Effectiveness of Occupational Therapy Approaches for Feeding in Early Intervention: A Rapid Systematic Review

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Key Words
- evidence-based practice
- infant feeding
- oral motor stimulation
- multisensory approach
- occupational therapy
- caregiver education

Abstract

Objective
Newborns are admitted to the NICU for multiple reasons that require services. Feeding difficulties is an aspect of care that many NICU babies present with that require care from a multidisciplinary team. The objective of this study was to evaluate the effectiveness of numerous OT feeding interventions on the infants’ ability to feed independently compared to one that does not receive OT services.

Study design
The study was conducted as a RSR using a software called Covidence. There were 3,189 articles uploaded to screen in Covidence and one additional article individually uploaded. From those articles a full text review was completed including 50 articles which then resulted in 24 articles which were included in the RSR from the initial search. Total, there were 25 articles included: 24 from Covidence and one individually uploaded.

Results
This study aimed at examining numerous feeding interventions approaches to increase independence in feedings. Multisensory stimulation was found to have a significant increase in weight gain compared to groups receiving a different approach. Infants exposed to a soothing noise while feeding had an increase in sucking rates compared to infants that were not exposed to sound. Infants that received an odor-based intervention approach of being exposed to a food related scent were shown to have a decreased length in time until full feedings and shorter hospital stays. Infants who
received skin to skin contact 60 minutes after birth had no difference shown but ones that received skin to skin contact immediately after had a higher breastfeeding and sucking scores. Parents that received caregiver education on feeding and positioning were shown to have less feeding difficulties, appropriate positioning of the baby during feedings, and improved bonding relationships with infants. Adaptive equipment such as nipples for feeding were analyzed and showed moderate improvement of feeding performance. Studies that used various approaches of oral motor stimulation showed a decreased hospital stay, improved feedings, and weight gain.

**Conclusion**

Numerous approaches of intervention to improve feeding performance on infants were reviewed in the RSR. Studies concluded an improvement in one or more outcomes measure of weight gain, improved performance, sucking ability, relationship, and decreased hospital stay. Further research could be conducted to enhance reliability of the intervention approaches due to limited population sizes, geographical differences, and wider age range evaluated.

**Focused Clinical Question**

The purpose of this rapid systematic review is to review the literature and critically appraise the evidence relating to the following question: How does occupational therapy feeding intervention in infants compare to no intervention to achieve the goal of feeding independence?

Occupational therapy practitioners are interested in the ability of individuals to engage in meaningful and relevant occupations with as much independence as circumstantially possible. Eating is a crucial occupation that occupational therapists work closely with individuals to address difficulties in. Infants of different populations are susceptible to feeding difficulties, which may later result in failure to thrive, developmental delays, and decreased independence (Jolley, 2020). As occupational therapists' role in feeding is still widely being developed, the purpose of this review is to expand the understanding of intervention methods on feeding in early intervention to achieve the goal of independence with feeding. The review widens the range of interventions that occupational therapists may utilize to target full occupational independence in activities of daily living. While not all interventions analyzed in this review are implemented by occupational therapists, they are all in the OT scope of practice and can be implemented in future occupational therapy practice.

**Statement of Problem and Background**

**Background**

This rapid systematic review appraised and analyzed data from randomized control trials that examined the effects of different therapy interventions that could be administered by occupational therapists to improve preterm infant feeding.

**Description of Condition**

Feeding problems in early childhood and infancy have a large impact on physical and behavioral development. Feeding disorders are characterized by food aversion, inability to latch and suck, texture avoidance, structural abnormalities, neurological conditions, or any other condition that limits a child’s ability to receive proper nutrition (Feeding disorders, 2023). Feeding can also be impacted by sensory differences, motor planning abilities and reflux (Feeding disorders, 2023).

A common diagnosis for children under the age of 3 with a feeding disorder is failure to thrive. Failure to thrive is defined as a “decelerated or arrested growth in physical growth and is associated with abnormal growth and development” (The Children's Hospital of Philadelphia, 2014). Approximately 5-20% of typically developing children will be diagnosed with a feeding disorder (Feeding disorders, 2023). For children born prematurely, this number increases to 40-80%. Other implications of feeding disorders include lack of weight gain/weight loss, longer hospital stays, stress on families, and delays in development.

Feeding and eating problems are extremely prevalent in children, especially children born premature. Untreated, they can cause problems in development that will impact their ability to participate in occupations. Feeding experiences of preterm infants in their first year of life are different from infants who were born full term. Occupational therapists play a unique role in preterm infant care in the NICU. OTs not only treat the infant, but the families and caregivers (Jolley, 2020). OTs can modify, adapt and educate the infant’s experience to promote feeding skill acquisition and therefore promote growth and development (Jolley, 2020). Previous studies have found that OT intervention
Regarding environment, muscle development, sensory system and family education are helpful in preterm infant growth (Hand to Hold Staff, 2022). This rapid systematic review seeks to synthesize research that addresses different interventions and how they impact feeding skill development in preterm infants.

Method for Conducting the Evidence-Based Review

This systematic review examines methods of feeding interventions for NICU babies for various outcomes. Data was collected through a mass search and then imported into a data screening software called covidence. Five occupational therapy students screened 3,189 articles from PubMed and one study was individually uploaded to covidence via search criteria outside of the mass search. Article filters were put on to narrow the articles to ones published within the last ten years. The article title and abstract screening narrowed down the articles to 50. Those 50 were full text screened to narrow down to 24. The 24 articles were extracted and used in the RSR.

Search Terms

(Feeding) OR (eating) OR (food) OR (swallowing)) AND ((infant) OR (Baby) OR (pediatric) OR (12 month)) AND ((occupational therapy) OR (occupational therapist) OR (OT) OR (early intervention))

To be included in the review, the articles had to meet the following inclusion criteria:

- Participants under the age of 12 months
- Articles published within the last 10 years
- Involvement of Occupational Therapy intervention
- Participants are infants with feeding deficits

Articles were excluded from the review for the following reasons:

- Articles published longer than 10 years old
- Interventions that did not include Occupational Therapy
- Participants are older than 12 months

Results

For this review, 17 Level I, 2 Level II, and 6 Level III studies were included for a total of 25 infant feeding studies. Each study was examined and thematically were placed into 7 intervention categories that were administered by an occupational therapist or are within the occupational therapy scope of practice. The intervention categories were multisensory stimulation, skin-to-skin, oral motor stimulation, olfactory stimulation, adaptive feeding equipment, and caregiver education. Each of the listed interventions were utilized to promote infant feeding. Supplemental Table 1 summarizes the studies that have been included within this review.

Multisensory Stimulation

Figure 1.
PRISMA table generated from Covidence of study inclusion process

*One study was excluded from Covidence search findings

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Two Level I Randomized Control Trial and one Level III Semi Experimental Design were included to assess the impact of multisensory stimulation on infant feeding. The Level I Randomized Control Trial was double blinded including 3 intervention groups. The study compared groups with no intervention, infants receiving solely oral motor stimulation, and infants receiving oral motor stimulation along with tactile stimulation, multisensory stimulation. The intervention group with multisensory stimulation demonstrated a significant increase in weight gain compared to the other groups (Negi et al, 2022). The Level III Semi Experimental Design was conducted that compared infants with no intervention to a group that was exposed to a soothing noise during feeding. The soothing noise stimulation demonstrated a higher sucking success rate than the infants that were not exposed to the noise (Akca & Aytekin, 2014).

Skin-to-Skin

One Level I Randomized Control Trial and one Level II Quasi Experimental Design were included to assess the impact of skin-to-skin contact initiated immediately after birth on infant feeding. The Level I Randomized Control Trial included an intervention and a control group with the control group waiting to initiate infant skin-to-skin contact until after 60-minutes of infant life. This study found no difference in percentage of infants exclusively breastfed with immediate skin-to-skin contact in comparison to skin-to-skin contact after 60 minutes of life (Agudelo, et al, 2021). The Level II Quasi Experimental Design found that infants who received skin-to-skin contact immediately after birth showed higher average scores of breastfeeding and sucking abilities (Huang, et al, 2022). Occupational therapists can use skin-to-skin contact to promote increased infant feeding.

Olfactory Stimulation

One Level I Randomized Control Trial found that infants exposed to a food related odor, such as vanilla, before feeding had a reduced duration until full feeding and a decreased hospital length, when compared to non-food scents and no scent (Schriever, et al, 2018). Occupational therapists can use olfactory stimulation by using food related scents as a stimulant to promote increased infant feeding.

Adaptation and Modification of Feeding Environment

Two adaptation and environmental modification studies, including one level 1 RCT, one level 3 convenience sample and one level 3 pre-experimental design study, were assessed. There was moderate evidence for the effectiveness of OT adaptation and modification of feeding environment on improving feeding performance. The interventions used included nipple monitoring devices to evaluate feeding performance, modifying age at which independent oral feeding therapy begins and adapting bottle types to allow infant to participate in self-paced feeding.

One level 1 RCT (Lau et al., 2015) evaluated the effectiveness of self-paced bottle feeding on improvement of sucking skills and time until fully independent oral feeding. The study included 30 participants who were born at very low birth weight (VLBW) and considered feeders and growers with no clinical diagnoses. A self-paced bottle was utilized that eliminated hydrostatic and vacuum pressure and allowed the infant to control the amount and speed of drip from bottle. The traditional bottle forces infants to consume the amount and speed of milk based on bottle pressure. The study found that infants who were introduced to independent oral feeding with the self-paced bottle experienced greater rate of overall transfer (amount of milk taken/ amount of milk prescribed) and greater rate of transfer (mL/min) than infants who used the traditional bottle. Self-paced bottle-fed infants also decreased length of hospital stay and ensured safe oral feeding. This study shows that OT can utilize the self-paced bottle to improve the amount of food consumed by infants. The self-paced bottle also allows for greater family involvement as it decreases distress in the infants and allows the family to feed the infant.

One level 3 convenience sample study (Fucile et al., 2022) examined the effects of a nipple monitoring device on evaluating and treating feeding disorders in preterm infants. There were 16 participants who were born less than 34 weeks gestational age and receiving only tube feedings. The study sought to evaluate the clinical utility and safety of the nipple monitoring device to allow clinicians to treat oral feeding skills. The nipple device measured sucking, swallowing, and breathing activities. The study did not show any difference in oral feeding ability with the nipple monitoring device. The study found that the nipple monitoring device allowed the family to become more involved in feeding sessions and evaluating feeding performance. Overall, the device was safe and effective.
at measuring infant sucking, swallowing, and breathing. This information can be used to guide OT practice. Often, feeding evaluation is not completed with the family and is completed by only the physician. This is not a client centered practice and can cause disconnect and anxiety in the family. OT can utilize the nipple monitoring device to collect vital data regarding the infant's feeding ability while including the treating the family by allowing them to assist in or complete infant feedings.

One level 3 pre-experimental design (Pickler et al., 2015) explored the impact of adapting the age at which oral feeding was introduced to infants. The study included 86 infants who were born at less than 32-week gestation who received enteral feedings every 3 hours. There were 4 groups of infants who all received introduction to oral feeding at different times. Group 1 began 2 oral feedings a day at 32 weeks and increased by 1 oral feeding every other day for 11 days (length of study). Group 2 began oral feeding at 32 weeks and receives 8 oral feeds per day for 11 days. Group 3 received 2 oral feedings per day and increased by 1 oral feed every other day but began feeding at 34 weeks. Group 4 had 8 oral feeds every day but began at 34 weeks. The study found that group 4 reached full independent oral feedings quickest at 9 days. These results suggest that starting oral feedings later can result in more rapid transitions to full oral feedings and quicker time to discharge than infants who begin oral feeding earlier. OTs can use this information to guide evidence-based treatment of feeding skills. OTs can use this adaptation strategy to begin oral feeding therapy and independent feeding with infants born before 32 weeks gestation.

Caregiver Education

Three Level I Randomized Control Trials and one Level III Written Survey reviewed the potential of caregiver education as a technique to improve infant feeding levels. The first Level I RCT concluded that mother-infant dyads who participated in the intervention had less feeding conflict, less struggle for control, allowed the infant to initiate more feeding interactions and made fewer negative statements about food intake than those who did not participate in the education intervention. The mothers in the intervention group also positioned their infants more appropriately during mealtime and were less excessive in handling. Infants in the control group rejected food more, cried more and arched their back in distress more when food was offered (Globus, et al, 2019). The second Level I RCT analyzed the effects of child-parent bonding, and it showed improvements in feeding came alongside improved relationships (An S. J., et al, 2014). The third Level I RCT reviewed the effect of educational interventions on preventing the early or late onset of complementary feeding and correcting other relevant behaviors (Rafieyan-Kopaei, et al, 2019). Lastly, the Level III Written Survey discussed the role of caregiver in the NICU and the positive effects on feeding difficulties (Hardy, et al, 2018).

Oral Motor Stimulation

Five Level I Randomized Control Trials found that massage therapy stimulation results in a higher feeding efficiency in premature infants. One study followed the effects of the Premature Infant Oral Motor Intervention (PIOMI) given to preterm infants. The PIOMI promoted significant improvement within oral coordination and neurodevelopment. Oral motor stimulation resulted in a lower body weight at overall achievement of independent feeding. These results were evaluated and determined by the Preterm Infant Oral Motor Intervention (PIOMI) (Li et al, 2020). The second RCT found that massage stimulation and visual attention showed significantly higher rates of infant feeding time. This was completed through 10 minutes of slow tactile stimulation of the back with both hands (Camilla et al, 2018). The third RCT found that using the PIOMI for 5 minutes reduced hospital stay and improved feeding progression. However, PIOMI showed no significant difference in duration of transition to oral feeding (Hadiseh et al, 2019), only an improvement in coordination of sucking pattern and neurodevelopment. The fourth RCT found that massage oral stimulation significantly shortened time to achieve maximum feeding rates; and decreased length of hospital stay ( Bache M, et al, 2014). This was detected through routine medical staff implementing an OSMS protocol. Results indicated that preterm infants receiving this intervention will improve feeding skills by 8 days compared to usual feeding care to preterm infants (Aguilar-Rodriguez et al, 2020). One Randomized Control Trial found that there was significant increase in weight gain post enrollment in implementing an unstructured stroking procedure. This stroking procedure was done by assisted movement to activate muscle contraction against resistance to build...
strength within and around the oral cavity. (Arora et al, 2018).

Five Level 1 Randomized Control Trials found that increased and implemented oral stimulation; tactile, kinesthetic, and non-nutritive sucking patterns lead to decreased length of hospital stay and shorter time to independently feed in preterm infants. One RCT found this outcome through identifying measured feeding time and duration of sucking pattern using finger placement within pacifiers, moderate stroking pressure around the mouth, and gentle movements of the joints. However, results indicated that oral stimulation and standard care using one finger prior to beginning breastfeeding correlates no significant difference in preterm infant feeding but did show improvements within shorter time to independently feed (Hernandez Guteirrez et al, 2022). Another RCT also used single finger stimulation around the mouth to try and improve feeding habits and duration, however results indicated that there was no significant difference within feeding time. This result was received by the caregivers/parents of the infants through a questionnaire. (Skaaning et al, 2017).

One multicentered Randomized Control Trial found that using a patterned frequency modulated pacifier (PFOS) during feeding shortens hospital stay and improves feeding time. Modulated pacifiers detect feeding duration and improvements of feeding through bursts and pauses during feeding period (Song et al, 2019). This article used an N-Trainer device to detect the burst, signals, pauses, and periods of time during infant feeding when using the PFOS. Results indicated that the PFOS supports infant feeding development and shortens hospital stay. However, age, disease, and general feeding development are vital limitations within using this device to track feeding capabilities (Song et al, 2019).

One Double Blinded 3 Parallel Level 1 study and one double blinded RCT found that stroking of the cheeks in circular motions on the kips, gums, and tongue showed significant increase in weight gain and feeding habits (Negi et al, 2022, Da Rosa, Pereira, 2020). This article used 3 groups of preterm infants, a control group, and 2 experimental groups: one receiving oral stimulation and one receiving tactile stimulation. Oral stimulation group consisted of stroking the cheeks in a circular motion using fingertips for 12 minutes prior to feeding time. The tactile stimulation group received gentle rubbing on the back, cheeks, legs, arms, and head and then proceeded to typical feeding time. Results indicated that preterm infants receiving these multisensory approaches to feeding had a significant increase in feeding development versus infants who did not receive the stimulation. Tactile and Oral stimulation were found to have equal improvements in feeding habits (Negi et al, 2022). The second RCT used a similar approach and implied stroking of the cheeks for 12 minutes prior to feeding time. Fingertips went along cheeks and gums in an anterior posterior direction. Results indicated that the overall percentage to achieve independent feeding was higher in infants under this stimulation versus not receiving the stimulation (Levy, D, et al, 2020).

One Retrospective Review found that cognitive development scores can be indicated and show effect on coordination in feeding and sucking patterns. This result was dictated through the Bayley assessment administered to preterm infants. Sucking and swallowing patterns were monitored by the NOMAS scale. Results showed that cognition showed an independent correlation with feeding development, but further research must be taken to identify further evidence (Yi et al, 2019).

One Level 3 Case Matched Control trial found that completing 5 consecutive sucking movements will decrease hospital stay through oral intervention and oral-motor management in very low birth weight infants. This study’s intervention consisted of implementing 5 consecutive strength focused movements onto preterm infants. This was done prior to feeding. Results indicated that early intervention implying strengthening of the mouth and jaw can lead to improved feeding performance and shorter neonatal hospital stay (Liu Y., et al, 2013).

Discussion

Limitations

Limitations of this review include difficulty drawing general conclusions about the results from systematic reviews. Due to all studies identified within this RSR being taken for research purposes, resulting in limited evidence of decision makers reliability. Other limitations included not having many research articles focusing on typical developing infants. Articles are primarily focused on preterm infants only, confounded periods, and using a small sample size. No studies were identified among children above premature age, reflecting a lack of information and background data available to cover interventions within this older age...
This Rapid Systematic Review used multiple non-blinded research studies, this elicits possible biased appraisal and selection when indicating results within a study. Selection bias and selective outcome play a significant role within using a non-blinded RCT. Limitations of this RSR also include interrater reliability. Two studies using them same intervention were conducted and used in this RSR; however, findings were different, indicating decreased reliability in results of feeding interventions. Practitioners must be cautious of the interpretation of the findings within the articles for there may be only one or two reviewers.

Implications to OT

Occupational Therapists work with infants in a variety of settings to increase the feeding independence of the infant. The results from this study have an implication to the necessity of feeding interventions performed by an OT to improve feeding independence, weight gain, and decreased hospital stays in the NICU. Infants receiving one of the many forms of feeding interventions showed significant improvements compared to the infants that received no interventions. Occupational therapists can use this information to base their intervention approach accordingly to what approach showed an increase in these specific outcomes needed for that infant. All approaches showed an improvement in feedings independence, but certain approaches showed improvements in different domains such as sucking, weight gain, or hospital stay duration.

Conclusions

Further studies should be reviewed to promote further development of occupational therapy’s use of interventions on improving feeding in early intervention. Many of the studies’ interventions were not administered by occupational therapists, while they are in the occupational therapy scope of practice. Multiple approaches of intervention were examined during the RSR review to analyze improvement of feeding abilities. Articles reviewed displayed an improvement in one or more outcome measures; weight gain, feeding improvement, decreased hospital stay, relationship, and sucking ability while feeding. Further research should be conducted to be able to have a widespread population as reference in order to increase reliability of intervention approaches. For future research, a focus should be placed on feeding outside of the NICU setting to create a more holistic view of feeding in early intervention outside of only infants.

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References


An AnS. J. (2014). Occupation-based family-centered therapy approach for young children with feeding problems in

The American Journal of Occupational Therapy


### Supplemental Table 1

#### Intervention 1: Multisensory Stimulation

<table>
<thead>
<tr>
<th>Author/Year/ DOI</th>
<th>Level of Evidence/ Study Design</th>
<th>Participant and inclusion criteria</th>
<th>Intervention and Control groups</th>
<th>Outcome Measures</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akca, K., &amp; Aytekin, A. (2014). <a href="https://doi.org/10.1089/bfm.2014.0131">https://doi.org/10.1089/bfm.2014.0131</a></td>
<td>Level of Evidence: Level III Study Design: Semi Experimental</td>
<td>Participants: 127&lt;br&gt; Inclusion Criteria: Gestational age of 38-42 weeks, Birth weight between 2,500- and 4000g, Apgar score 8 or above at 1 min and 5 min</td>
<td>Control Group: No&lt;br&gt; Intervention Group: Soothing noise played for participants for duration of breastfeeding</td>
<td>LATCH score between group at 1 and 2 min for each 2 feedings&lt;br&gt; Latch on nipple&lt;br&gt; Audible swallow&lt;br&gt; Type nipple Comfort hold/help</td>
<td>Soothing noise helped to increase the infants success rate postpartum when played throughout the duration of being fed compared to an infant that is not exposed to a soothing noise.</td>
</tr>
<tr>
<td>Negi, D., Swain, D., &amp; Som, T. K. (2022). <a href="https://doi.org/10.1016/j.euro.2022.100159">https://doi.org/10.1016/j.euro.2022.100159</a></td>
<td>Level of Evidence: Level I Study Design: Randomized Control Trial</td>
<td>Participants: 41&lt;br&gt; Inclusion Criteria: Hemodynamically stable, weight &gt; 1500 gm to &lt; 2500 gm. Babies within the NICU that have received informed consent from caregivers</td>
<td>Control Group: Received routine newborn care that consisted of staying near the incubator for the same amount of time as the intervention group. No stimulation procedures were given. Intervention Group 1: Tactile Stimulation -</td>
<td>Oral Feeding Skills (ORF) Checklist&lt;br&gt; One-way ANOVA</td>
<td>Oro motor intervention and non-nutritive sucking shows significant impact and benefits to volume intake on infant feeding performance. Significant improvement in feeding habits and weight was seen after the completion of the</td>
</tr>
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</table>
received routine newborn care that consisted of staying near the incubator for the same amount of time as the intervention group. No stimulation procedures were given. **Intervention Group 2:** Oral Stimulation - stroking the cheeks in a circular motion, and stroking the vestibular region of the lips, gums, and tongue. This occurred the first 12 minutes of stimulation. Non-nutritive sucking was used for the last 3 minutes.

### Intervention 2: Skin-to-Skin

<table>
<thead>
<tr>
<th>Agudelo SI, Gamboa OA, Acuña E, Aguirre L, Bastidas S, Guijarro J, Jaller M, Valderrama M, Padrón ML, Gualdrón N, Obando E, Rodríguez F, Buitrago L. (2021) doi:10.1186/s13006-021-00379-z</th>
<th><strong>Level of Evidence:</strong> Level I</th>
<th><strong>Control Group:</strong> Skin-to-skin contact with newborn and mother initiated at 60 minutes of infant life.</th>
<th><strong>Participants:</strong> 297</th>
<th><strong>Infant Breastfeeding Assessment Tool</strong></th>
<th><strong>Participants:</strong></th>
<th><strong>Control Group:</strong> Skin-to-skin contact with newborn and mother initiated at 60 minutes of infant life.</th>
<th><strong>Infant Breastfeeding Assessment Tool</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Study Design:</strong> Randomized Control Trial</td>
<td><strong>Inclusion Criteria:</strong> Full term newborns with appropriate weight for gestational age,</td>
<td><strong>Survey of breastfeeding</strong></td>
<td><strong>Participants:</strong></td>
<td><strong>Control Group:</strong> Skin-to-skin contact with newborn and mother initiated at 60 minutes of infant life.</td>
<td><strong>Participants:</strong></td>
<td><strong>Control Group:</strong> Skin-to-skin contact with newborn and mother initiated at 60 minutes of infant life.</td>
<td><strong>Survey of breastfeeding</strong></td>
</tr>
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This study showed no difference in percentage of infants exclusively breastfed with immediate skin-to-skin

study. Both oromotor simulation and tactile stimulation are equally beneficial for the improvement of infant feeding performance.
| Level of Evidence: Level II Study Design: Quasi Experimental | Participants: 104 Inclusion Criteria: Normal vaginal delivery, singleton pregnancy at 37-42 gestational weeks, infant birth weight between 2500 and 400 g, and the ability for the mother to listen, read, speak, and write in Chinese | Control Group: 20 minutes of skin-to-skin contact after 5-10 minutes of nursing neonatal care immediately after birth Intervention Group: 60 minutes of skin-to-skin contact immediately after birth without the typical neonatal nurse routine time (5-10 minutes) | Infant Breastfeeding Assessment Tool (IBFAT) Breastfeeding Self Efficacy Scale Short Form (BSES-SF) | The key findings showed that both the intervention and control group infants improved in breastfeeding and sucking ability. The intervention group showed a higher average score for breastfeeding and sucking. There was a statistically significant difference in neonatal sucking ability after the initial skin-to-skin contact between the intervention and control group. |


born at single gestations and by vaginal birth, stable at birth, mother desired to breastfeed

Medical evaluations performed immediately after birth. **Intervention Group:** Skin-to-skin contact with newborn and mother initiated within one minute of life. Medical evaluations after skin-to-skin contact.
<table>
<thead>
<tr>
<th>Intervention 3: Oral Motor Stimulation</th>
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<tbody>
<tr>
<td><strong>Level of Evidence:</strong> Level I Study Design: Randomized Control Trial</td>
</tr>
<tr>
<td><strong>Participants:</strong> 47 <strong>Inclusion Criteria:</strong> Preterm infants between 25 and 30 weeks of gestation who were tube fed, but clinically stable without any severe pathology</td>
</tr>
<tr>
<td><strong>Control Group:</strong> Routine medical care from staff including Non-Nutritive Sucking (NNS) with pacifier, physiotherapy to treat respiratory and musculoskeletal care <strong>Intervention Group:</strong> Oral sensorimotor stimulation (OSMS) protocol. 12 manual perioral and intraoral maneuvers</td>
</tr>
</tbody>
</table>
| **Times elapsed for**
| **until full feeding**
| **Time elapsed**
| **until first 30% of oral intake completed in first 5 minutes of feeding**
| **Days of hospitalization**
| **Results show that OSMS protocol applied to preterm infants before feeding will improve their feeding skills by 8 days compared to usual care group** |

<p>| <strong>Level of Evidence:</strong> Level I Study Design: Randomized Control Trial |
| <strong>Participants:</strong> 30 <strong>Inclusion Criteria:</strong> Born between 28-32 weeks gestational age, Medically stable with no respiratory support for at least 48 hours, On full gavage feeds for 150cc/kg/day |
| <strong>Control Group:</strong> Unstructured stroking procedure done in and around the oral cavity <strong>Intervention Group:</strong> Premature infant oro-motor intervention; assisted movement to activate muscle contraction and provide Neonatal Oro Motor Assessment Scale (NOMAS) |
| Improvement in the mean NOMAS score over the 7 days from baseline was statistically significant in the intervention group than in the control group. Infants receiving intervention reached full wati spoon feeds significantly earlier than |</p>
<table>
<thead>
<tr>
<th>Study Design</th>
<th>Participants</th>
<th>Control Group</th>
<th>Transition Feeding Period</th>
<th>Overall transfer</th>
<th>Proficiency Transfer rate</th>
<th>Percent to achieve 100% oral feeding was higher in GI P.0.024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomized Controlled Trial</td>
<td>101 Infants born between 26- and 33 weeks GA</td>
<td>No oral stimulation or pacifier before or during gavage feeding</td>
<td>Oral Feeding Transition Length of Hospital Stay Breastfeeding Rates</td>
<td></td>
<td>Breastfeeding rate in the intervention group was statistically higher than the control group. No difference in the groups for transition periods and hospital stay.</td>
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</table>


<table>
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<tr>
<th>Study Design</th>
<th>Participants</th>
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<th>Transition Feeding Period</th>
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<th>Proficiency Transfer rate</th>
<th>Percent to achieve 100% oral feeding was higher in GI P.0.024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomized Controlled Trial</td>
<td>74 Preterm 26 weeks to 32 week and 6 days</td>
<td>Received a sham intervention where they remained beside the incubator for the same time as intervention group spent and placed infant in a proper positioning while giving gentle perioral touch with stimulation.</td>
<td>Oral Feeding Transition Length of Hospital Stay Breastfeeding Rates</td>
<td></td>
<td>Breastfeeding rate in the intervention group was statistically higher than the control group. No difference in the groups for transition periods and hospital stay.</td>
<td></td>
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</tbody>
</table>

| **Intervention Group:**
Received oral stimulation where the first 12 minutes was stroking cheeks in a circular motion and the vestibular region of the lips, gums and tongue with fingertips in an anteroposterior direction. |
|---|
| **Control Group:**
Standard NICU care – including kangaroo care, nesting, and minimal handling |
| **Participants:**
57
**Study Design:**
Randomized Control Trial |
| **Inclusion Criteria:**
Mothers’ inclusion criteria: age over 18 years old, good comprehension of Italian language, no single-parent families, no obvious cognitive impairments or psychiatric disorders, and no drug addictions
Infant inclusion criteria: clinically stable with no need for invasive mechanical ventilation and no active sepsis |
| **Observation:**
The infants receiving early intervention were full oral feeding almost one week earlier than the infants without early intervention. The early intervention group showed a significantly higher rate of infants fed with human milk. |
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Control Group</th>
<th>Intervention Group</th>
<th>Findings</th>
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<tbody>
<tr>
<td>Hadiseh Ghomi, Fariba Yadegari, Farin Soleimani, Brenda Lessen Knoll, Mahdi Noroozi, Ali Mazouri (2019) <a href="https://doi.org/10.1016/j.ijporl.2019.02.005">https://doi.org/10.1016/j.ijporl.2019.02.005</a></td>
<td>30</td>
<td>Therapist stood by bed for 5 minutes</td>
<td>PIOMI implemented by therapist for 5 minutes</td>
<td>Weight gain, Length of hospitalization, Feeding progression. No significant difference between groups for duration of transition to oral feeding or hospital stay. 10 days of 5-minute intervention using PIOMI had a positive impact on development of oral-motor skills, feeding progression, and reduction in duration of hospitalization. No significant difference between groups for duration of transition to oral feeding or hospital stay.</td>
</tr>
<tr>
<td>Hernández Gutiérrez MF, Díaz-Gómez NM, Jiménez Sosa A, Díaz Gómez JM, Domenech Martinez E. (2022) <a href="https://doi.org/10.1016/j.anpede.2020.12.020">doi: 10.1016/j.anpede.2020.12.020</a></td>
<td>43</td>
<td>No intervention</td>
<td>Oral stimulation group- Infants received perioral and intraoral stimulation using little finger instead of pacifier to</td>
<td>Days to independent early feeding, Length of hospital stay. This study found that combined OS and T+K+OS led to shorter time to independent oral feeding. The findings regarding length of stay were not found to be clinically significant.</td>
</tr>
</tbody>
</table>
stimulate sucking

**Combined tactile, kinesthetic and oral stimulation group**

Tactile and kinesthetic and OS intervention on alternate days. Tactile consisted of stroking moderate pressure for 5 minutes a day. Kinesthetic stimulation was gentle passive movements of joints in UE and LE for 10 minutes a day.

| Li, X. L., Liu, Y., Liu, M., Yang, C. Y., & Yang, Q. Z. (2020). | **Level of Evidence:** Level I | **Study Design:** Randomized Control Trial | **Participants:** 151 |
| | | | **Inclusion Criteria:** Gestation age of 26-36 weeks, birth weight more than 1,500g |
| | Control Group: Routine Treatment | Intervention Group: PIOMI-program involved 12 minutes of oral stimulation massage and 3 minutes of non nutritive sucking for 2 weeks | Oral motor ability of preterm infants assessment
Neonatal Behavioral Neurological Assessment |
<table>
<thead>
<tr>
<th>This study found that infants who received PIOMI intervention had greater feeding efficacy than the control group, independent feeding was achieved sooner than the control group, and the intervention group had a</th>
</tr>
</thead>
</table>
| **Level of Evidence:** Level III  
**Study Design:** Case-Matched Control  
**Participants:** 68  
**Inclusion Criteria:** Birth weight less than 1500 g or GA less than 32 weeks  
**Control Group:** No  
**Intervention Group:** Strengthening using 5 consecutive sucking movements  
**Transition Period:**  
**Feeding**  
**Body Weight**  
**Length of Hospital Stay**  
**Milk Intake** |
| Lower percent of infants have abnormal results on the NBNA assessment indicating that PIOMI supported neuromotor function. |

| --- |
| **Level of Evidence:** Level I  
**Study Design:** Randomized Control Trial  
**Participants:** 41  
**Inclusion Criteria:** Hemodynamically stable, weight > 1500 gm to < 2500 gm. Babies within the NICU that have received informed consent from caregivers  
**Control Group:** Received routine newborn care that consisted of staying near the incubator for the same amount of time as the intervention group. No stimulation procedures were given.  
**Intervention Group 1:** Tactile Stimulation - received routine  
**Oral Feeding Skills (ORF) Checklist:** One-way ANOVA  |
| Oral motor intervention and non-nutritive sucking shows significant impact and benefits to volume intake on infant feeding performance. Significant improvement in feeding habits and weight was seen after the completion of the study. Both oromotor |
newborn care that consisted of staying near the incubator for the same amount of time as the intervention group. No stimulation procedures were given.

**Intervention Group 2:**

Oral Stimulation - stroking the cheeks in a circular motion, and stroking the vestibular region of the lips, gums, and tongue. This occurred the first 12 minutes of stimulation. Non-nutritive sucking was used for the last 3 minutes.

The key findings were that there was no significant difference between time spent exclusively breastfeeding between the control group and the

<table>
<thead>
<tr>
<th>Skaaning D, Carlsen E, Brødsgaard A, Kyhnaeb A, Pedersen M, Ravn S, Pryds O, Kronborg H. (2020) doi: 10.1111/apa.15</th>
<th><strong>Level of Evidence:</strong> Level I</th>
<th><strong>Participants:</strong> 211</th>
<th><strong>Control Group:</strong> Standard care; breastfeeding according to The Ten Steps to Successful Breastfeeding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Study Design:</strong> Randomized Controlled Trial</td>
<td><strong>Inclusion Criteria:</strong> Maternal age greater than 18, delivery of a premature infant (single or twin), intention to breastfeed, and able to speak and understand Danish</td>
<td><strong>Intervention Group:</strong> Oral</td>
<td><strong>Questionnaire answered by parents:</strong> The key findings were that there was no significant difference between time spent exclusively breastfeeding between the control group and the intervention groups.</td>
</tr>
<tr>
<td>Level of Evidence: Level I</td>
<td>Participants: 210</td>
<td>Control Group: No</td>
<td>PFOS supports overall infant feeding development and shortens hospital stay. PFOS also shortens full oral feeding time. Study found that chronological age and lung disease impact the general feeding development and are vital to effect feeding capabilities in preterm infants.</td>
</tr>
<tr>
<td>Study Design: Randomized Controlled Trial</td>
<td>Inclusion Criteria: 28 0/7 weeks postmenstrual age (PMA)</td>
<td>Intervention Group: Used a patterned frequency modulated pacifier during feeding to stimulate oral response and improvement in feeding time of preterm infants</td>
<td></td>
</tr>
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</table>

| Level of Evidence: Level III | Participants: 70 | Control Group: No | Cognitive development scores were lower in 8-12 m and 18-24 months old with incoordination sucking patterns. For 8-12 the incoordination was n=22 and coordination incoordination |
| Study Design: Retrospective Review | Inclusion Criteria: Born premature < 32 wks or low birth weight < 1500 g Born between jan 2014 and dec 2016 Disorganized sucking pattern in NOMAS within 40 weeks Bayley -3 scale of 8-12 months | Intervention Group: Analysis of the video of NOMAS scale being administered to the infant to determine if they had a disorganized Bayley scores for cognitive function at 8-12 m and 18-24 m NOMAS score | |

read English or Danish stimulation and standard care; 5 minutes of oral stimulation with one finger prior to beginning breastfeeding intervention group.
corrected age for prematurity or dysfunctional swallowing pattern. The recording was of a close up lateral view of the mouth jaw and neck while bottle feeding.

**Intervention 4: Olfactory Stimulation**

<table>
<thead>
<tr>
<th>Level of Evidence: Level I</th>
<th>Participants: 135</th>
<th>Control Group: No Intervention</th>
<th>Transition feeding period Length of hospital stay Intake Amount Body weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Design: Randomized Control Trial</td>
<td>Inclusion Criteria: Born at gestational age of more than 27 weeks, stable vital parameters, without invasive ventilation or CPAP</td>
<td>Intervention Group: Intervention 1: Vanilla odor presented to the infant before feeding</td>
<td>Infants exposed to the vanilla odor before feeding had a reduced duration until full feeding and decreased hospital length.</td>
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<td></td>
<td>Intervention 2: Rose odor presented to the infant before feeding</td>
<td></td>
</tr>
</tbody>
</table>

**Intervention 5: Adaptation and Modification of Feeding Environment**

<table>
<thead>
<tr>
<th>Level of Evidence: Level III</th>
<th>Participants: 16</th>
<th>Control Group: No Intervention</th>
<th>Polyethylene micro tube - sucking Bipolar surface EMG -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Design: Pre-experimental</td>
<td>Inclusion Criteria: Born at less than or equal to 34 weeks gestational age, appropriate size for their GA, and</td>
<td>Intervention Group: Nipple Monitoring</td>
<td>This tool is safe and may be used by OTs. Family centered tool, due to parents becoming involved</td>
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</table>


Device was administered to infants during feeding to ensure it did not interfere with infant’s oral feeding performance. THEN infants are fed 3 or more times a day, the nipple monitoring device was given to one feeding session, and not the other.

Pressure swallowing regulation within the feeding assessment of their child using this device. This study showed that this device is a unique method that can be used during feeding in infants. Measures infants suck accurately and efficiently for quantitative data retrieval.


Participants: 30
Control Group: Standard bottle which forces the infant to consume milk based on bottle drip
Intervention Group: self-paced bottle system does not drip automatically and allows the infant to control feeding pace

Overall transfers: volume taken/ volume prescribed
Rate of transfer: mL/ min over entire feeding

This study found that infants who use a self-paced feeding bottle show greater oral feeding performance than infants who use a standard bottle. The self-paced bottle allows the infant to not fatigue as easily and take breaks when needed. Infants who used the self-paced bottle showed greater OT.

Rita H. Pickler, Barbara A. Reyna, Paul A. Wetzel, Mary Lewis, (2015)

Participants: 86
Control Group: Time to full oral feedings

Group 4 reached full oral feeding
Study Design: Convenience Sample

Gestational age less than 32 weeks
Enteral feedings every 3 hours
Able to medically feed orally by 32 weeks

No Intervention

Intervention Group:
Group 1: Start at 32 weeks PMA
2 oral feedings per day for 3 days
Increased 1 oral feed every other day for the rest of study (11 day)

Group 2: Start at 32 weeks PMA
8 oral feeds every day at the 8 feeding times starting on day 1

Group 3: same as 1 but start at 34 weeks PMA

Group 4: same as 2 but start at 34 weeks PMA

Time to discharge
Weight gain

the fastest at 9 days and discharge time was 15 days from start of oral feeds.
Group 1 and 2 reached at 18 days and discharged at 26-25 days after start of oral feeds.
Group 3 was 14 days and discharged after 19 days.
Group 1 differed most from group 3 overall
Average weight gain was 205 grams per week and did not by group but differed by NMI classification where NMI 4 gained more than 3 NMI 5 infants took significantly longer to reach full oral feedings from the start than NMI 1 and 2. NMI 4 and 5 took longer to discharge than NMI 1 and 2. NMI 2 in groups 1 and 2 took longer to achieve full
oral feeds than NMI 2 in group 4
NMI 3 took longer in group 2 than same
NMI 3 in group 4
Time to oral feeds was not significant
based on NMI rather was longer discharged

<table>
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<tr>
<th>Intervention 6: Caregiver Education</th>
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</table>
| **Level of Evidence:** Level I  
**Study Design:** Randomized Controlled Trial |
| **Participants:** 16-month-old boy with diagnosis of global developmental delays, Proteus syndrome and infantile spasm. |
| **Intervention Group:** Model supporting the involvement and collaboration of parents within family-centered OT feeding interventions. |
| **Self Reported Questionnaire to Caregiver undergoing intervention with child** |
| Approach addressed the physical components of child feeding problems and parent-child dynamics, which improved overall family dynamics. |

| Caitlin Hardy, Jessica Senese & Sandra Fucile (2018) DOI: 10.1080/07380577.2017.1419398 |
| **Level of Evidence:** Level III  
**Study Design:** Written Survey |
| **Participants:** 68 Occupational therapists working a level 2 or 3 NICU for oral feeding difficulties |
| **Intervention Group:** NICU Occupational Therapists reported their experience, field, evidence, and interventions used |
| **Caseload Commonalities**  
**Oral Feeding Interventions Evidence Used** |
| Occupational therapists use a client-centered approach when treating within the NICU. Continuing education and personal experience are the typical choice of evidence over the use of journals. |

<table>
<thead>
<tr>
<th>Level of Evidence:</th>
<th>Participants: 128</th>
<th>Control Group: These mothers-infant dyads received standard care from staff. The mothers watched a 2 hr video lecture on topics covered in intervention group.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I Study Design: Randomized Control Trial</td>
<td>Infant inclusion: normal birth weight and no health problems, 4-6 mo old at intervention</td>
<td><strong>Intervention Group</strong>: These mother-infant dyads participated in four 2 hour sessions in small groups of 8-12 dyads. Internet resources were provided at 12 mo.</td>
</tr>
<tr>
<td><strong>Inclusion Criteria:</strong> Mother inclusion: age 30 +/- 2.6 years, high school educated, minimum high school education, first time mothers with healthy pregnancy</td>
<td>Knowledge of Solid Foods Survey: Mothers knowledge of food consistencies their infant can eat is assessed when the infant is 12 mo.</td>
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<tr>
<td><strong>Feeding Scale:</strong> Mother/infant interaction scored based on analysis of a videotaped feeding session.</td>
<td>This study found that mother-infant dyads who participated in the intervention had less feeding conflict, less struggle for control, allowed the infant to initiate more feeding interactions and made fewer negative statements about food intake than those who did not participate in the education intervention. The mothers in the intervention group also positioned their infants more appropriately during mealtime and were less</td>
<td></td>
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</table>

| Level of Evidence: Level I | Study Design: Randomized Control Trial | Participants: 90 Inclusion Criteria: Mothers who had 4-month-old infants, infants were singleton and breastfed, gestational age of 37-42 weeks, no disease or disorder. Must have a smartphone and telegram. | Control Group: No Intervention Group: 1. Receiving GF messages 2. Receiving LF messages 3. No message | Self-report using valid researcher made questionnaire Paired T-Test ANOVA & CHI-Square |

Following the intervention, mean knowledge scores improved in all three groups. More favorable in the intervention groups compared to the control group. No difference observed in the GF and LF groups regarding knowledge. Diversity, appropriateness of continuing complementary feeding were higher in the LF group compared to the GF group.

excessive in handling. Infants in the control group rejected food more, cried more and arched their back in distress more when food was offered.