days. Procedures and assessments included type of food, number of defecations, checks for residuals, body weight, abdominal circumference, duration and hours of oral administration of breast milk droplets, and duration and time of oral stimulation with a finger.

Study conduct

Before the Procedure: The steps before the procedure were identical for all three groups. Before the procedure, we checked the subjects' identities and filled out the Demographic Information Form (gender, gestational week, birth weight, head circumference, and height) and the Patient Follow-up Form. We prepared the materials and equipment for use. Measuring and marking on OGT following hygiene rules, we inserted OGT in newborns in all groups, verified their positions, and, finally, elevated the infants' heads slightly to a 30-degree angle from the bed. Achieving the correct position, we checked residuals and noted the results. We checked whether residuals were present every 3 hours before feeding for 7 days in all premature infants in the study.

Order of Procedures: We fed the infants via OGT in the oral administration of breast milk droplets group after applying a total of 0.5 cc of breast milk in drops into their mouths for 5 minutes by using an insulin injector. In the palatal stimulation group, following the necessary hygiene rules, we used the little finger with a glove on and stimulated infants' palate and gums by slow and peristalsis-like movements for 5 minutes while the infants were fed via OGT. The premature infants in the control group were fed via OGT following hygiene rules, without any intervention. In the intervention groups, we orally applied breast milk in droplets in one group and stimulated the palate of the newborns by using a finger in the other. We performed these interventions every 3 hours for 5 minutes for 7 days at feeding times.

After the Procedure: Performing routine comfort care, we examined defecation and noted our results every day in all subjects during the follow-up period of 7 days. Daily, abdominal circumference and body weight of the newborns were measured and noted on the forms.

Statistical analysis of data

We used SPSS (Statistical Package for Social Sciences) 22.0 for Windows software for statistical analyses. Number, percentage, mean, and standard deviation were used in descriptive statistical methods. Differences between the rates of categorical variables in independent groups were analyzed by using the Chi-square test and Fisher's exact test. One-way analysis of variance was used to compare quantitative continuous data between groups. The repeated measures ANOVA test was used for intragroup comparisons.

Ethical considerations of the study

The approval was obtained from the Non-Interventional Clinical Research Ethics Committee of Istanbul Medipol University (Decision No. 977 Date: 30/09/2021). The permission to conduct the study was obtained from the hospital, where the study would be performed. Infants included in the study were not exposed to practices or procedures violating patient rights or practices considered inappropriate by parents. This study was conducted in compliance with the Declaration of Helsinki.

Results

Among the infants included in the study, 52.2% were boys, 58.9% were born at the 34th–36th weeks of

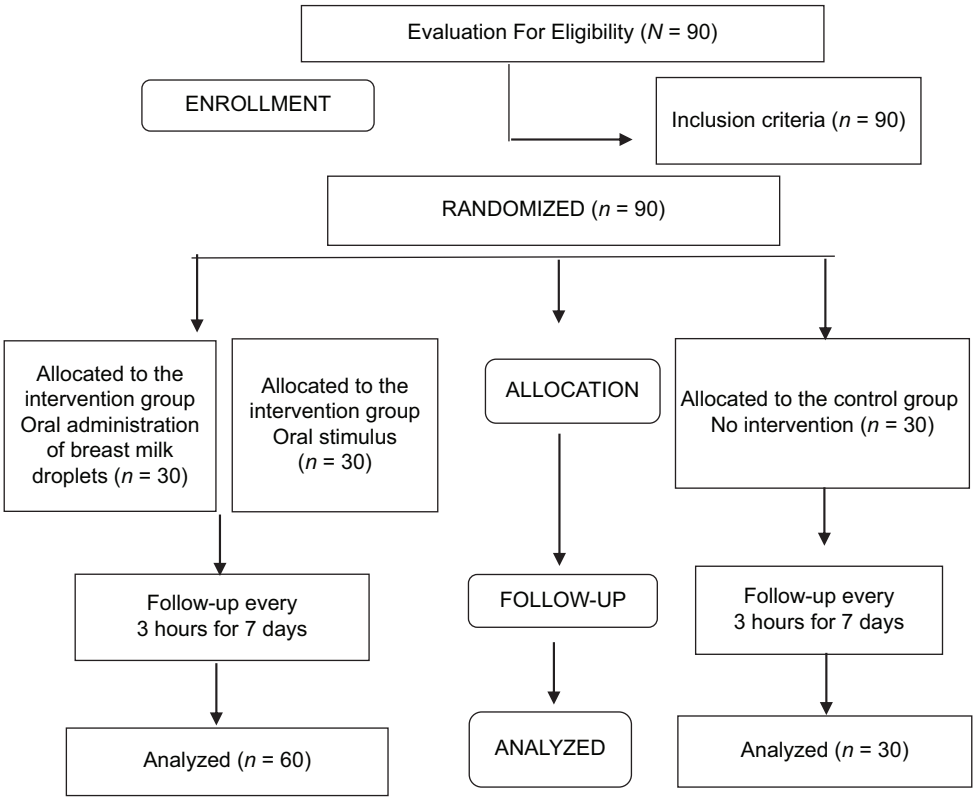

Figure 1: Study sample flow chart

Table 1: Demographic characteristics (*n*=90)

Characteristics		Palatal stimulation		Oral administration of breast milk droplets		Control		Total		*P*
		n	%	*n*	%	*n*	%	*n*	%	
Infant's gender	Girl	19	63.3	14	46.7	10	33.3	43	47.8	X^2=5.433
	Boy	11	36.7	16	53.3	20	66.7	47	52.2	*P*=0.066
Gestational week	28–33 weeks	16	53.3	12	40.0	9	30.0	37	41.1	X^2=3.396
	34–36 weeks	14	46.7	18	60.0	21	70.0	53	58.9	*P*=0.183
Birth weight	1000–1500 g	8	26.7	4	13.3	5	16.7	17	18.9	X^2=6.581
	1501–2000 g	10	33.3	8	26.7	4	13.3	22	24.4	*P*=0.361
	2001–2500 g	7	23.3	11	36.7	13	43.3	31	34.4	
	>2501 g	5	16.7	7	23.3	8	26.7	20	22.2	
Head circumference	22.6–25.6 cm	2	6.7	1	3.3	0	0.0	3	3.3	X^2=10.044
	25.7–28.5 cm	8	26.7	5	16.7	2	6.7	15	16.7	*P*=0.123
	28.6–31 cm	7	23.3	7	23.3	4	13.3	18	20.0	
	31.1–33.8 cm	13	43.3	17	56.7	24	80.0	54	60.0	
Height of newborn	29–31 cm	4	13.3	0	0.0	0	0.0	4	4.4	X^2=10.177
	32–34 cm	4	13.3	3	10.0	3	10.0	10	11.1	*P*=0.117
	35–37 cm	10	33.3	8	26.7	9	30.0	27	30.0	
	≥38 cm	12	40.0	19	63.3	18	60.0	49	54.4	

Chi-square analysis

gestation, and 34.4% weighed 2001–2500 g. There were no significant differences in infants' demographic characteristics between the groups ($P > 0.05$) [Table 1].

Defecation numbers on the 3rd, 4th, 5th, 6th, and 7th days had significantly higher values in the palatal stimulation group compared to the other groups ($P < 0.05$). The high numbers of defecations in the palatal stimulation group were followed by those in the oral administration of breast milk droplets group with high values on the 4th and 7th days [Table 2].

Intergroup assessments of preterm infants' residuals for 7 days revealed no significant relationships on the 6th day ($P > 0.05$). However, intergroup differences were

Table 2: Distribution of the number of defecations by groups

Characteristics		Palatal stimulation		Oral administration of breast milk droplets		Control		Total		*P*
		n	%	*n*	%	*n*	%	*n*	%	
Number of defecations – Day 1	1	17	100.0	15	93.8	4	80.0	36	94.7	X^2=3.153
	2	0	0.0	1	6.2	1	20.0	2	5.3	*P*=0.207
Number of defecations – Day 2	1	13	68.4	13	86.7	5	83.3	31	77.5	X^2=2.242
	2	5	26.3	2	13.3	1	16.7	8	20.0	*P*=0.691
	3	1	5.3	0	0.0	0	0.0	1	2.5	
Number of defecations – Day 3	1	12	44.4	18	66.7	13	86.7	43	62.3	X^2=10.360
	2	12	44.4	9	33.3	2	13.3	23	33.3	*P*=0.035
	3	3	11.1	0	0.0	0	0.0	3	4.3	
Number of defecations – Day 4	1	12	40.0	13	50.0	24	92.3	49	59.8	X^2=23.020
	2	11	36.7	12	46.2	2	7.7	25	30.5	*P*=0.000
	3	7	23.3	1	3.8	0	0.0	8	9.8	
Number of defecations – Day 5	1	6	20.7	13	44.8	20	74.1	39	45.9	X^2=22.305
	2	13	44.8	13	44.8	7	25.9	33	38.8	*P*=0.001
	3	9	31.0	3	10.3	0	0.0	12	14.1	
	4	1	3.4	0	0.0	0	0.0	1	1.2	
Number of defecations – Day 6	1	2	7.1	4	13.8	16	66.7	22	27.2	X^2=33.282
	2	13	46.4	17	58.6	8	33.3	38	46.9	*P*=0.000
	3	12	42.9	8	27.6	0	0.0	20	24.7	
	4	1	3.6	0	0.0	0	0.0	1	1.2	
Number of defecations – Day 7	1	1	3.3	3	10.0	17	60.7	21	23.9	X^2=37.858
	2	8	26.7	10	33.3	9	32.1	27	30.7	*P*=0.000
	3	19	63.3	15	50.0	2	7.1	36	40.9	
	4	2	6.7	2	6.7	0	0.0	4	4.5	

Chi-square analysis

Table 3: Assessment of residuals by groups (*n*=90)

Characteristics		Palatal stimulation		Oral administration of breast milk droplets		Control		Total		*P*
		n	%	*n*	%	*n*	%	*n*	%	
Residual is present – Day 1	Yes	23	76.7	30	100.0	30	100.0	83	92.2	X^2=15.181
	No	7	23.3	0	0.0	0	0.0	7	7.8	*P*=0.001
Residual is present – Day 2	Yes	19	63.3	29	96.7	30	100.0	78	86.7	X^2=21.346
	No	11	36.7	1	3.3	0	0.0	12	13.3	*P*=0.000
Residual is present – Day 3	Yes	10	34.5	25	83.3	24	80.0	59	66.3	X^2=19.553
	No	19	65.5	5	16.7	6	20.0	30	33.7	*P*=0.000
Residual is present – Day 4	Yes	3	10.0	12	40.0	16	53.3	31	34.4	X^2=13.089
	No	27	90.0	18	60.0	14	46.7	59	65.6	*P*=0.001
Residual is present – Day 5	Yes	2	6.7	6	20.0	11	36.7	19	21.1	X^2=8.139
	No	28	93.3	24	80.0	19	63.3	71	78.9	*P*=0.017
Residual is present – Day 6	Yes	1	3.3	5	16.7	4	13.3	10	11.1	X^2=2.925
	No	29	96.7	25	83.3	26	86.7	80	88.9	*P*=0.232
Residual is present – Day 7	Yes	0	0.0	0	0.0	4	13.3	4	4.4	X^2=8.372
	No	30	100.0	30	100.0	26	86.7	86	95.6	*P*=0.015

Chi-square analysis

significant on the other days ($P < 0.05$). The frequencies of residuals were lower in the palatal stimulation group on all days compared to the oral administration of breast milk droplets group and the control group [Table 3].

Table 4: Intergroup comparisons of body weight gain (n=90)

Groups	Palatal stimulation Mean±SD	Oral administration of breast milk droplets Mean±SD	Control Mean±SD	F^a	P	Difference
Body weight Day 1	8.470±3.674	10.800±6.122	10.530±5.393	1.834	0.166	
Body weight Day 2	10.270±4.266	12.200±6.071	12.200±4.985	1.403	0.251	
Body weight Day 3	13.800±4.310	12.500±6.107	12.500±5.309	0.603	0.549	
Body weight Day 4	15.500±4.167	13.600±6.350	12.770±4.783	2.193	0.118	
Body weight Day 5	17.570±4.174	14.930±6.186	13.530±4.622	4.898	0.010	1>2 1>3 2>3
Body weight Day 6	19.330±5.821	16.200±5.968	12.730±3.732	11.758	0.000	1>2 1>3 2>3
Body weight Day 7	20.800±6.499	16.970±6.239	12.970±3.399	14.893	0.000	1>2 1>3 2>3
F^b	91.101	30.660	3.476			
P	0.000	0.000	0.019			
Bonferroni	1<2.3.4.5.6.7; 2<3.4.5.6.7; 3<4.5.6.7; 4<5.6.7; 5<6.7; 6<7	1<2.3.4.5.6.7; 2<4.5.6.7; 3<4.5.6.7; 4<5.6.7; 5<6.7	1<2.3.4.5.6.7			

a: One-Way Analysis of Variance, b: Repeated Measures ANOVA Test

Table 5: Intergroup comparisons of abdominal circumference (n=90)

Groups	Palatal stimulation Mean±SD	Oral administration of breast milk droplets Mean±SD	Control Mean±SD	F^a	P	Difference
Abdominal circumference – Day 1	27.167±0.651	27.330±0.477	27.497±0.512	2.684	0.074	
Abdominal circumference – Day 2	27.053±0.556	27.183±0.499	27.457±0.492	4.770	0.011	3>1 3>2
Abdominal circumference – Day 3	26.790±0.370	26.983±0.443	27.213±0.503	6.894	0.002	3>1 3>2
Abdominal circumference – Day 4	26.533±0.408	26.840±0.523	27.137±0.427	13.161	0.000	2>1 3>1 3>2
Abdominal circumference – Day 5	26.347±0.300	26.573±0.443	27.103±0.465	26.990	0.000	2>1 3>1 3>2
Abdominal circumference – Day 6	26.190±0.313	26.503±0.423	27.037±0.531	29.511	0.000	2>1 3>1 3>2
Abdominal circumference – Day 7	25.970±0.359	26.377±0.450	27.103±0.608	42.286	0.000	2>1 3>1 3>2
F^b	62.103	44.396	9.984			
P	0.000	0.000	0.000			
Bonferroni	1>3.4.5.6.7; 2>3.4.5.6.7; 3>4.5.6.7; 4>5.6.7; 5>6.7; 6>7	1>2.3.4.5.6.7; 2>3.4.5.6.7; 3>4.5.6.7; 4>5.6.7; 5>7; 6>7	1>3.4.5.6.7; 2>3.4.5.6.7; 3>6			

Body weight values on the 5th, 6th, and 7th days were significantly different between the groups ($P < 0.05$). The body weight was the highest in the palatal stimulation group, followed by the higher body weight values in the oral administration of breast milk droplets group compared to the control group. The increments in body weight were statistically significant throughout observation period in all groups ($P < 0.05$) [Table 4].

Abdominal circumferences of the preterm infants for the assessment of FI were significantly different between the groups on the 2nd, 3rd, 4th, 5th, 6th, and 7th days ($P > 0.05$). Abdominal circumference values were lowest in the palatal stimulation group, followed by the oral administration of breast milk droplets group and the control group. Abdominal circumference tended to decrease significantly in all groups in the study ($P < 0.05$) [Table 5].

Discussion

Promoting the transition to breastfeeding in preterm newborns fed via an OG tube is important. FI, the most common problem in premature infants during this period, is associated with unfavorable effects and manifests itself in various clinical findings.

The number of defecations is one of the clinical indicators of FI in premature infants. In a randomized controlled study similar to our study by Shaeri *et al*.[24] investigating the effects of abdominal massage on feeding tolerance in 64 premature infants, no significant difference was found in the control group ($n = 32$) in terms of defecation frequency, whereas a significant increase was found in the intervention group ($n = 32$), as in our study.

In another similar study by Mohamed and Ahmed[21] investigating the effect of abdominal massage on feeding tolerance in 60 preterm infants for 6 months, it was found that there was no significant difference between the first and last day in the control group ($n = 30$), while the frequency of defecation increased on the fifth day in the intervention group ($n = 30$).

In our study, we found a higher number of defecations every day compared to the previous day in all three groups (palatal stimulation group, oral administration of breast milk droplets group, and control group). While the number of defecations increased on the 3rd and 5th days in the palatal stimulation group, the number of defecations increased more on days 4, 5, 6, and 7 in the oral breast milk droplet application group compared to the other groups. Starting from the third day, there was a significant relationship between the frequency of defecation and the groups during the 7-day follow-up period ($P < 0.05$). The frequency of defecations was highest in the palatal stimulation group, followed by the oral administration of breast milk droplets group. When compared to the study results in the literature, our results showed that the number of defecations started to improve from the 3rd day, indicating that the methods used in the study were successful.

Singh *et al*.[25] conducted a study on 87 low-birth-weight premature infants and reported no statistical difference during transition to enteral feeding between the group of 45 subjects who underwent routine examinations for gastric residuals (GR), and the other group of 42 subjects who did not. Torrazza *et al*.[26] conducted a study on 61 very preterm infants and reported no significant differences in the length of time to achieve full enteral nutrition and in the length of total parenteral nutrition between the subjects with routine GR checks and those without. However, these periods were shorter for the subjects without GR routines. The relationship between the increases in GR and the development of NEC is not clear.[11,18,27] In this study, we monitored residuals for 7 days to examine the effect of our study methods on feed tolerance. There was a statistical relationship on all days except the 6th day ($P < 0.05$). Intergroup comparisons revealed that the frequencies of residuals were high in all three groups on the first day of the study assessments, but decreased gradually subsequently. We observed that palatal stimulation led to statistically more favorable results compared to those observed in the other two groups. On all days of the assessments for residuals, the frequencies of residuals were lower in the palatal stimulation group compared to the oral administration of breast milk droplets group and the control group. Assessments of residuals do not directly act on feed tolerance; however, we may suggest that the oral application of breast milk droplets and palatal stimulation minimize the frequency of residuals.

Nyaga *et al*.[28] applied tactile-kinesthetic intervention three times a day for 10 days on 72 newborns in two groups. They found that tactile-kinesthetic stimulation decreased feeding intolerance and increased weight gain in moderately preterm newborns. In our study, the body weight measurements of the group whose palate was stimulated were the highest, followed by the breast milk dripping group and the control group. As a result, the results of the study conducted by Nyaga *et al*.[28] support the body weight measurement results obtained in our study. Thus, Hypothesis 2 stated in the research planning was supported.

Another important clinical symptom of FI is increased abdominal circumference.[21,29] The absence of abdominal distension in premature infants is an accepted criterion

for feed tolerance. FI needs to be considered in cases of abdominal distension. A direct relationship between the frequency of defecation and abdominal distention and, consequently, abdominal circumference was reported in the literature.[26] We suggest that the gradual and significant daily decreases in the abdominal circumference in all groups are related to the development process of premature infants ($P < 0.05$). The results of our study are similar to those previously reported in the literature, confirming our hypotheses, namely Hypothesis 1 and Hypothesis 2.

Beker *et al*.[30] conducted a similar study to investigate the effect of smell and taste on the feeding of preterm infants (milk smell and milk taste group = 28/control group = 23) and found that there were significant differences in the weight *z* scores of preterm infants at discharge in favor of the intervention group ($P < 0.05$). Researchers have reported that the smell and taste of milk may increase feeding tolerance and weight gain in preterm infants, as in our study.

In a study on 130 preterm infants fed via an OG tube, Chen *et al*.[31] investigated the effect of oropharyngeal exposure to breast milk on salivary secretory immunoglobulin A (sIgA) levels. The study reported a significant positive correlation between the sIgA levels of the intervention group and number of interventions. The authors argued that oropharyngeal exposure to breast milk could improve the salivary sIgA levels of preterm infants. During oral feeding, the oral mucosa contacts with sIgA in breast milk, and this enables the establishment of the mucosal immune barrier against pathogens.[31] The oral mucosa is not exposed to breast milk in preterm infants fed via an OG tube, resulting in the growth of many pathogenic bacteria in the oral cavity. These bacteria can cause local or systemic infections readily.[32] Thus, salivary sIgA is suggested to provide benefits against nutritional problems. In our study, we observed significant differences in the daily abdominal circumference values between the groups. We found significant reductions in the measured values of abdominal circumference in all groups during the period from the 1st day to the 7th day ($P < 0.05$). These statistically significant decreases in our study are consistent with the results reported by Chen *et al*.[31] Furthermore, these findings are similar to those reported in the literature and thus confirm our Hypothesis 1, suggesting that oral administration of breast milk droplets affects feed tolerance favorably.

Limitations

The study population was limited to 90 preterm newborns, admitted to the NICU of a private hospital in Batman province, whose parents consented to their participation in the study.

Conclusion

As a result of the study, it was found that there was a significant intergroup difference in terms of feeding tolerance of preterm infants fed with OGS ($P < 0.05$). It was determined that the method of giving stimulus to the palate had a more positive effect on feeding tolerance than the other methods. To reduce feeding intolerance, which is an important problem in premature infants, it is recommended to apply first the method of giving stimulus to the palate of the baby and then the method of dripping breast milk into the mouth.

ClinicalTrials.gov ID: NCT06447558.

Place where the research was conducted: Batman Private Life Hospital Turkey.

Authors' contribution

Study concept and design, Ceyhan Tunç and Aysel Kokcu Dogan; acquisition of data, Ceyhan Tunç; analysis and interpretation of data, Ceyhan Tunç and Aysel Kokcu Dogan; drafting of the manuscript, Ceyhan Tunç and Aysel Kokcu Dogan; critical revision of the manuscript for important intellectual content, Aysel Kokcu Dogan.

Ethical policy and Institutional review board statement

Ethical approval was obtained from the Institutional Review Board of Istanbul Medipol University.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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