

## Effect of Pre-Feeding Oral Motor Stimulation on Preterm Infants' Outcomes

Sabreen Abd-Allah Mostafa<sup>1</sup>, Awatef El- sayed Ahmed<sup>2</sup>, Nafisa Hassan Refaat<sup>3</sup> & Amal Ahmed Mobarak<sup>4</sup>

<sup>1</sup>. Assistant Lecturer in Pediatric Nursing Department, Faculty of Nursing, Assuit University, Egypt.

<sup>2</sup>. Professor of Pediatric Nursing Faculty of Nursing, Assuit University, Egypt

<sup>3</sup>. Professor of Pediatrics Faculty of Medicine Assiut University, Egypt

<sup>4</sup>. Assistant Professor of Pediatric Nursing, Faculty of Nursing, Assuit University, Egypt.

### Abstract

**Background:** Feeding issues are mainly obvious among preterm infants; for these infants to discharge earlier from the hospital they must attain totally independent oral feeding. **Aim of the study** to determine the effect of oral motor stimulation on preterm infants' outcomes. **A** quasi-experimental research design was applied. **Sample:** A convenience sampling of 60 preterm infants who fulfilled the inclusion criteria were included. **Setting:** This study was implemented in four neonatal intensive care units at Assiut City, Egypt. **Tools:** Three tools were employed to gather the needed data: Preterm infant data, a premature oral feeding readiness assessment scale, and a feeding progression protocol. **Method:** To test the clarity and relevant of the sheet, a pilot study was implemented on 10% of preterm infants. **Results:** Revealed that; (83.3%) of the studied preterm infants in oral motor stimulation group had feeding readiness at time of discharge while (23.3%) in the control group, also statistically significant differences were found between them regarding to transition time and length of hospital stay  $P=0.000^*$ . **Conclusion:** Oral motor stimulation faster the transition time to total oral feeding and reducing hospitalization period. So the researcher **Recommended that** oral motor stimulation should become an essential component of standard nursing care for preterm infants in neonatal intensive care units.

**Keywords:** Feeding, Oral motor stimulation & Preterm infants.

### Introduction

Worldwide, about 130 million neonates born every year, 13.5 million are born preterm. Preterm infant referred as any infant who borne before 37 completed weeks of gestation this period measured from the first day of the last menstrual cycle to the date of birth (WHO, 2023). About 13% of preterm infants are born between 32 to less than 37 weeks of gestation in Egypt (Hassan, 2022). Preterm infants are un able to start oral feeding after delivery due to different factors such as weakness of oral muscle, and inability to coordinate between sucking, swallowing and breathing. All these factors play significant role in delaying or unsuccessful oral feeding in preterm infants (Vizzari et al., 2023).

About 80% of preterm infants during their hospitalization may experience difficulties with oral feeding these issues may arise from the central nervous system's immaturity (Pineda et al., 2020). The inability to latch on to a nipple, an unorganized sucking pattern, inefficient sucking, weak sucking strength, uncoordinated sucking-swallow-breathe, which frequently results in episodes of apnea, disturbed heart rate or hypoxia, are the most common oral feeding difficulties experienced by preterm infants during hospitalization (Izzaturrohman & Zubaidah, 2023).

Early intervention, such as the oral motor stimulation (OMS) technique, which involves mouth stimulation to strengthen the sucking reflex, is necessary for preterm infants to develop oral feeding skills. By giving sensory-motor input to the cheeks, lips, gums, and tongue, OMS is used to promote oral feeding, maintain normal oral motor development, and enhance oral muscle tone and movement in preterm infants. OMS accelerates the switch from gavage to oral feeding and improves the coordination of preterm infants' respiratory and sucking-swallowing reflex. (Aguilar et al., 2020). Oral motor stimulation considered one of the most widely used methods of pre-feeding stimulation which have significant role in improving oral feeding skills, achieving full oral feeding, and shortening hospital (El Mashada et al., 2021).

Neonatal nurses have crucial role in assisting preterm infants in receiving adequate nutrition and have a smooth and safe transition to oral feeding. As attainment of independent oral feeding is considered the main criteria infants need to meet prior to home discharge. And in order to attain this, they must be able to assess the infants' willingness to take feeding orally and apply new interventions and protocols (Mörelus et al., 2022).

**Operational definitions:****Oral motor stimulation:**

Oral motor stimulation (OMS) is defined in this study as manipulative actions of the lips, jaw, tongue and soft palate before feeding with non- nutritive sucking (NNS) to improve preterm infant's ability to suck (Aguilar et al., 2020).

**Preterm infants' outcomes:**

Preterm infants' outcomes are defined in this study as feeding readiness, progression and length of hospital stay.

**Significance of the study**

Oral feeding is a complex and dynamic process in preterm infants, it involves coordination of the neurological, gastrointestinal, cardio-respiratory, and oral-motor system. Preterm infants' physiological and neurological immaturity is the primary cause of these issues, as it makes them dependent on long-term enteral feeding through an oro-gastric or nasogastric tube until they are able to develop sufficient oral feeding skills (Fathi et al., 2022). In Assiut University Children Hospital, it was reported that (56.8%) of NICU admission were preterm and (43.2%) are full-term (Abdel-Aziz et al., 2021). When preterm infants can feed orally well, they can fulfill their needs through the mouth and tolerate oral feeding may be discharged from hospital sooner. So, oral motor stimulation interventions could be performed for all stable preterm infants admitted to NICUs to improve feeding skills.

**Aim of the Study:**

To determine the effect of oral motor stimulation on preterm infants' outcomes

**Research hypothesis:**

Preterm infants who receive oral motor stimulation will expect to have early feeding readiness, faster feeding progression and hospitalization period less than those in the control group.

**Subjects and Method:****Research design:**

A quasi experimental research design was employed in this study.

**Setting:**

The study was carried out in four Neonatal Intensive Care Units at "Assiut University Children Hospital," which is affiliated with the Ministry of Higher Education and Scientific Research. "Gynecology, Obstetrics, and Children Hospital, Assiut General Hospital, and El-Eman Hospital" are affiliated with the Ministry of Health in Assiut, Egypt.

**Subjects:**

A convenience sampling of 60 preterm infants in the previous chosen settings, the sample was calculated by using power analysis according to the population

flow at confidence interval of 99.9% with a precision level of 5% and  $p \leq 0.05$ . Sample calculated by using the following formula: Sample size

$$n = [DEFF * Np(1 - p)] / \left[ d^2 / z^2_{1-\alpha/2} * (N - 1) + p * (1 - p) \right]$$

**N:** Population size,

**P:** The population,

**D:** Confidence limits as % of 100(absolute +/- %):5%,

**DEFF:** Design effect (for cluster surveys-).

Preterm infants randomly assigned into two groups.

Each group consists of 30 preterm infants as follows:

**Group (I):** Preterm infants who received oral motor stimulation.

**Group (II):** Control group preterm infants who receive routine ward care without any intervention.

**Inclusion criteria:**

Preterm infants were included according to the following criteria:

1. Preterm infants born between 30-34 weeks.
2. Clinically stable preterm infants.
3. Both sexes.

**Exclusion criteria;**

Preterm infants were excluded according to the following criteria:

1. Congenital anomalies.
2. Severe systemic diseases such as sepsis or necrotizing enterocolitis (NEC).
3. Brain injury (including intra-ventricular hemorrhage).
4. Major surgery and invasive mechanical ventilation

**Tools for data collection:**

Three tools were used to obtain the needed data for this study:

**Tool I: Preterm infant's data:**

- It was designed by the researchers to get the necessary data:
- It involved gender, postnatal age, gestational age at birth, birth weight.
- Clinical data such as: medical diagnosis on admission and APGR score at the 1st and 5<sup>th</sup> minutes.

**Tool (II): Premature oral feeding readiness assessment scale (POFRAS):**

The premature oral feeding readiness assessment scale is the unique tool that evaluates all aspects of oral-motor abilities in preterm infants before feeding. It was designed by (Fujinaga et al., 2007). It consists of 18 items, and it assesses oral feeding readiness in preterm infants. The scale is scored between 0 and 2, and its maximum score is 36. The aspects of this scale include corrected gestational age, behavioral organization, oral posture, oral reflexes, nonnutritive sucking, and stress signs.

**Scoring system:**

- A total score less than 28 indicated no readiness.

- A total score between 28 and 30 there was strong sucking.
- Total score more than 30 suggest readiness for oral feeding (Aboelmagd et al., 2022 & Mahmoodi et al., 2019).

### Tool III: Infant feeding progression protocol:

This protocol was developed by (Lessen., 2011) which estimated the feeding progression from the day oral feedings began until the day full oral feedings were attained and contained six phases.

### Method of data collection

- The director of neonatal intensive care units provided official permission to collect the required data for this study.
- At the neonatal intensive care unit (NICU), the researcher introduced herself and informed medical and nursing staff about the purpose and nature of the study.
- Before the beginning of the study a pilot study was conducted on 10% of preterm infants to evaluate the sheet's clarity and application as well as to calculate the time required to complete it, the preterm infants were included in the total sample of the study, as there were no modifications were needed
- The researchers developed tools I and III, and five experts in the disciplines of pediatrics and pediatric nursing evaluated it for their contents validity index. The results showed that Tool I's index was 0.87% and Tool III's was 98%.
- The alpha Cronbach test indicated the tools' reliability to be  $\alpha = 0.764$  for tool I and  $\alpha = 0.861$  for tool III.

### Field of the work:

This study was conducted from the beginning of February 2023 until the end of July 2023, duration of six months. The studied preterm infants were followed for 12 consecutive days. The premature oral feeding readiness assessment scale was employed on the first day of the intervention, four days later, and at time of discharge to assess the oral motor skill of both groups. The control group studied first followed by the intervention group. The simulation applied to preterm infants half hour before feeding to minimize the possibility of aspiration, when preterm infants were in quiet awake state. The required time for each preterm infant in the intervention group was about 30 minutes. (A pre-intervention assessment was done on a preterm infant by the premature oral feeding readiness assessment scale (POFRAS) for about 15 minutes and the last 15 minutes for applying intervention.) The required time for each preterm infant in the control group was about 15 minutes (assessment done to the preterm infant by POFRAS).

### Intervention:

#### Group (I): Oral motor stimulation(OMS):

- Preterm infants received 12 minute perioral and intraoral stimulation (movement of the tongue, cheek and jaw) and non-nutritive sucking for 3 minutes following the protocol described by (Fucile et al. 2002). It was altered as follows: in the final maneuver, the researcher stimulated sucking by using the little finger rather than a pacifier to prevent pacifier from hindering with the initiation of sucking at the breast.

Structure	Frequency	Duration
Cheek	4 times for each cheek	2 min
Upper lip	4 times for each lip	1 min
Lower lip	4 times for each lip	1 min
Upper& Lower lip curl	2 times for each lip	1 min
Upper gum	2 times for each side	1 min
Lower gum	2 times for each side	1 min
Internal cheek	2 times for each side	2 min
Lateral border of the tongue	2 times for each side	1 min
Mid blade of the tongue	4 times for each side	1 min
Elicit a suck	1 time	4 min

**Group (II):** The preterm infants in the control group did not receive any intervention other than the routine care provided by the unit.

### Ethical consideration:

- Research proposal was approved from Ethical Committee in the Faculty of Nursing (IRB: 1120240418).
- After informing parents of the study's purpose and the confidentiality of the data collected, parents gave written consent for participation of their preterm infants in the research.

### Statistical analysis:

The statistical package for social science, SPSS version 22, was used for both data entry and analysis. Numbers, percentages, means, standard deviations, medians, and ranges were used to display the data. The qualitative variables were compared using the chi-square test. For parametric data, an independent sample t-test was employed, to compare quantitative variables between groups; for non-parametric data a Mann-Whitney test was utilized. P-value regarded statistically significant when  $P < 0.05$

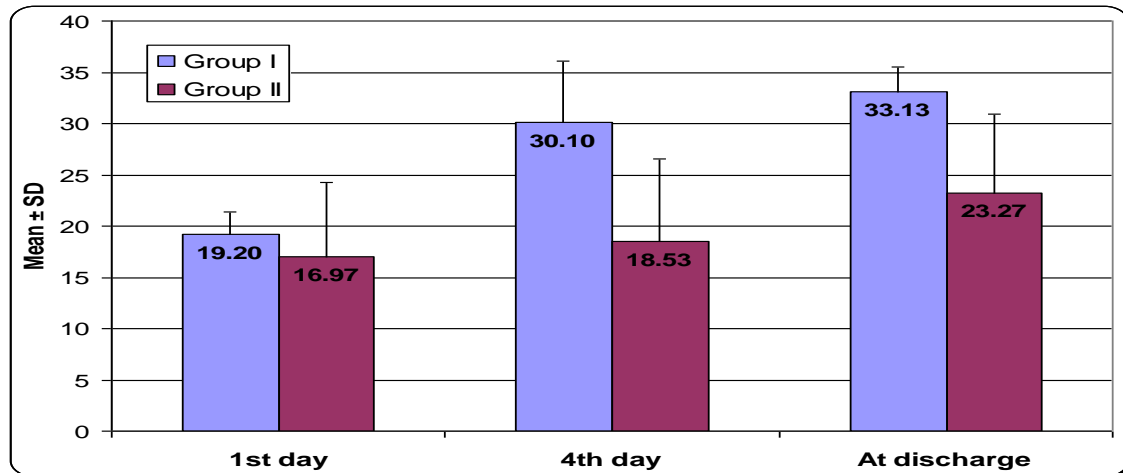
**Results:****Table (1): Personal data of the studied preterm infants according to their (n= 60).**

Personal data	Oral motor stimulation group (n= 30)		Control Group (n= 30)		Total (n= 60)		P-value
	No.	%	No.	%	No.	%	
<b>Gender</b>							
Male	14	46.7%	16	53.3%	30	50%	0.606
Female	16	53.3%	14	46.7%	30	50%	
<b>Age (days):</b>							
≤ 3	14	46.7%	14	46.7%	28	46.7%	1.000
> 3	16	53.3%	16	53.3%	32	53.3%	
<b>Mean ± SD</b>	4.4 ± 2.7		4.3 ± 3.2		4.4 ±3		0.794
<b>Median (Range)</b>	4.0 (1.0-10.0)		4.0 (1.0-15.0)		4.0 (1.0- 12.5)		
<b>Gestational age at birth (weeks):</b>							
30 - 32	9	30.0%	13	43.3%	22	36.7%	0.284
32≤ 34	21	70.0%	17	56.7%	38	63.3%	
<b>Mean ± SD</b>	33 ± 1.3		33 ± 1.4		33 ±1.4		0.433
<b>Birth weight gm:</b>							
< 1500	8	26.7%	13	43.3%	21	35%	0.176
≥ 1500	22	73.3%	17	56.7%	39	65%	
<b>Mean ± SD</b>	1567.3 ± 174		1490.7 ± 326.2		1529±250.1		0.260
<i>t- test</i>	<i>Chi-square test</i>		<i>Mann-Whitney test</i>				

*t- test**Chi-square test**Mann-Whitney test***Table (2): Clinical data of the studied preterm infants (n=60):**

Clinical data	Oral motor stimulation group (n= 30)		Control Group (n= 30)		Total (n= 60)		P-value
	No.	%	No.	%	No.	%	
Medical diagnosis on admission:							
Jaundice	6	20.0%	4	13.3%	10	16.7%	0.424
RDS	9	30.0%	6	20.0%	15	25%	
RDS & jaundice	15	50.0%	20	66.7%	35	58.3%	
APGR score at 1 <sup>st</sup> minute:							
Mean ± SD	5.7 ± 1.3		5.2 ± 1.9		5.5± 1.6		0.180
APGR score at 5 <sup>th</sup> minute:							
Mean ± SD	7.9 ± 0.9		7.8 ± 1.8		7.9±1.4		0.722
<i>t- test</i>	<i>Chi-square test</i>						

*t- test**Chi-square test*



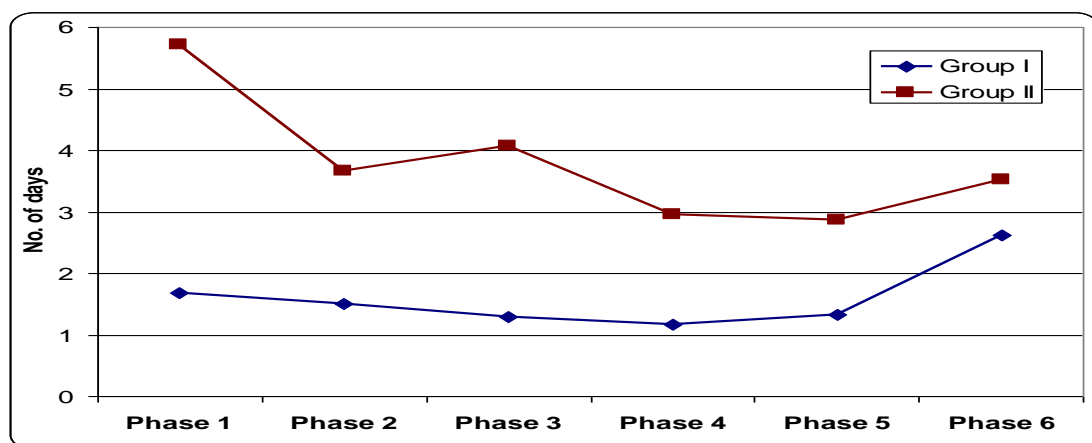
**Figure (1): Total score of Premature oral feeding readiness assessment scale (n=60).**  
 Group I: oral motor stimulation      Group II: control

**Table (3): Preterm infants' readiness to oral feeding (n=60).**

Readiness to oral feeding	Oral motor stimulation group (n= 30)		Control group (n= 30)		P-value
	No.	%	No.	%	
<b>1<sup>st</sup> day:</b>					
No readiness	22	73.3%	26	86.7%	0.223
Strong sucking	3	10.0%	3	10.0%	
Readiness for oral feeding	5	16.7%	1	3.3%	
<b>4<sup>th</sup> day:</b>					
No readiness	7	23.3%	24	80.0%	0.000*
Strong sucking	5	16.7%	3	10.0%	
Readiness for oral feeding	18	60.0%	3	10.0%	
<b>At discharge:</b>					
No readiness	1	3.3%	21	70.0%	0.000*
Strong sucking	4	13.3%	2	6.7%	
Readiness for oral feeding	25	83.3%	7	23.3%	

(\*) Statistical significant difference (p-value <0.05)

Chi-square test



**Figure (2): Feeding progression in the intervention and control groups (n=60).**  
 Group I: oral motor stimulation      Group II: control

**Table (4): Outcomes of the studied preterm infants (n=60).**

infants' outcomes	Oral motor stimulation group (n= 30)	Control group (n= 30)	P-value
<b>Transition time (days):</b>			
Mean $\pm$ SD	3.7 $\pm$ 2.5	14 $\pm$ 11.6	0.000*
Median (Range)	3.0 (0.0-9.0)	10.0 (1.0-47.0)	
<b>Age at beginning oral feeding (days):</b>			
Mean $\pm$ SD	5 $\pm$ 3.4	10.1 $\pm$ 7.5	0.008*
Median (Range)	4.0 (1.0-14.0)	9.0 (1.0-30.0)	
<b>Age at total oral feeding(days):</b>			
Mean $\pm$ SD	8.7 $\pm$ 4.3	22.3 $\pm$ 15.6	0.000*
Median (Range)	8.0 (3.0-20.0)	19.5 (2.0-55.0)	
<b>Length of hospital stay (days):</b>			
Mean $\pm$ SD	7.7 $\pm$ 4.2	26 $\pm$ 17.5	0.000*
Median (Range)	6.0 (3.0-19.0)	25.0 (4.0-72.0)	

*t- test* (\*) Statistical significant difference (*p-value* <0.05) Mann-Whitney test

**Table (1):** Shows personal data of the studied preterm infants, there were no statistically significant differences between the groups in terms of their baseline data which indicated that they were matched. It was found that 50% of preterm infants were females; their postnatal age ranged from 1.0 to 12.5 days. The mean  $\pm$  SD of their gestational age and birth weight was 33 $\pm$  1.4 weeks and 1529 $\pm$ 250.1gm, respectively.

**Table (2):** Illustrates clinical data of the studied preterm, it revealed that more than half (58.3%) of them had both jaundice and respiratory distress syndrome on admission, the mean  $\pm$  SD of the Apgar score at the 1<sup>st</sup> minute and at the 5<sup>th</sup> minute was 5.5 $\pm$  1.6 & 7.9 $\pm$ 1.4, respectively.

**Figure (1):** Presents the total mean score of the premature oral feeding readiness assessment scale of the studied preterm infants. It was noted that the mean total score of the POFRAS at the 4<sup>th</sup> day of intervention and at the time of discharge in the intervention group was (30.10 & 33.13), respectively, compared to the control group (18.53 & 23.27), respectively.

**Table (3):** Illustrates no statistically significant difference was found between preterm infants in intervention and control groups concerning to their readiness for oral feeding on the 1<sup>st</sup> day of intervention. But statistically significant differences were observed between them at the 4<sup>th</sup> day of intervention and at the time of discharge (*P-value* = 0.012\* & 0.000\*) respectively

**Figure (2):** Represents feeding progression of the studied preterm infants. It noticed that the control group consumes longer time across six phases of feeding progression compared to the intervention group.

**Table (4):** Shows outcomes of the studied preterm infants. It revealed that statistically significant differences were found between preterm infants in the intervention and control groups regarding to age at beginning oral feeding, age at total oral feeding, transition time, and length of hospital stay (*P-value* = 0.000\* & 0.008\*) respectively.

### Discussion:

One of the causes that results in preterm infants' longer stay in NICUs is feeding issues, in order to improve preterm infants' sucking and feeding manipulating the lips, jaw, tongue, and palate prior to feeding with nonnutritive sucking are referred as oral motor stimulation (Robinson et al., 2022). Therefore, the aim of this study was to determine how oral motor stimulation before feeding affected preterm infants.

According to the results of the present study, it noted that no statistically significant difference was found between two groups regarding their personal data (Table 1). It revealed about half of the studied preterm infants were females; this finding was in accordance with the results by (Mahmoodi et al., 2019) who found that more than half of them were females. Regarding their postnatal age, it noticed that the mean $\pm$  SD age of the studied preterm infants was (4.4  $\pm$  3) days. These results were consistent with the results by (Aboelmagd et al., 2022) who reported that the mean $\pm$  SD age of the studied preterm infants in the intervention and the control groups were (4.5  $\pm$  0.9 & 4.4  $\pm$  0.9) days respectively.

Also the present study demonstrated that the mean $\pm$  SD gestational age of the studied preterm infants at birth in both groups was (33 $\pm$  1.4) weeks. These findings were consistent with (Çamur & Çetinkaya., 2022) who demonstrated that the mean $\pm$  SD gestational age of the studied preterm infants was



(32.6± 1.32) weeks. Concerning birth weight, it was noticed that the mean± SD birth weight of the studied preterm infants was 1529±250.1gm. These results align with the a study by (Dogan et al., 2023) which stated that the mean± SD birth weight of them was 1595.6 ± 302.3gm.

The current study revealed that the mean± SD of Apgar score of the studied preterm infants at 1<sup>st</sup> and 5<sup>th</sup> minutes was (5.5± 1.6 & 9±1.4) respectively. The results of this study, in accordance with the study conducted by (Farag et al., 2022) who found that the mean± SD Apgar score of the studied preterm infants at the 1<sup>st</sup> and 5<sup>th</sup> minutes was (5.2±0.5 and 8.1±0.9) respectively.

In the present study, the mean total score of the premature oral feeding readiness assessment scale was higher in the intervention group in comparison to the control group. These results were in accordance with (Li et al., 2022) who reported that following 7 and 14 days of intervention, the intervention group POFRAS score was significantly higher than the control group and this difference was statistically significant ( $p < 0.05$ ). Also these results in congruent with (Sasmal et al., 2023) who indicated that the total score POFRAS between the study and control groups was  $27.20 \pm 2.1$  &  $25.14 \pm 0.8$  respectively on 7<sup>th</sup> day, and on the day of totally oral feeding was  $32 \pm 1.19$  &  $30.29 \pm 0.91$  respectively. The researcher interpreted it as oral exercise reduces mouth sensitivity and improves sucking ability to improve oral feeding skills.

Once the mean total score is high, the preterm infants' willingness to oral feeding increased, these results in align with (Huang et al., 2024) who conducted study about effects of oral stimulation on feeding readiness of preterm infants and concluded that the 7-day oral motor exercise enhances the preterm infants' preparation for oral feeding, and that feeding readiness improved as the preterm infants be mature. And also in line with (Mahmoodi et al., 2019) they concluded that no statistically significantly difference was found between the intervention and control groups at 1<sup>st</sup> day of intervention with mean total score POFRAS was (24.5&17.5) respectively, while after 7 days oral motor intervention the mean total score POFRAS between them was (33.9&24) respectively. From the researcher point of view; Early oral exercise intervention enhances the maturity of oral muscle of preterm infants; by improving strength of oral muscle, increasing oral activity and reflex organization which facilitates sucking.

The current study also revealed that rapid shifting to oral feeding in the intervention group when compared to the control group. These results are in agreement with (Guler et al., 2022) who conducted study about the effect of the premature infant oral motor

intervention on sucking capacity in preterm infants and found that in compared to the control group, the experimental group switched to oral feeding 9.9 days earlier. It interpreted by the researcher as oral motor intervention improves preterm infants' sucking and feeding by strengthening the jaw, lips, and palate and help coordinate sucking, swallowing and breathing.

In the contrary; these results in contrast with (Govindarajan et al., 2020), who conducted a study on the effects of combined modalities of pre-feeding stimulation on feeding progression, length of stay, and weight gain in early preterm babies. They found that there was no statistically significant difference between the study and control groups regarding to the shifting time to totally full oral feeding. From the researcher's opinion there were difference in the sample size and the study carried out by more than one researcher (mother and nursing staff) resulting in some unintentional bias.

Regarding to hospital stay period, the current study presented that the control group stay in NICUs longer than the intervention group. This result is in accordance with (Thabet et al., 2021) who carried out study on the effectiveness of the premature infant oral motor intervention on feeding performance, duration of hospital stay, and concluded that pre-feeding oral motor intervention reduced hospitalization period. In addition, these results were agree with (Yavanoglu et al., 2024) who reported that the mean hospital stay was found to be shortened with a mean duration of 10 days in the intervention group compared to the control group. The researcher interpreted it once the preterm infant take oral feeding well and able to meet their requirements through mouth without any adverse reaction discharged earlier from hospital.

However, the current results contrary with (Gowda et al., 2024) who performed study on multimodal sensory stimulation among very low birth weight preterm newborns, and found that the mean hospitalization length was longer in the intervention group compared to the control group. This can be interpreted as; there were difference in the sample size and the study carried on early preterm infants & low birth weight.

The research hypothesis is accepted whereas preterm infants in oral motor stimulation group achieve feeding readiness earlier, had faster transition time and shorter hospital stay than those in the control group.

### Conclusion:

There were differences among preterm infants in the oral motor stimulation group compared to those in the control group regarding feeding readiness, transition time to feeding by mouth, and length of hospitalization with statistically significant.

**Recommendations:**

Based on the results of the current study, the following recommendations are suggested:

1. Encourage use of pre-feeding oral motor stimulation to enhance feeding intake orally and reduce hospitalization period among preterm infants.
2. Periodic training of the nursing staff concerning the importance of oral motor stimulation in their routine nursing clinical practice for caring for preterm infants.
3. Developing manual guidelines for nurses about oral motor stimulation and their benefits. This manual should be easily accessible within the unit and provided to nurses to better understand the care of preterm infants.
4. Further studies should be done on other gestational age groups and large sample size in different hospitals to determine the effect of oral motor stimulation on preterm infants

**Acknowledgment:**

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