

The relationship between oral motor stimulation and sucking ability in low birth weight infants

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ABSTRACT

Background: Low birth weight infants (LBWIs) often experience difficulties in sucking due to immaturity of the oral-motor system, which affects the transition to oral feeding and prolongs hospitalization. Oral motor stimulation is used as an intervention to help improve the sucking ability of LBWIs. This study aimed to describe the relationship between oral motor stimulation and sucking ability in LBWIs.

Methods: This literature review was conducted by searching articles in the PubMed database using relevant keywords. A total of five articles were selected after a screening process based on inclusion and exclusion criteria to obtain a comprehensive overview of the effectiveness of oral motor stimulation.

Results: The review results indicate that oral motor stimulation techniques such as oral motor intervention (OMI), premature infant oral motor intervention (PIOMI), and non-nutritive sucking (NNS) have a positive effect on increasing sucking volume and pattern, accelerating the transition to oral feeding, and improving feeding readiness. Several studies also reported weight gain and reduced length of hospital stay, although these outcomes were not consistent across all studies.

Conclusion: Oral motor stimulation has been proven effective in improving the sucking ability of LBWIs and accelerating the transition to oral feeding. This intervention has the potential to be applied in neonatal clinical practice. Further research with stronger experimental designs and larger sample sizes is needed to evaluate the long-term effects more comprehensively.

Keywords: feeding skills, low birth weight infants, oral motor stimulation, preterm infants, sucking ability

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Introduction

Birth weight refers to the initial weight of a fetus or infant obtained immediately after delivery. For live births, it is recommended that the measurement be taken within the first hour of life, before any significant postnatal weight loss occurs. According to the World Health Organization (WHO), low birth weight (LBW) is defined as a birth weight of less than 2,500 grams (5.5 pounds).¹ Globally, the prevalence of LBW remains a major public health concern, particularly in developing regions.² In 2015, Asia recorded the highest global prevalence of LBW infants at 17.3%.³ Within Southeast Asia, the incidence ranges from 7% to 21%, while Indonesia reports a rate between 5% and less than 10%, ranking sixth among Southeast Asian countries in terms of LBW incidence.⁴

Infants born with LBW frequently encounter difficulties with breastfeeding due to an underdeveloped sucking reflex.

This condition is primarily caused by immature oral musculature and incomplete development of the nervous system, which disrupts the coordination between sucking, swallowing, and breathing.⁵ The effectiveness of an infant's sucking ability is crucial for ensuring adequate nutritional intake, promoting optimal growth, and shortening the duration of hospitalization.⁶ Although direct breastfeeding is strongly recommended for LBW infants, it is often limited by the infant's weak sucking strength and poor oral motor coordination.⁷

During the first year of life, the feeding experiences of premature or LBW infants differ significantly from those of full-term infants.⁸ They often face challenges in adapting to new food textures, exhibit increased oral sensitivity, and may develop aversions to feeding.⁹ To overcome these challenges, oral motor stimulation has been introduced as a therapeutic

intervention.¹⁰ This technique involves gentle and systematic stimulation of the oral structures such as the lips, tongue, and cheeks to enhance muscle tone, improve sucking efficiency, and support successful breastfeeding in premature infants.¹¹

A growing body of research has demonstrated that oral motor interventions are effective in accelerating the maturation of feeding skills, improving the strength and rhythm of sucking, promoting faster weight gain, and reducing hospital stay durations.¹² However, despite the reported benefits, differences in intervention methods, duration, and stimulation protocols may lead to variations in clinical outcomes.¹³ Therefore, this literature review aims to comprehensively evaluate the relationship between oral motor stimulation and sucking ability in low birth weight infants (LBWIs), synthesizing scientific evidence from studies published over the past decade.

Methods

This study employed a literature review method with the aim of collecting, evaluating, and analyzing previous research related to the relationship between oral motor stimulation and sucking ability in LBWIs. The literature content was obtained through a journal search using databases such as PubMed. The search was conducted using keywords such as “oral motor stimulation”, “sucking ability AND low birth weight infants”, “oral motor stimulation AND feeding skills”, “oral motor stimulation AND preterm infants”, and “oral motor stimulation AND weight infants”. The journals used in this study were selected based on predetermined inclusion and exclusion criteria. The inclusion criteria consisted of journals published within the last 10 years (2015–2025), written in either Indonesian or English, and employing experimental, interventional, or observational study designs. The exclusion criteria included studies that did not involve LBWIs as subjects or did not discuss oral motor stimulation.

Results

The five reviewed studies primarily focused on analyzing the effects of oral motor stimulation on sucking ability and feeding performance in preterm or LBWIs (Table 1). Although the focus was similar, variations were observed in the study approaches, populations, and intervention combinations used.

Anak Agung Ayu Winda P. and Dewi Tirtawati (2024) conducted an experimental study using a one-group pretest–posttest design involving all LBWIs with sucking difficulties at RSUP Prof. Dr. I. G. N. G. Ngoerah Hospital in Denpasar, Bali. A total of 21 LBWIs participated after two of the initial 23 were excluded due to desaturation. The intervention consisted of oral motor stimulation performed once daily for seven days, with each session lasting five minutes and conducted before feeding. Breast milk volume over 10 minutes was measured before and after the intervention. Data were analyzed using the Wilcoxon test, and results showed a significant increase in the average sucking volume

from 1.14 ml to 22.38 ml ($p = 0.000$). The intervention also positively influenced infant weight gain.⁶

Similarly, Yavanoglu Atay et al. (2023) carried out a prospective cohort study involving 50 preterm infants aged ≤ 34 weeks in the neonatal intensive care unit (NICU). The infants received oral motor stimulation (OMS) once daily, five times per week, administered by a speech therapist. Oral Feeding Skills (OFS) and Non-Nutritive Sucking (NNS) were evaluated on days 0, 5, and 10. The study reported significant improvements in OFS and NNS scores, and OMS was found to accelerate the transition to oral feeding as well as shorten the length of NICU stay.⁷

Li, Li, Liu, Chen, and Huang (2022) conducted a single-blind randomized controlled trial (RCT) involving 60 preterm infants with dysphagia in a neonatal ICU. Participants were randomly divided into two groups of 30: an intervention group receiving oral motor intervention (OMI) combined with non-nutritive sucking (NNS), and a control group receiving NNS only, both for 14 days. Results showed that POFRAS-CV scores increased more in the intervention group than in the control group. The infants in the intervention group consumed breast milk more quickly and in larger amounts, achieved full oral feeding faster, demonstrated better feeding efficiency and weight gain, and had fewer adverse reactions.⁹

In a double-blind randomized clinical trial, Brenda S. Lessen et al. (2019) studied 30 preterm infants (15 in the intervention group and 15 in the control group) in the NICUs of two hospitals in Tehran, Iran. The intervention group received the premature infant oral motor intervention (PIOMI) for 10 days, while the control group received routine care. Using repeated measures ANOVA, the study analyzed outcomes including postmenstrual age, body weight, and progression through oral feeding phases. The results indicated that the intervention group achieved their first oral feeding after an average of 7.2 days, reached eight oral feedings per day in 13.47 days, and had a significantly shorter hospital stay ($p = 0.03$). Although weight gain showed significant changes over time, the difference between groups was not statistically significant ($p = 0.39$).⁸

Finally, Alidad et al. (2021) conducted a single-blind randomized clinical trial involving 44 preterm infants aged ≥ 30 weeks. The intervention group received a combination of NNS, oral motor stimulation, and oral support once daily for 14 days, whereas the control group received NNS only. The results showed that the combined intervention significantly improved POFRAS scores and milk intake volume and accelerated the attainment of full oral feeding compared to NNS alone. However, no significant differences were observed in weight gain or length of hospital stay between the two groups.¹⁰

Discussion

The results of the literature review indicate that oral motor stimulation has a positive effect on feeding ability in preterm or LBWIs. However, variations in intervention approaches, combinations of therapies used, and the outcome indicators evaluated affect the overall

Table 1. Characteristics of the 5 included studies

Author (Year)	Study design	Population	Sample size	Methods	Main results
Winda P and Tirtawati D. (2024) ⁶ .	Eksperimen (one-group Pretest posttest)	All low birth weight (LBW) infants with sucking difficulties at RSUP Prof. Dr. I. G. N. G Ngoerah, Denpasar, Bali.	21 low birth weight (LBW) infants (after 2 out of the initial 23 were excluded due to desaturation)	Oral motor stimulation intervention once daily for 7 days, with a duration of 5 minutes; performed prior to feeding. Measurement of breast milk volume over 10 minutes before and after the intervention. Data analyzed using the Wilcoxon test.	The average sucking volume increased from 1.14 ml to 22.38 ml. Statistical analysis showed a significant result ($p = 0.000$). The intervention also had a positive impact on infant weight gain.
Yavanoglu Atay et al. (2023) ⁷ .	Kohort prospektif	Preterm infants ≤ 34 weeks in the NICU	50 participants	Oral Motor Stimulation (OMS) once daily, 5 times per week, administered by a speech therapist; evaluation of Oral Feeding Skills (OFS) and Non-Nutritive Sucking (NNS) on days 0, 5, and 10.	Significant improvement in OFS and NNS scores. Oral Motor Stimulation (OMS) accelerated the transition to oral feeding and discharge from the NICU.
Li, Li; Liu, Li; Chen, Fang; Huang, Li (2022) ⁹ .	Randomized Controlled Trial Single-Blind	Preterm infants with dysphagia in the neonatal ICU.	60 preterm infants; randomly divided into two groups (30 in each group).	Intervention group: Oral Motor Intervention (OMI) + Non-Nutritive Sucking (NNS) Control group: NNS only Duration: 14 days	PIOFRAS-CV scores increased more in the intervention group than in the control group after 14 days. The speed and amount of breast milk consumed were higher, with a faster transition to full oral feeding. Feeding efficiency and weight gain were better in the intervention group, and the incidence of adverse reactions was lower compared to the control group.
Ghomi H et al. (2019) ⁸ .	Randomized, double-blind clinical trial	Preterm infants in the NICU of two hospitals in Tehran, Iran.	A total of 30 infants (15 in the intervention group, 15 in the control group).	Intervention: PIOMI for 10 days Control group: routine care without PIOMI Analysis: Repeated Measures ANOVA for postmenstrual age, body weight, and the time to reach oral feeding phases (once, four times, eight times per day, and at hospital discharge).	Time to first oral feeding: an average of 7.2 days in the intervention group (faster than the control group). Time to achieve 8 oral feedings per day: 13.47 days (faster in the intervention group). Length of hospital stay: significantly shorter ($p = 0.03$). Weight gain: showed significant changes over time and in the time-group interaction, although the between-group difference was not statistically significant ($p = 0.39$)

Author (Year)	Study design	Population	Sample size	Methods	Main results
Alidad et al. (2021) ¹⁰ .	Randomized clinical trial, single-blind	Preterm infants aged ≥ 30 weeks	44 infants	The intervention group received NNS + oral motor stimulation + oral support for 14 days (1 session per day); the control group received NNS only.	The combined intervention significantly improved POFRAS scores, milk volume, and accelerated the achievement of full oral feeding compared to NNS alone. There were no significant differences in weight gain and length of hospital stay. ⁶

generalizability and scope of the research findings. The study by Agung Ayu Winda et al. evaluated the effect of single oral motor stimulation on the sucking ability of LBWIs using a quasi-experimental design.⁶ The results showed significant improvements in sucking strength and coordination after the intervention. Yavanoglu Atay F employed a randomized controlled trial (RCT) to assess the impact of oral motor stimulation on feeding ability and intake volume. The study found that infants who received the intervention experienced a faster transition to full oral feeding compared to the control group. Li et al. examined the combined effects of oral motor stimulation and non-nutritive sucking (NNS) in preterm infants with swallowing difficulties. The findings demonstrated that this combined intervention increased oral intake volume and accelerated the achievement of full feeding, suggesting that a multimodal approach may be more effective than a single intervention.⁷

The study by Ghomi et al. evaluated the Premature Infant Oral Motor Intervention (PIOMI) using a RCT design. Their findings showed that infants who received PIOMI experienced faster feeding transitions, increased milk intake volume, and reduced complications—demonstrating that PIOMI is an effective and structured method to accelerate the maturation of feeding ability. Meanwhile, Alidad et al. combined oral motor stimulation, NNS, and oral support, and assessed feeding readiness using the preterm oral feeding readiness assessment scale (POFRAS) score. The results showed a significant improvement in feeding readiness scores and time to achieve full oral feeding, confirming that a more comprehensive intervention approach yields better clinical outcomes.⁸

All five studies consistently demonstrated that oral motor stimulation whether applied independently or in combination with other interventions such as NNS, PIOMI, and oral support proved effective in improving sucking ability, accelerating the transition to full oral feeding, and enhancing the quality of feeding in LBWIs.¹⁴

This intervention not only accelerates the maturation of oral function but also contributes to a shorter duration of hospitalization and a reduced risk of complications associated with delayed oral feeding.¹⁵ Combined approaches have been shown to produce better outcomes than single interventions, highlighting the importance of multimodal strategies in addressing feeding development challenges in LBWIs.¹⁶

The analyzed studies possess several strengths that support the validity of their findings.¹⁷ The interventions applied were standardized, such as PIOMI, combinations of oral motor stimulation with NNS, and oral support all of which have been shown to be effective in enhancing feeding function in preterm and LBWIs.¹⁸ In addition, most studies employed clinically relevant outcome measures, including sucking strength, milk intake volume, duration of transition to full oral feeding, and feeding readiness scores, which have direct implications for neonatal clinical practice.¹⁹ The diversity of study locations including Indonesia, Iran, and China also enriches the perspective on the effectiveness of

these interventions across different healthcare settings. Furthermore, the variation in duration and frequency of interventions among the reviewed studies contributes to data diversity, offering broader insights into effective intervention strategies.²⁰

Although the studies reviewed provide strong evidence supporting the positive relationship between oral motor stimulation and sucking ability in LBWIs, several limitations should be acknowledged. First, most of the included studies employed relatively small sample sizes, limiting the generalizability of the findings to broader populations.²¹ The majority were conducted in single-center hospital settings, which may not represent variations in healthcare practices, neonatal care protocols, or cultural feeding behaviors in other regions. Second, there were notable variations in the intervention protocols, including differences in the frequency, duration, and specific techniques of oral motor stimulation used. This heterogeneity makes it difficult to determine the most effective standardized approach.²²

Based on these limitations, future research should aim to include larger and more diverse samples across multiple healthcare centers to enhance the external validity of findings. Standardization of oral motor stimulation protocols is highly recommended to allow for more accurate comparison and replication of results. Future studies should also adopt robust randomized controlled trial designs with appropriate blinding and control groups to minimize bias. Moreover, longitudinal follow-up is needed to assess the lasting effects of oral motor stimulation on long-term feeding behavior, growth, and developmental outcomes. Finally, incorporating advanced assessment tools such as instrumental swallowing evaluations or electromyographic analysis may provide more objective and quantitative data on oral motor function.

Conclusions

Based on the results of the literature review, it can be concluded that flatfoot is influenced by internal and external factors. Internal factors are age, gender, BMI/ nutritional status (obesity), and heredity. While external factors are low physical activity, the use of non-ergonomic footwear and the environment. The measurement tools used, such as the Plantar Staheli Arch Index and footprint analysis, proved effective for screening. For future research, further studies are needed regarding these factors on the incidence of flatfoot.

Ethical clearance

This review study utilized publicly available published articles, so informed consent and ethical approval were unnecessary.

Conflict of interest

The authors hereby declare that there are no conflicts of interest, whether financial or non-financial, that could be construed as influencing the conduct of the research, the preparation of the manuscript, or the process of publication

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Author contributions

PIF developed the study design, conducted data collection, and prepared the initial manuscript; IMNW and GV were responsible for data collection and provided revisions to the manuscript.

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