Effect of Sensory Motor Stimulation on Enhancing Oral Feeding Readiness of Preterm Neonates

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Abstract

Sensory Motor Stimulation is one of the first coordinated muscular activities in the fetus. This study **aimed** to evaluate the effect of sensory-motor stimulation on enhancing the oral feeding readiness of preterm neonates. **Subject and Method:** A quasi-experimental design was utilized and conducted in the neonatal intensive care unit at Minia University Hospital for obstetrics and pediatrics. A purposeful sample of 140 preterm neonates and one tool was used in the current study which includes: Personal data of the preterm infant, such as gender, post-natal age, and premature oral feeding readiness assessment scale. **Results**: More than one-third of the study and control groups gestational age ranged between 34 – 35 weeks. Mean scores of premature oral feeding readiness were increased in the study group than the control group, especially on the third and fourth days of the intervention with statistically significant differences. In addition, more than one-quarter of the preterm neonates in the study group begins oral feeding within 4 – 6 days of admission. **Conclusion**: Sensory motor stimulation is an effective technique for enhancing premature oral feeding readiness of stable premature neonates as evidenced by the improvement of the mean scores of premature oral feeding readiness assessment scale items and decreasing the time needed for the onset of full oral feeding. **Recommendation:** Provide nursing training for all nursing staff in the neonatal intensive care unit about Sensory Motor Stimulation for premature neonates.

Keywords*:* Oral Feeding readiness, Preterm Neonates, Sensory Motor Stimulation.

Introduction

Preterm birth is one of the most common causes of neonatal mortality, as it is one of the most common causes of birth defects. It is estimated that 15 million newborns are born preterm every year around the world, and that number is growing. Preterm birth complications claim the lives of more than one million newborns each year. Many survivors are faced with the prospect of a lifetime of disability, which may include difficulties in learning as well as vision and hearing impairments **(World Health Organization, 2017).**

Neonates who are born alive before the 37th week of pregnancy are referred to as preterm. There are sub-categories of preterm delivery that are determined by the gestational age of the baby; very premature birth (less than 28 weeks). very preterm (28 to < 32weeks). Oral feeding can be challenging for premature newborns because their bodily systems, including, cardiovascular and respiratory, nervous systems, and oral muscles, are not fully developed. In addition, a delay in feeding can be caused by premature newborns having poor sucking and feeding or being denied those activities (**World Health Organization, 2020)**.

The coordinated interaction of numerous complicated processes is required for oral feeding to be possible. Oral feeding is an integrated skill that needs the combination of breathing, sucking, and swallowing, all of which are related to the musculoskeletal system, cardiorespiratory, gastrointestinal, behavioral, and neurological systems **(Mousa et al., 2017).**

Oral motor interventions (OMIs) performed on preterm infants early are effective for oral feeding. OMI is defined as the sensory stimulation of the lips, jaw, tongue, soft palate, larynx, pharynx, and respiratory muscles, which are thought to influence the physiological parameters of the oropharyngeal mechanism, in order to improve its functions. OMI has been proven in previous studies to reduce the amount of time needed to transition from tube feeding to full oral feeding, as well as promote the effectiveness of oral feeding **(El -Mashad et al., 2021).**

Increased oral intake and decreased fluid loss are the results of increased perioral stimulation, which improves oral motor organization, increases muscle contraction and sucking rate, and minimizes fluid loss. Applied intraoral enhancement and non-nutritive

sucking (NNS) enhance salivary secretions and make it easier to swallow **(Anchu, 2017).**

Oral stimulation during full gavage feeding can help preterm babies' oral feeding development. Sensory motor stimulation (SMS) is one of the first coordinated fetal muscle actions. Oral pre-feeding stimulation is widespread. It demonstrated to be useful for oral feeding skills, an accomplishment of full oral feeding, weight gain, and lowering the length of hospital stay **(Morais et al., 2022).**

Significance of the Study

Oral feeding proficiency is the primary requirement for releasing preterm infants from intensive care once they have been hospitalized. The feeding skills of preterm infants should be evaluated with a method that is objective and focused on the needs of the neonate in order to guarantee a smooth and risk-free transition to oral nutrition **(Thoyre et al., 2018)**. Numerous research studies have demonstrated that sensorimotor therapies, which offer direct and targeted input to the oral components that are involved in feeding are effective in enhancing oral feeding in preterm neonates **(Ghomi et al., 2019).**

Recent research suggests that applying an oral motor stimulation (OMS) program to preterm infants while they are receiving gavage feeding can improve sucking abilities, shorten the amount of time it takes for the infant to shift from gavage to full oral feeding, and improve the sucking pattern (Thakkar et al., 2018). Oral motor stimulation and nonnutritive sucking both improve the likelihood that more premature infants will be nursed when they are discharged from the hospital **(Zimmerman et al., 2020).**

Operational definition

Sensory Motor Stimulation is a sensory stimulation of the cheeks, lips, gums, tongue, and pacifier sucking.

Oral feeding readiness includes enhancing oral posture, behavioral organization, non-nutritive sucking, oral reflexes, and decreasing stress signs to promote independent oral feeding of preterm.

Aim of the Study

To evaluate the effect of sensory-motor stimulation on enhancing oral feeding readiness of preterm neonates

Research Hypotheses

H0: No effect of sensory-motor stimulation on enhancing oral feeding readiness among preterm neonates.

H 1: Sensory Motor Stimulation will enhance oral feeding readiness among preterm neonates of the study group than in the control group.

Subjects and Method

Research design:

A quasi-experimental design was utilized to achieve the hypotheses of the study.

Setting:

The study was conducted in the neonatal intensive care unit (NICU) on the third floor at Minia University Hospital for obstetrics and pediatrics (MUHOP). It receives high-risk neonates from all over Minia governorate who complained of different diseases, and the total number of incubators in this unit is 25 incubators and provides levels of care up to the 3rd level.

Sample:

A purposeful sample of 140 preterm neonates admitted to NICU. Neonates were divided into two equal groups randomly (study & control groups). The determination of the sample size is based upon the following sample calculation
formula: http://www.ifad.org/gender/tools/hfs/anthropometry).

$$N = \frac{t^2 \times p(1-p)}{m^2}$$

$$N = \frac{(1.96)^2 \times 0.1(1-0.1)}{0.05^2} \quad N = 140 \text{ neonates}$$

Description:

N = required sample size

t = confidence level at 95 % (standard value of 1.960)

P = estimated prevalence of preterm neonates in the previous setting (356 / 2021)

m = margin of error at 5 % (standard value of 0.050)

Inclusion criteria:

- Preterm neonates aged 28-35 weeks of gestational age.
- Stable condition and vital signs.
- Weighted less than 2500 grams

Exclusion criteria:

- Preterm neonates with respiratory distress, on continuous positive airway pressure/ ventilator.
- Preterm neonates with congenital anomalies were excluded.

Data Collection Tool:

One tool was used in the current study.

A structured questionnaire that includes two parts:

Part I: **Personal data of the preterm infant**, such as gender, and post-natal age.

Part II: Premature Oral Feeding Readiness Assessment Scale (POFRAS): It was adopted from **Fujinaga et al., (2013**). It is an 18-item observational checklist that aims to assess preterm infants' readiness to start breastfeeding. It was composed of six categories: Gestational age, behavioral organization (3 items), oral posture (2 items), oral reflexes (4 items), non-nutritive sucking (7 items), and stress signs (1 item).

Scoring system:

Total scores on the POFRAS range from zero to 36, when the scores <28 referred to no readiness for oral feeding, between 28 and 30 referred to strong sucking, and >30 suggest readiness for oral feeding.

Data Collection Procedure:

Preparatory phase:

Primary approval was obtained from the ethics committee, Faculty of Nursing, Minia University. Official permission was obtained from the director of the Pediatric University Hospital, and permission from the head of neonatal intensive care units.

The preterm neonates who met the eligibility requirements were divided evenly into two groups, one for the study and the other for the control group, at random. From the records of the preterm newborns, personal information was gathered.

Implementation phase:

In the study group: Applying sensory motor stimulation: Each oral stimulation session consisted of 5 minutes. It included two forms of oral stimulation: Three minutes of manual peri- and intraoral stimulation followed by two minutes of sucking on a pacifier through the following technique: Placing the preterm infant gently and comfortably in a prone position or flexed lateral decubitus position of the lower and upper limbs and aligned head inside the incubator. The researchers rubbed their hands to warm it up. Starting the sensory-motor stimulation by gently talking and speaking to the preterm infant in a calm tone.

Perioral Stimulation is done as follows: For cheeks: Eight times on each cheek with the index finger. The index finger is used to stroke the cheek, first from the nose's bridge to the ear and then from the ear's corner to the lip's outer corner (eight strokes for each cheek). To be continued on the reverse side. For lips: Quickly yet gently, the researchers place the index and middle finger in the hollow of the upper lip (lower lip) and stretch outward (eight stretches for each lip) after that; move the finger in a circular motion from one corner of the lips to the middle and back to the other corner, and then reverse direction (four strokes for each lip). Intraoral Stimulation: Gums: Utilizing a pacifier, gently but firmly the researchers touch the upper gum from the center toward the back and back to the center for each side (four rubs for each side of the gum). Gum surgery should be repeated on the lower gum. A pacifier can be used to soothe the tongue by placing it on the tongue and stroking forward while applying downward pressure (eight times). Pacifier sucking: A pacifier is placed in the middle of a premature infant's hard palate, and the palate should be softly stroked forward to encourage sucking. The researchers Provide a pacifier and let the baby suck on it for two minutes. By using a sterilized pacifier or a gloved little finger, the researchers were able to test the

baby's biting and sucking reflexes and evaluate whether or not they were engaging in any nonnutritive sucking.

In the control group: The routine protocol of feeding in the neonatal intensive care unit was followed and included cleaning the oral cavity before and after feeding with a warm water swap.

Evaluation phase:

The first session of sensory-motor stimulation was performed after assessing weak or absent sucking in the morning shift at 9 am and the second session of sensory-motor stimulation therapy was performed in the afternoon shift at 12p.m by the researchers. After four consecutive days of sensory-motor stimulation therapy, bottle feeding was introduced to each preterm infant and they were assessed for their ability of sucking and readiness for oral feeding at each feeding time. The POFRAS was completed four days after the intervention. Collecting the data was performed over 5 months from the beginning of January 2022 to the end of May 2022.

Tool validity:

The tools were provided to a group of five specialists in the fields of neonatology and pediatric nursing so that they could evaluate the content validity. Alterations to the content were made in accordance with the appropriateness of the content and the sequences of the elements.

Tool reliability:

Cronbach's Alpha reliability, which was used utilized to test the reliability of the tools used to check its consistency was 0.897.

Ethical consideration:

A letter of permission was provided by the research ethics committee of the Faculty of Nursing at Minia University. Approval to carry out the study was received from the Dean of the Nursing Faculty at Minia University. Permissions were obtained from the director of the hospitals and the chief person of the nursing department. Before the application of the pilot study as well as the actual study, consent was obtained from one parent of each neonate that is willing to participate in the study, after explaining the nature and purpose of the study. Each parent has the right to refuse to participate or withdraw from the study without any rationale at any time. Participants' privacy was considered during the application of the procedure. Participants were assured that all their data are highly confidential; anonymity was also assured.

Pilot study:

A pilot study was done on 14 neonates (10 %) of total preterm neonates to test the clarity, comprehensiveness, accessibility, and applicability of the tools and to estimate the appropriate time require to implement the data collection procedure.

Statistical design:

The collected data was then encoded and entered into a statistical package specifically designed for research in social sciences (SPSS 28.0). The data are given in the form of frequencies and percentages for categorical variables, with the relevant descriptive and inferential statistical tests being utilized. When the P value was less than 0.05, statistical significance was assumed to exist.

Results:

Table (1): Presents that, no statistically significant differences between the study and control groups regarding their personal data.

Figure (1): Reveals that, 45.7% of the study preterm neonates aged between 34 – 35 gestational weeks compared to 42.9% of the control group.

Table (2): Shows that; there was an improvement in the behavioral state, global posture, and tonus on the 3rd and 4th days of the intervention among the study group than the control group with statistically significant differences.

Table (3): Reveals that there was an improvement in the lips posture, and tongue posture on the 3rd and 4th days of the intervention among the study group than the control group with statistically significant differences.

Table (4): Reveals that there was an improvement in the rooting, sucking, biting, and gag reflexes on the 3rd and 4th days of the intervention among the study group than the control group with statistically significant differences.

Table (5): Proves that; there was an improvement in tongue movement, tongue cupping, jaw movement, sucking strain, sucking and pause, maintenance of rhythm, and maintenance of alert state on the 3rd and 4th days of the intervention among the study group than

the control group with statistically significant differences

Table (6): shows that; 14.3% of the preterm neonates in the study group on the 3rd day of the intervention and 32.9% of the preterm neonates in the study group on the 4th day had no stress signs with statistically significant differences *P* – value < 0.0001 & 0.0001 respectively.

Table (7): Reveals that mean scores of premature oral feeding readiness assessment scale and all items as a behavioral organization, oral posture, oral reflexes, non-nutritive sucking, and stress signs were increased among the study group than control, group with a highly statistically significant difference at 3rd and 4th day of the intervention.

Table (8) Shows that; 28.6% of the preterm neonates in the study group begins oral feeding early at 4– 6 days after the intervention compared to 7.1% in the control group, with statistically significant differences of 0.008.

Table (1): Personal data of the preterm neonates among the study and control groups (n = 140).

Items	Study group (n = 70)		Control group (n = 70)		Significance of the study	
	No.	%	No.	%	X^2	*P* – value
Gender						
Male	46	65.7	47	67.1	0.032	0.858
Female	24	34.3	23	32.9		
Post-natal age						
2-4	17	24.3	20	28.6	0.331	0.565
4- 6	53	75.7	50	71.4		
Mean ± SD	4.5 ± 0.9		4.4 ± 0.9			

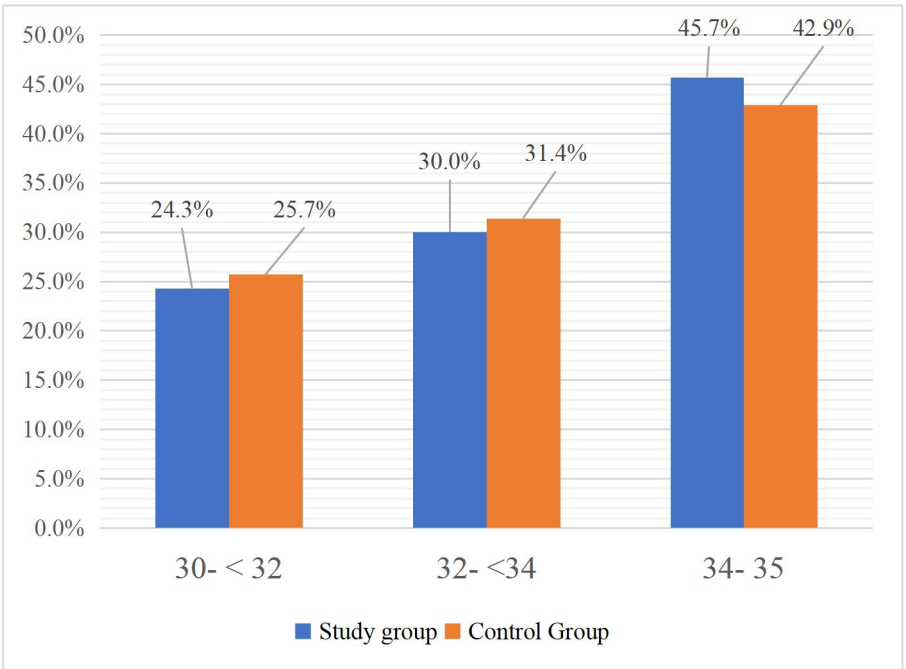

Figure (1): Comparison between the study and control groups regarding their gestational age (n= 140).

Table (2): Comparison between the study and control groups regarding the behavioral organization of premature oral feeding readiness assessment scale during the follow-up time (1st to 4th day of application) (n = 140).

Behavioral organization	1st day				2nd day				3rd day				4th day			
	Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Behavioral state																
Alert	3	4.3	2	2.9	4	5.7	2	2.9	12	17.1	4	5.7	13	18.6	5	7.1
Drowsy	41	58.6	39	55.7	43	61.4	40	57.1	45	64.3	42	60.0	50	71.4	44	62.9
Sleep	26	37.1	29	41.4	23	32.9	28	40.0	13	18.6	24	34.3	7	10.0	21	30.0
X^2 (P – value)	0.813				0.53				7.373 (0.025) *				10.938 (0.004) **			
Global posture																
Flexed	0	0.0	0	0.0	0	0.0	0	0.0	5	7.1	1	1.4	10	14.3	2	2.9
Party flexed	46	65.7	45	64.3	50	71.4	47	67.1	60	85.7	50	71.4	56	80.0	58	82.9
Extended	24	34.3	25	35.7	20	28.6	23	32.9	5	7.2	19	27.2	4	5.7	10	14.2
X^2 (P – value)	0.0314(0.859)				0.302(0.583)				11.74 (0.003) **				7.939 (0.018) *			
Global tonus																
Normotonia	10	14.3	11	15.7	12	17.1	13	18.6	25	35.7	14	20.0	35	50.0	18	25.7
Hypertonia	24	34.3	25	35.7	23	32.9	24	34.3	11	15.7	24	34.3	10	14.3	22	31.4
Hypotonia	36	51.4	34	48.6	35	50.0	33	47.1	34	48.6	32	45.7	25	35.7	30	42.9
X^2 (P – value)	0.125(0.939)				0.120 (0.941)				7.992 (0.018) *				10.407 (0.005) **			

*Statistically significant differences at 0.05 ** Highly statistically significant differences at 0.001

Table (3): Comparison between the study and control groups regarding oral posture of oral feeding readiness assessment scale during the follow-up time (1st to 4th day of application) (n = 140).

Oral posture	1st day				2nd day				3rd day				4th day			
	Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Lips posture																
Closed	3	4.3	2	2.9	4	5.7	2	2.9	11	15.7	4	5.7	13	18.6	5	7.1
Half-open	41	58.6	39	55.7	43	61.4	40	57.1	44	62.9	40	57.1	50	71.4	44	62.9
Open	26	37.1	29	41.4	23	32.9	28	40.0	15	21.4	26	37.2	7	10.0	21	30.0
X^2 (P – value)	0.813				1.265 (0.531)				6.408(0.04) *				10.939 (0.004) **			
Tongue posture																
Flat	8	11.4	8	11.4	15	21.4	11	15.7	33	47.1	19	27.1	47	67.1	24	34.3
Elevated	12	17.2	13	18.6	10	14.3	12	17.1	5	7.1	10	14.3	2	2.9	8	11.4
Retracted	50	71.4	49	70.0	45	64.3	47	67.1	32	45.7	41	58.6	21	30.0	38	54.3
X^2 (P – value)	0.05(0.975)				0.840(0.657)				6.546 (0.038) *				15.949 (0.0034) **			

*Statistically significant differences at 0.05 ** Highly statistically significant differences at 0.001

Table (4): Comparison between the study and control groups regarding oral reflexes of premature oral feeding readiness assessment scale during the follow-up time (1st to 4th day of application) (n = 140).

Oral reflexes	1st day				2nd day				3rd day				4th day			
	Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Rooting reflex																
Present	8	11.4	10	14.3	18	25.7	11	15.7	25	35.7	13	18.6	33	47.1	20	28.6
Weak	57	81.4	56	80.0	50	71.4	55	78.6	45	64.3	55	78.6	37	52.9	50	71.4
Absent	5	7.2	4	5.7	2	2.9	4	5.7	0	0.0	2	2.8	0	0.0	0	0.0
X^2 (P – value)	0.843				0.273				6.976 (0.031) *				5.131 (0.023) *			
Sucking reflex																
sent	8	11.4	8	11.4	15	21.4	11	15.7	33	47.1	19	27.1	47	67.1	24	34.3
Weak	50	71.4	49	70.0	45	64.3	47	67.1	32	45.7	41	58.6	21	30.0	38	54.3
Absent	12	17.2	13	18.6	10	14.3	12	17.2	5	7.2	10	14.3	2	2.9	8	11.4
X^2 (P – value)	0.05(0.975)				0.840 (0.657)				6.546 (0.038) *				15.949 (0.003) **			
Biting reflex																
sent	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Weak	13	18.6	14	20.0	17	24.3	15	21.4	30	42.9	15	21.4	37	52.9	20	28.6
Absent	57	81.4	56	80.0	53	75.7	55	78.6	40	57.1	55	78.6	33	47.1	50	71.4
	0.0459 (0.830)				0.162 (0.678)				7.368 (0.0067) **				8.552 (0.0035) **			
Gag reflex																
sent	10	14.3	8	11.4	11	15.7	8	11.4	20	28.6	8	11.4	25	35.7	11	15.7
Weak	57	81.4	58	82.9	56	80.0	58	82.9	49	70.0	59	84.3	45	64.3	59	84.3
sent	3	4.3	4	5.7	3	4.3	4	5.7	1	1.4	3	4.3	0	0.0	0	0.0
X^2 (P – value)	0.374 (0.829)				0.652(0.722)				7.0688 (0.0292) *				7.329 (0.0067) **			

*Statistically significant differences at 0.05 ** Highly statistically significant differences at 0.001

Table (5): Comparison between the study and control groups regarding non-nutritive sucking of premature oral feeding readiness assessment scale during the follow-up time (1st to 4th day of application) (n = 140).

Non-nutritive sucking	1st day				2nd day				3rd day				4th day			
	Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Tongue movement																
Adequate	21	30.0	22	31.4	27	38.6	22	31.4	39	55.7	24	34.3	51	72.9	28	40.0
Altered	45	64.3	43	61.4	42	60.0	44	62.9	30	42.9	44	62.9	19	27.1	42	60.0
Absent	4	5.7	5	7.2	1	1.4	4	5.7	1	1.4	2	2.8	0	0.0	0	0.0
X^2 (P – value)	0.179 (0.914)				2.357 (0.308)				6.553 (0.0378)*				15.368 (0.008)**			
Tongue cupping																
Adequate	20	28.6	21	30.0	25	35.7	23	32.9	38	54.3	25	35.7	49	70.0	32	45.7
Absent	50	71.4	49	70.0	45	64.3	47	67.1	32	45.7	45	64.3	21	30.0	38	54.3
X^2 (P – value)	0.0345 (0.852)				0.127 (0.723)				4.877 (0.027)*				8.466 (0.0036)**			
Jaw movement																
Adequate	21	30.0	22	31.4	27	38.6	22	31.4	40	57.1	24	34.3	51	72.9	28	40.0
Altered	45	64.3	43	61.4	42	60.0	44	62.9	30	42.9	44	62.9	19	27.1	42	60.0
Absent	4	5.7	5	7.2	1	1.4	4	5.7	0	0.0	2	2.9	0	0.0	0	0.0
X^2 (P – value)	0.179 (0.914)				2.357 (0.308)				7.368 (0.0066) **				15.368 (0.0088) **			
Sucking strain																
Strain	8	11.4	8	11.4	15	21.4	11	15.7	33	47.1	19	27.1	47	67.1	24	34.3
Weak	50	71.4	49	70.0	45	64.3	47	67.1	32	45.7	41	58.6	21	30.0	38	54.3
Absent	12	17.2	13	18.6	10	14.3	12	17.1	5	7.2	10	14.3	2	2.9	8	11.4
X^2 (P – value)	0.05 (0.975)				0.840 (0.657)				6.546 (0.038) *				15.949 (0.003) **			
Sucking and pause																
5 to 8	50	71.4	49	70.0	45	64.3	47	67.1	32	45.7	41	58.6	21	30.0	38	54.3
>8	8	11.4	8	11.4	15	21.4	11	15.7	33	47.1	19	27.1	47	67.1	24	34.3
<5	12	11.2	13	18.6	10	14.3	12	17.2	5	7.2	10	14.3	2	2.9	8	11.4
X^2 (P – value)	0.050 (0.975)				0.841 (0.657)				6.546 (0.038) *				15.949 (0.0003) **			
Maintenance of rhythm																
Rhythmic	28	40.0	27	38.6	37	52.9	28	40.0	46	65.7	28	40.0	55	78.6	30	42.9
Arrhythmic	37	52.9	36	51.4	29	41.4	36	51.4	22	31.4	38	54.3	15	21.4	36	51.4
Absent	5	7.1	7	10.0	4	5.7	6	8.6	2	2.9	4	5.7	0	0.0	4	5.7
X^2 (P – value)	0.365 (0.833)				2.4 (0.301)				9.312 (0.0095)**				18.833 (0.0081)**			
Maintenance of alert state																
Yes	3	4.3	2	2.9	4	5.7	2	2.9	8	11.4	4	5.7	13	18.6	5	7.1
Partial	41	58.6	39	55.7	43	61.4	40	57.1	50	71.4	42	60.0	50	71.4	44	62.9
No	26	37.1	29	41.4	23	32.9	28	40.0	12	17.2	24	34.3	7	10.0	21	30.0
X^2 (P – value)	0.414 (0.813)				1.265 (0.53)				6.029 (0.049)*				10.938 (0.004)**			

*Statistically significant differences at 0.05 ** Highly statistically significant differences at 0.001

Table (6): Comparison between the study and control groups regarding the stress signs related to premature oral feeding readiness assessment scale during the follow-up time (1st to 4th day of application) (n = 140).

Stress signs	1st day				2nd day				3rd day				4th day			
	Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)		Study group (n = 70)		Control group (n = 70)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Absent	0	0.0	0	0.0	1	1.4	0	0.0	10	14.3	1	1.4	23	32.9	3	4.3
Up to 3	10	14.3	8	11.4	19	27.2	10	14.3	54	77.1	15	21.4	46	65.7	19	27.1
More than 3	60	85.7	62	88.6	50	71.4	60	85.7	6	8.6	54	77.2	1	1.4	48	68.6
X^2 (P – value)	0.255 (0.614)				4.480 (0.106)				67.807 (0.0001) **				71.6816 (0.0001) **			

*Statistically significant differences at 0.05 ** Highly statistically significant differences at 0.001

Table (7): Comparison between the study and control groups as regards mean scores of premature oral feeding readiness assessment scale during the follow-up time (1st to 4th day of application) (n = 140).

Items	1st day		2nd day		3rd day		4th day	
	Study group (n = 70)	Control group (n = 70)	Study group (n = 70)	Control group (n = 70)	Study group (n = 70)	Control group (n = 70)	Study group (n = 70)	Control group (n = 70)
Behavioral organization	2.3 ± 1.2	2.25 ± 1.2	2.4 ± 1.2	2.3 ± 1.2	3.1 ± 1.3	2.5 ± 1.2	4.2 ± 1.3	2.7 ± 1.3
t-test (P value)	0.032 (0.977)		0.061 (0.957)		2.845 (0.03) *		4.258 (0.001)**	
Oral posture	2.0 ± 1.1	1.9 ± 0.9	2.0 ± 1.1	2.0 ± 1.0	2.5 ± 1.3	2.1 ± 1.0	2.7 ± 1.2	2.1 ± 1.0
t-test (P value)	0.415 (0.641)		0.024 (0.879)		2.214 (0.05) *		3.245 (0.001)**	
Oral reflexes	2.3 ± 1.5	2.2 ± 1.4	2.5 ± 1.7	2.6 ± 1.64	5.9 ± 2.0	4.1 ± 1.1	6.2 ± 1.6	4.3 ± 1.2
t-test (P value)	0.384 (0.61)		0.419 (0.441)		3.245 (0.001)**		3.750 (0.001)**	
Non-nutritive sucking	6.23 ± 1.6	6.1 ± 1.65	6.4 ± 1.74	6.5 ± 1.67	11.4 ± 2.4	6.9 ± 2.1	12.3 ± 1.7	7.2 ± 1.8
t-test (P value)	0.341(0.584)		0.745 (0.486)		3.215 (0.001)**		3.215 (0.001)**	
Stress signs	0.07 ± 0.18	0.057 ± 0.16	0.15 ± 0.25	0.07 ± 0.18	0.53 ± 0.24	0.12 ± 0.23	1.41 ± 0.25	0.18 ± 0.28
t-test (P value)	0.032 (0.977)		0.124 (0.785)		2.417 (0.02) *		4.417 (0.001)**	
Total scale	16.5 ± 3.5	16.7 ± 3.4	19.5 ± 2.4	17.5 ± 2.3	29.0 ± 2.6	18.4 ± 2.7	32.1 ± 3.1	20.0 ± 2.8
t-test (P value)	0.384 (0.61)		1.354 (0.08)		4.154 (0.001)**		5.457 (0.001)**	

Table (8): Comparison between the study and control groups about oral feeding onset (n = 140).

Oral feed onset	Study group (n = 70)		Control group (n = 70)		Significance of the study	
	No.	%	No.	%	X^2	P - value
4 – 6	20	28.6	5	7.1	11.779	0.008**
6 – 8	12	17.1	20	28.6		
8 – 10	21	30.0	27	38.6		
10 – 12	17	24.3	18	25.7		

** Highly statistically significant differences at 0.001

Discussion

Regarding behavioral organization, observed that improvement in the behavioral state, tonus, and global posture on the 3rd and 4th days of the intervention among the study group than the control group with statistically significant differences.

This study's results proved that sensory oral stimulation of preterm before feeding leads to improvement in the behavior state due to the coordination between the central neural system and the musculoskeletal system, which affects the accomplishment of oral feeding.

The current study results were consistent with the results by **Azuma & Maron (2020)**

about adjusting oral feeding assessment in the neonate cleared that; infants with oral feeding readiness show active signs such as alertness, focus concentration on the surroundings and make eye interaction with mothers. Also, the study by **Lubbe and ten Ham-Baloyi, (2017)** cleared that; non-nutritive sucking contributes to the behavioral organization, since the practice improves self-awareness, calms the infant, improves muscle tone and coordination, and is associated with increased alertness during feeding.

In addition, an Egyptian study by **Said & Mahmoud (2016)** about oral stimulation and non-nutritive suction program and their effect on feeding skills of preterm found that, statistically significant differences in global posture, behavioral state, and global tonus between the intervention and control groups.

Regarding oral posture, it was observed that, improvement in the lips, and tongue posture on the 3rd and 4th days of the intervention among the study group than in the control group with statistically significant differences.

The study results were in the same line with **Veedu and Jacob (2021)** in their study about pre-feed oral enhancement program and its effect on feeding performance and growth pattern of preterm infants cleared that; in preterm neonates, oral stimulation develops muscle tone and development which enhance normal oral motor developing forms and improvement of oral feeding performance. Also, **Brantes et al. (2021)** who studied feeding methods and their effect on oral motor functions of preterm neonates revealed that; oral-motor function is a multifaceted process of the musculoskeletal system through the synchronic movement of the oral region, The ability of this oral-motor role is shown by the infants opening the mouth, tongue position, and sustaining the head and neck position.

Meanwhile, the study by **Said & Mahmoud (2016)** proved that; there was a highly statistically significant difference at P-value of 0.001 regarding lips posture pre- and post-oral enhancement program and non-nutritive suction support our study results.

Regarding oral reflex, evidenced that improvement in the biting, gag, rooting, and sucking reflexes on the 3rd and 4th days of the intervention among the study group than the control group with statistically significant differences.

Also**,** the current study results were consistent with **Shaki et al., (2022)** who compare the effect of two approaches of pacifier sucking and mother's finger on oral feeding performance in preterm and concluded that; the mean rooting score between the study and control groups was 1.76 ±0.47 and 1.64±0.48, respectively with a significant difference. Also, the mean sucking score was significantly higher in the non-nutritive sucking group compared to the control group. In the same line with our study results, the study by **Çelik et al., (2022)** about the effects of oral motivation and additional nursing care on the change time from tube to completer breast of mother and sucking progress in preterm neonates, concluded that; the sucking scores of the infants in the intervention group were better than the control group due to the applying of oral enhancement.

The study findings were in the same line with the Egyptian study by **Nassar et al. (2021)** about oral stimulation and its effect on improving feeding among preterm infants proved that; there were significant differences and development in the areas of staying latched, sucking exertion, and longest sucking bursts after receiving oral stimulation.

Regarding non-nutritive sucking, proved that improve in tongue movement, tongue cupping, jaw movement, sucking strain, sucking and pause, maintenance of rhythm, and maintenance of alert state at the 3rd and 4th days of the intervention among the study group than the control group with statistically significant differences.

The current study results were similar to the study done by **Yang et al. (2019)** who studied the clinical implication of oral motor program on the progress of early premature infants and stated that the non-nutritive suction (NNS) scores of the study group at 10 and 14 days were significantly more than those of the control group P.0.01.

Concerning stress signs, showed that the minority of the preterm neonates in the study group on the 3rd day of the intervention had absent stress signs and near one-third of the preterm neonates in the study group on the 4th day of the intervention with statistically significant differences P – value < 0.0001.

The current study results cleared that; when the preterm infant received sensory oral motor stimulation, especially non-nutritive signs this makes the infant calm and quiet, coordinate swallowing with breathing, improve their physiological parameters and prevent undesired problems such as aspiration and vomiting.

The study results agreed with the study done by **El-Shahat et al. (2018)** concluded that; all preterm infants in the intervention and control groups had no devastating reactions during the three days of the study neither before nor after oral feeding. Also, the study done by **Sasmal and Shetty (2021)** about the standardized protocol to investigate the effect of pre-feeding Oro motor stimulation on preterm infant's feeding consequences cleared that; the stability of physiological function is important to prevent airway disorders such as minimizing energy expenditure and aspiration this is related to the point of swallowing-sucking-breathing coordination ability, success in this ability is indicated by the stability of oxygen saturation, minimal energy expenditure, and the absence of fatigue.

The current study results were consistent with **Li et al. (2022)** about the scientific effects of oral motor interference combined with non-nutritive sucking on oral feeding in preterm infants with dysphagia. Also, **Calik and Esenay (2019)** who studied the clinical effect of pacifier use on orogastric feeding of preterm neonates found that; the mean heart rate and respiration rate in the pacifier group were decreased than in the control group, but the oxygen saturation during and after feeding in preterm neonates using a pacifier was increased than those in the control group.

Furthermore, **Say et al. (2018)** who studied the effects of pacifier use on shifting time from gavage to breastfeeding in preterm infants, indicated that the incidence of harmful reactions, including apnea, decreased oxygen saturation, abdominal distension, and vomiting, was lower in the intervention group than that in the control group, and the difference was statistically significant ($p < 0.05$).

Concerning mean scores of premature oral feeding readiness assessment scale among the study and control groups, revealed that; the mean scores of premature oral feeding readiness assessment scale and all items as a behavioral organization, oral posture, oral reflexes, non-nutritive sucking, stress signs were increased among study group than the control group with highly statistically significant differences at 3rd and 4th day of the intervention.

Similar to this study results the study by **Li et al. (2022)** proved that; the score of the oral feeding readiness assessment scale among the preterm infant significantly increased after 14 days of intervention, and this score was higher in the study compared to the control group.

In addition, **Veedu & Jacob (2021)** who studied the pre-feed oral stimulation intervention and its effect on feeding behavior and growth rate of preterm infants, cleared that; a significant difference in feeding behavior of preterm neonates between control and experimental group is noted in post-test (p-value 0.012).

The current study results were supported by the study done by **Li et al. (2020).** About premature infant oral motor program to improve oral feeding and progress by promoting neurodevelopment found that; the premature infant oral motor intervention score was higher in the intervention group and increased with time, the study group displayed increased feeding effectiveness, a shorter shift time from supported oral feeding to full oral feeding.

Also, the study done by **Arora et al. (2018)** who studied pre-feeding Oro-motor stimulation intervention for improving Oro-motor function in preterm infants, cleared that; infants receiving a peri- and intra-oral stimulation just before oral feedings scored well on the neonatal oral motor assessment scale (NOMAS) which was also confirmed in enhancement in mean (SD) NOMAS score over 7 days from baseline showed a significant difference in the

study group infants as compared to control group with statistically significant differences (P = 0.02).

Also, our study results were supported by the study of **Anchu (2017)** about the study to assess the effect of oral enhancement on feeding skills among preterm infants in his study results show that; the mean pretest score of feeding performance was increased than the post-test score with P - value 0.0001 which show a highly significant difference.

Similar to our study results, the study by **Said & Mahmoud (2016)** proved that; there was a highly statistically significant difference in the oral feeding readiness score of preterm for studied preterm infants pre-and post-applying oral stimulation and non-nutritive sucking program.

Concerning the onset of oral feeding, the current study results proved that; more than one-quarter of the preterm infants in the study group begins oral feeding at 4-6 days after the intervention compared to the minority in the control group with statistically significant differences of 0.008.

The current study results proved that; applying the oral stimulation technique for a preterm infant is very beneficial for preterm infants to help them reach full oral feeding and decrease the incidence of stress signs as it increases oral motor regulation, improves muscle tone and sucking reflex, enhance the salivary production, and facilitate swallowing.

This finding was in the same line with the study done by **Jaywant and Kale (2020) who** assessed oral motor intervention and its effect on oral motor skills of preterm infants, and illustrated that; the number of days from tube feedings to oral feedings significantly reduced for the study group compared to the infants on routine care.

Also, the study by **Say et al. (2018)** and **Mansori et al. (2018)** about the effect of Non-nutritive sucking on a mother's finger on feeding tolerance and attainment of independent oral feeding in preterm infants, proved that; the time for transition to full oral feeding days, in the pacifier group, were significantly shorter compared to control group with statistically significant differences $p < 0.05$ and 0.001 respectively.

In addition, **Bala et al. (2016)** who studied Oro motor stimulation for conversion from gavage to full oral feeding in preterm neonates cleared that; infants who obtained oral stimulation had a statistically significant reduction in the number of days to achieve full oral feeding for the study compared to control group respectively. Also, **Asadollahpour et al., (2015)** who studied the effects of non-nutritive sucking and pre-feeding oral stimulation on time to achieve full oral feeding for preterm infants support our study results and cleared that; oral motor intervention (OMI) can decrease the shift time from gavage feeding to full oral feeding and improve oral feeding competence.

Conclusion:

Sensory Motor Stimulation was effective on enhancing premature oral feeding readiness of the stable premature neonates. Subsequently, the improvements in oral feeding led to the early onset of oral feeding.

Recommendations:

1. Create a simplified protocol handout for nurses' involvement techniques and the benefit of sensory-motor stimulation on preterm neonates.
2. Implement sensory-motor stimulation in routine clinical care with premature infants of appropriate gestational age.
3. Future research studies need to conduct in large sample sizes and different hospitals.
4. Sensory oral stimulation should be applied for high-risk infants and as well as preterm infant.
5. Nurses should be educated about the assessment of feeding skills with gloved fingers.

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