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Oral Motor Intervention Improved the Oral Feeding in Preterm Infants

Evidence Based on a Meta-Analysis With Trial Sequential Analysis

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Abstract: Oral feeding for preterm infants has been a thorny problem worldwide. To improve the efficacy of oral feeding in preterm infants, oral motor intervention (OMI), which consists of nonnutritive sucking, oral stimulation, and oral support, was developed. Published studies demonstrated that OMI may be as an alternative treatment to solve this problem; however, these results remain controversial. We conducted a meta-analysis with trial sequential analysis (TSA) to objectively evaluate the potential of OMI for improving the current status of oral feeding in preterm infants.

A search of PubMed, EMBASE, Web of Science, the Cochrane Library, and China National Knowledge Infrastructure was performed to capture relevant citations until at the end of October, 2014. Lists of references of eligible studies and reviews were also hand-checked to include any latent studies. Two independent investigators screened literature, extracted data, and assessed the methodology, and then a meta-analysis and TSA was performed by using Reviewer Manager (RevMan) 5.3 and TSA 0.9 beta, respectively.

A total of 11 randomized controlled trials (RCTs), which included 855 participants, were incorporated into our meta-analysis. The meta-analyses suggested that OMI is associated with the reduced transition time (ie, the time needed from tube feeding to totally oral feeding) (mean difference [MD], -4.03 ; 95% confidence interval [CI], -5.22 to -2.84), shorten hospital stays (MD, -3.64 ; 95% CI, -5.57 to -1.71), increased feeding efficiency (MD, 0.08 ; 95% CI, 0.36 – 1.27), and intake of milk (MD, 0.14 ; 95% CI, 0.06 – 0.21) rather than weight gain.

Results of TSA for each outcomes of interest confirmed these pooled results.

With present evidences, OMI can be as an alternative to improve the condition of transition time, length of hospital stays, feeding efficiency, and intake of milk in preterm infants. However, the pooled results may be impaired due to low quality included, and thus, well-designed and large RCTs were needed to further established effects.

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Abbreviations: GA = gestational age, ITT = intention-to-treat, IV = inverse variance, LOS = length of hospital stays, MH = Mantel-Haenszel, NNS = nonnutritive sucking, OMI = oral motor intervention, RIS = required information size, SSB = sucking–swallowing–breathing, TSA = trial sequential analysis.

INTRODUCTION

The early survival rate of preterm infants, in recent 30 years, has been greatly increased as the development of assisted reproductive technologies.^{1–3} However, immature oral feeding ability has severely negatively impact on the normal development of preterm infants and even obviously increased the morbidity in this given population.⁴ Coordination of sucking–swallowing–breathing (SSB) movements, which usually tend to mature until 32 to 34 gestational weeks, is an essential to develop the delicate oral feeding in infants.⁵ The full-term infants can successfully complete the SSB activity, but preterm infants cannot.

Published studies revealed that nonnutritive sucking (NNS), which is closely associated with gestational age (GA), may improve the efficacy of oral feeding in preterm infants.^{6–9} However, the preterm infants characterized by immature cardiorespiratory system, central venous system, and oral musculature will suffer from some threatening clinical outcomes which included bradycardia, apnea, and low oxygen saturation when changed feeding approach from tube to totally oral feeding,^{10–12} and this condition was defined as oral feeding difficulty which is associated with the longer length of hospital stays (LOS), more medical costs, and serious psychological stress of parents after parturition, as well as even caused long-term oral feeding difficulties both related to bottle and breast feeding.^{13,14}

Some studies published previously suggested that early oral motor intervention (OMI), which consists of oral stimulation, oral support, and NNS, can better the effects of oral feeding in preterm infants and shorten the LOS.^{15–17} However, the powers of conclusions were impaired due to some shortages such as small sample size existed in across studies. Although a systematic review was performed by Arvedson et al¹⁸ to determine whether the OMI can improve the oral feeding ability of preterm infants, only studies published between 1960 and

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XT, L-JY, LZ, and G-MS conceived and designed the study protocol. XT, L-JY, and LZ searched literatures. J-GZ, LM, and Y-XO assessed the methodological quality. XT, L-JY, and TS analyzed the data. XT, ZZ, and G-MS wrote the first draft. All authors agreed with manuscript results and conclusions.

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2007 and in English, however, met its criteria. The Cochrane Collaboration recommended that a systematic review should be updated every other year,¹⁹ and it is important that a plenty of randomized controlled trials (RCTs) have been developed since then. Hence, we aimed to further evaluate the potential of OMI for oral feeding in preterm infants by undertook this meta-analysis with trial sequential analysis (TSA).

MATERIALS AND METHODS

We performed our meta-analysis according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement²⁰ and Cochrane Handbook for Systematic Reviews of Interventions.²¹ The prospective protocol of this topic has been registered on PROSPERO database and the register number of CRD42014014356 has been approved (available at: <http://www.crd.york.ac.uk/prosperto/>). Ethical approval and informed consent were not required because all analyses were carried out based on these data extracted from published previously studies and no clinical prejudice was put on patients.

Literature Search

A computerized search of PubMed, EMBASE, Web of Science, the Cochrane Library, and China National Knowledge Infrastructure (CNKI) was performed by using medical subject heading and full-text words based on Boolean logic operator. The following searched terms were used: “Infant, Premature,” “Infants, premature,” “Premature Infant,” “Preterm Infant,” “Infant, Preterm,” “Infants, Preterm,” “Neonatal Prematurity,” “oral motor intervention,” “oral motor exercise,” “oral stimulation,” OMI, and random*. The lists of references of included articles and reviews, which were related to our topic, were manually searched to capture any relevant studies. We summarized the search strategy of PubMed in Appendix 1, <http://links.lww.com/MD/A362>.

Studies Identification

An appropriate selection criterion is the key factor to guarantee the accurate studies identification. So we established this inclusion criteria according to the *PICOS* acronym: *P* (Population): all the patients diagnosed as preterm infants; *I* (Interventions) and *C* (comparisons): OMI compared with route interventions only; *O* (Outcomes): the transition time, LOS, feeding efficiency, intake of milk, and weight gain were assessed in our meta-analysis; *S* (Study Design): only RCTs with appropriate random sequence generation met the criteria. In addition, for duplicate data reported by the same author or 1 medical center, the article with high quality was included. Meanwhile, we included studies published in English and Chinese language.

Literature Screened and Data Extraction

Search was conducted, and data were extracted by 2 independent investigators (XT and L-JY). Each trial captured in the search stage was evaluated for author, publication year, the number of participants, allocation method, and patients' age, and interventions, period of treatments, eligibility criteria, baseline, and outcome measures of interest. Any divergences concerning the eligibility of a trial occurred in the any phases were resolved through discussion or consulting a third investigator (LZ).

Assessment of Risk of Bias

Two independent investigators (J-GZ and LM) assessed the methodological quality of trials included in our meta-analysis

by using the Cochrane Risk of Bias Tool.²¹ The procedure was performed based on the following 7 domains: randomization sequence generation, allocation concealment, blinding of participants and study personnel, blinding of outcome assessors, incomplete outcome data, selective reporting, and other biases. Based on the information extracted from each eligible trial, each domain was rated as “high risk,” “unclear risk,” or “low risk.” These domains will be classified as high risk unless appropriate methods were used; in contrast, corresponding domains will be graded as low risk when no obvious mistakes were detected; moreover, associated domains will be rated as unclear risk if lack of sufficient information to make a clear judgment on the risk of bias. Agreement on any domain was identified based on consensus or consulting a third investigator (Y-XO).

Statistical Analysis

All extracted data were entered into RevMan 5.3 (Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2013) for statistical analysis. Mean difference (MD) or standard mean differences (SMD) with 95% confidence interval (CI) for continuous outcomes were selected to estimate the pooled effect size. Heterogeneity in the included studies was evaluated using the χ^2 , corresponding *P* value and I^2 statistic. If $I^2 \geq 50\%$, the eligible studies were considered to be heterogeneity and a random-effects model based on Mantel–Haenszel (MH) or inverse variance (IV) statistical approach was selected. In contrast, the studies were considered to be homogeneous, and a fixed-effects model based on MH or IV statistical approach

PRISMA 2009 Flow Diagram

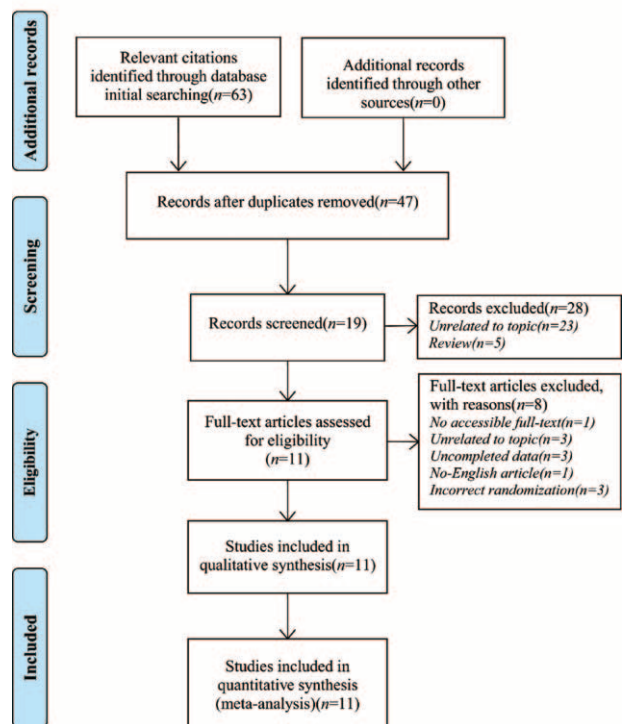


FIGURE 1. PRISMA flow diagram of search and selection of literature. PRISMA=Preferred Reporting Items for Systematic Reviews and Meta-Analysis.

TABLE 1. Characteristics of Included Trials

Study ID	Country	No. of Participants		Randomization	Gestational Age, wk (OMI/Control)	Outcomes		
		OMI (F/M)	Control (F/M)			Interventions	OMI	Control
Bache 2014 ²⁹	Luxemburg	15/25	21/25	Computerized random-number generator	31.4 ± 1.5/31.3 ± 1.7	Oral stimulation: <i>Perioral stimulation</i> 1. Right and left cheek 2. Upper lip: compress lip from middle of base of nose, to midline of lip compress lip from right base of nose to right corner upper lip 3. Lower lip: compress lip from middle of base of chin to midline of lip compress lip from right base of chin to right corner of upper lip 4. Orientation reflex: firmly touch middle of upper lip, then left labial commissural. <i>Intraoral stimulation</i> 1. Tongue: compress tongue at center of mouth with postero-anterior movement 2. Palate: compress hard palate from anterior hard palate to soft palate 3. Gum: compress gum from center of upper external gum to right and left corners of mouth. <i>Oral stimulation:</i>	Route care	Transition time
Boiron 2007 ³⁰	France	16/16	4/7	Computerized random-number generator	31.3 ± 1.32/31.1 ± 1.19	<i>Perioral stimulation:</i> the same as Bache 2014. <i>Intraoral stimulation:</i> the same as Bache 2014. <i>Oral supportral support:</i> Chin and cheek support, and aid to deglutition.	Route care	Transition time

Study ID	Country	No. of Participants		Randomization	Gestational Age, wk (OMI/Control)	Outcomes		
		OMI (F/M)	Control (F/M)			Interventions	OMI	Control
Lessen 2011 ¹⁶	United States	6/4	6/3	Unclear	28.1 ± 0.6/28.0 ± 0.9	Oral stimulation:	Route care	Transition time
						Perioral stimulation: the same as Bache 2014.		Length of hospital stays
						Intraoral stimulation: the same as Bache 2014.		
						NNS: The pacifier was placed in the infant's mouth whether or not they have any attempt to suck.		
Fucile 2002 ³¹	United States	9/7	10/6	Unclear	28.2 ± 1.3/28.1 ± 1.1	Oral stimulation:	Route care	Transition time
						Perioral stimulation: the same as Bache 2014.		Length of hospital stays
						Intraoral stimulation: the same as Bache 2014.		
						The same as Fucil 2002	Route care	Transition time
Fucile 2005 ³³	United States	9/7	10/6	Unclear	28.2 ± 1.3/28.1 ± 1.1		Route care	Weight gain
Fucile 2010 ³²	United States	22/33	4/16	Unclear	29.6 ± 1.5/29.4 ± 1.9		Route care	Transition time
Lyu 2014a ³⁵	China	16/16	15/16	Computerized random-number generator	30.87 ± 1.47/ 30.92 ± 1.48	Oral stimulation:	Route care	Transition time
						Perioral stimulation: the same as Bache 2014.		Length of hospital stays
						Intraoral stimulation: the same as Bache 2014.		Weight gain
Lyu 2014b ³⁶	China	41/49	15/17	Computerized random-number generator	30.79 ± 1.57/30.94 ± 1.39	The same as Bache 2014.	Route care	Intake of milk Feeding efficacy Transition time
Zhang 2014 ³⁸	China	38/43	13/14	Computerized random-number generator	31.0 ± 1.4/31.1 ± 1.2	Oral stimulation:	Route care	Intake of milk Feeding efficacy Transition time
						The same as Bache 2014.		Length of hospital stays
						NNS: The same as Brenda 2011.		Weight gain

Study ID	Country	No. of Participants		Randomization	Gestational Age, wk (OMI/Control)	Outcomes		
		OMI (F/M)	Control (F/M)			Interventions	OMI	Control
Lu 2014 ³⁴	China	31/33	29/35	Random number table	32.09 ± 2.48/32.17 ± 2.23	Oral stimulation: the same as Bache 2014. Perioral stimulation: the same as Bache 2014. Intraoral stimulation: the same as Bache 2014. NNS: The same as Brenda 2011.	Route care	Transition time Length of hospital stays
Xiao 2014 ³⁷	China	30/44	32/41	Random number table	31.46 ± 1.57/31.19 ± 1.71	Oral stimulation: the same as Bache 2014. Perioral stimulation: the same as Bache 2014. Intraoral stimulation: the same as Bache 2014. NNS: The same as Brenda 2011.	Route care	Transition time Weight gain; Intake of milk Feeding efficacy

F = female, M = male, NNS = nonnutritive sucking, OMI = oral motor intervention.

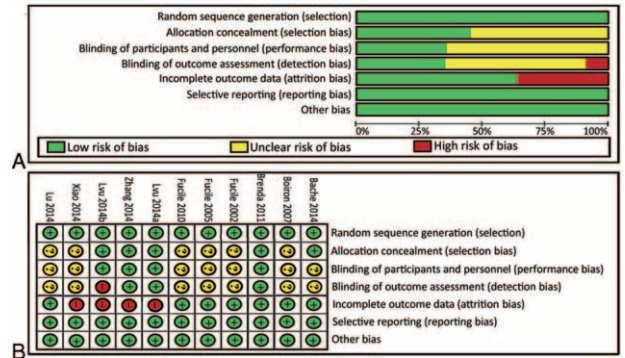


FIGURE 2. Assessment of risk of bias: (A) risk of bias graph and (B) risk of bias summary.

was selected. Changed data were selected to calculate the summary results according to the baseline and endpoint data.²²

TSA

Repeated significance test of sparse and accumulated data has a risk to yield random errors which cause false positive or negative results.²³⁻²⁵ For single primary trial, sequential analysis based on group sequential is similar to interim analysis that may increase the risk of type I errors. So the monitoring boundaries were developed and applied to determine if the trial should be ended early under the condition of a diminutive P value, which indicates statistical significant difference between study groups to minimize the type I error.²⁶ It is possible that sequential analysis, which can also be titled with TSA, can be adopted to analyze the pooled results of meta-analysis.²³ The quantification of the required information size (RIS) is a major factor to realize the TSA. We calculated the RIS adjusted for diversity because the heterogeneity adjustment with I² will underestimate the RIS value.¹⁹ The TSA was performed at the level of an overall 5% risk of a type I error and 20% of the type II error (a statistical test power of 80%).²⁷ If the Z-curve across the monitoring boundary, then we can draw the conclusion of getting credible conclusion before surpassing the RIS line. If the Z-curve across the futility boundary, then we can come to the conclusion of this intervention have no effect for this outcome even though the RIS was not reached. The reliable conclusion can be drawn if the adjusted monitory boundary was surpassed and/or RIS was reached. Because effect measures selected in this meta-analysis fall into continuous data category, and the outcomes of transition time, LOS, feeding efficiency, intake of milk, and weight gain, we estimated the RIS based on the empirical data autogenerated from software according to the data input.²⁸ TSA software (version 0.9 beta) was available at <http://www.ctu.dk/tsa/>.

RESULTS

Study Selection and Basic Characteristics

A total of 63 citations were captured at the initial literature search stage and add no trail to the searched result. Finally, 11 trials,^{16,29-38} which included 855 participants, were remained according to inclusion and exclusion criteria. The flow diagram of literature retrieval and selection was shown in Figure 1.

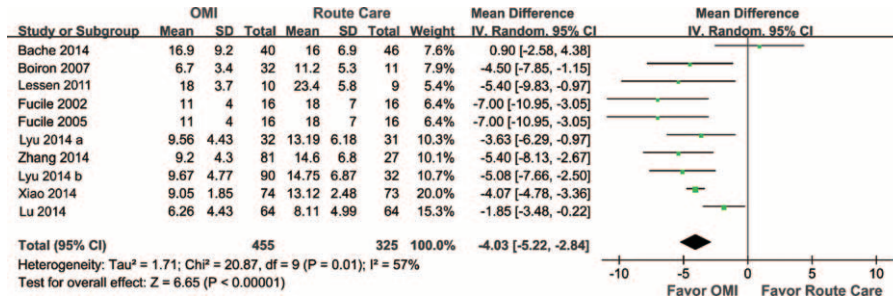


FIGURE 3. Meta-analysis on transition time: OMI effectively reduced the time needed from bottle feeding to total oral feeding compared to route NICU care, random-effect model. OMI = oral motor intervention.

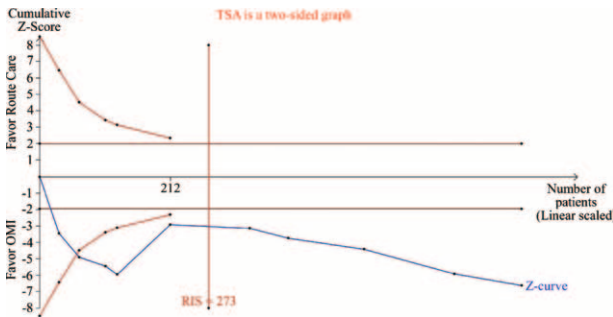


FIGURE 4. TSA on pooled result of transition time: the cumulative sample size over the RIS of 273 and the Z-curve across the adjusted monitor boundary. RIS = required information size, TSA = trial sequential analysis.

Assessment of Risk of Bias

A total of 855 participants were included into our meta-analysis. Basic characteristics of all eligible studies are shown in Table 1. Most of them have problems about blinding. Low-level literatures were resulted from incomplete outcome data. Although reported the dropouts, these studies have no intention-to-treat (ITT) analyses. The methodological quality assessments of included trials were shown in Figure 2.

Meta-Analysis on Transition Time

Ten of all trials involving 780 participants reported the transition time. Heterogeneity was identified across the included studies (P = 0.01; I² = 57%). Hence, a random-effects model, which indicates all the participants from included trials were sampled from the different population, was selected to summarize mean effect size because the resources caused heterogeneity were not detected among included trials. Meta-analysis suggested that OMI can effectively shorten the

transition time, with statistical significant difference (MD, -4.03; 95% CI, -5.22 to -2.84) (Figure 3). Sensitivity analysis based on different pooled model was adopted to test the robustness of pooled result. Pooled result from fixed-effects model was the same with that of random-effects model, and well suggested that the summary effect size is robust (MD, -4.03; 95% CI, -5.22 to -2.84). We undertook a TSA at the level of α of 0.05, β of 0.2, and then an RIS of 279 was calculated. This pooled result was considered to have reliability resulted from Z-curve across conventional statistically significance test boundary, TSA-adjusted boundary value, and the cumulative number of patients reached RIS of 279 (Figure 4). So, OMI has the potential for transition time on preterm infants and worth clinical use.

Meta-Analysis on LOS

Six trials, which include 436 participants, were enrolled in our meta-analysis calculating the LOS. We identified homogeneity in the 6 studies assessed (P = 0.27, I² = 21%). Therefore, a fixed-effects model, which indicates all the participants from included trials were sampled from the same population, was performed to calculate mean effect size. Meta-analysis revealed that OMI effectively shortened the LOS, with statistical difference (MD, -3.64; 95% CI, -5.57 to -1.71) (Figure 5). TSA was taken in the condition of α of 0.05, β of 0.2, and figured out RIS of 851. Although the accrued number of patients did not reach RIS of 851, the cumulative Z-curve cross conventional significance test boundary, RIS-adjusted boundary value, and the effect was prior established (Figure 6). So, OMI has effect for the LOS on preterm infants and worth clinical use.

Meta-Analysis on Feeding Efficiency

Three trials, which included 332 preterm infants, were enrolled in the meta-analysis identifying the feeding efficiency. There was homogeneity about the 3 studies (P = 0.78, I² = 0%). Therefore, a fixed-effects model of analysis was used. Meta-

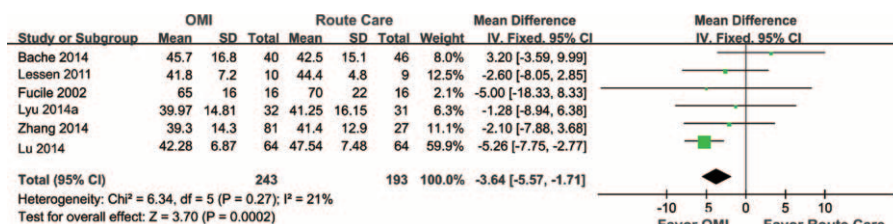


FIGURE 5. Meta-analysis on length of hospital stays: the length of hospitalization of preterm infants in OMI group was reduced by approximately 3.64 days relative to that of route care group, fixed-effect model. OMI = oral motor intervention.

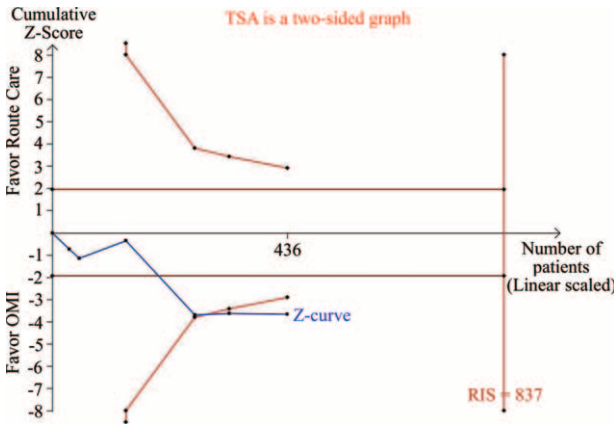


FIGURE 6. TSA on pooled result of length of hospital stays: although cumulative sample size less than RIS, the Z-curve across the adjusted monitor boundary. RIS = required information size, TSA = trial sequential analysis.

analysis result showed OMI can greatly improve the feeding efficiency, with statistical significant difference (MD, 0.81; 95% CI, 0.36–1.27) (Figure 7). TSA was performed in the level of α of 0.05, β of 0.2, and demonstrated RIS of 430. Even though the cumulated number of patients did not reach the value of RIS, the cumulative Z-curve cross conventional statistically significant boundary, TSA-adjusted boundary value and confirmed the result of reliability early (Figure 8). So, OMI has the potential for feeding efficiency on premature infants and worth clinical use.

Meta-Analysis on Intake of Milk

Three trials including 332 premature infants reported the intake of milk. Homogeneity was detected in the incorporated studies ($P = 0.25$, $I^2 = 27\%$), and then a fixed-effects model of analysis was performed to calculate mean effect size. OMI can validly enhance the intake of milk, with statistical difference (MD, 0.14; 95% CI, 0.06–0.21) (Figure 9). TSA was performed, and RIS of 430 was counted in the condition of α of 0.05, β of 0.2. The pooled result manifested reliability due to Z-curve across conventional statistically significant boundary, TSA-adjusted boundary although the RIS was not accrued (Figure 10). So, OMI has efficiency for intake of milk on premature infants and worth clinical use.

Meta-Analysis on Weight Gain

Three of all eligible trials, involving 318 patients, were enrolled in the meta-analysis reporting the weight gain. Heterogeneity was checked in eligible studies ($P = 0.00$, $I^2 = 88\%$). We chose a random-effects model to summarize mean effect

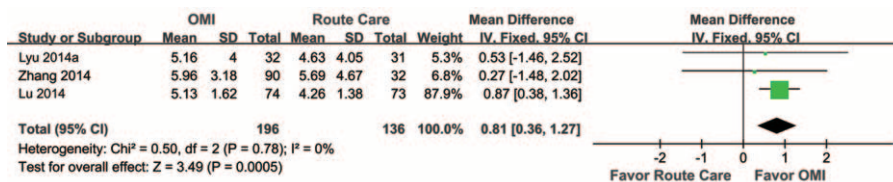


FIGURE 7. Meta-analysis on feeding efficiency: the feeding efficiency of preterm infants has been slightly improved after received the OMI approach, fixed-effect model. OMI = oral motor intervention.

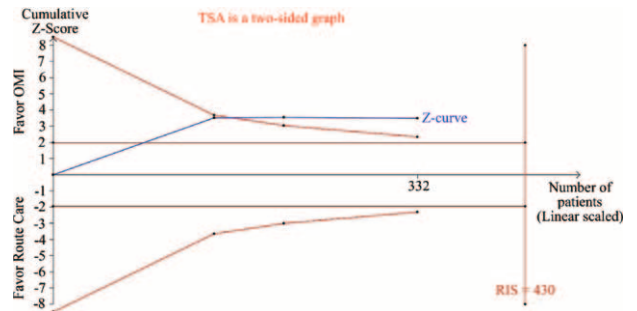


FIGURE 8. TSA on summarized result of feeding efficiency: although cumulative sample size less than RIS, the Z-curve across the adjusted monitor boundary. RIS = required information size, TSA = trial sequential analysis.

size. Meta-analysis result revealed that OMI cannot validly increase the weight gain (MD, -17.54; 95% CI, -151.34–116.26) (Figure 11). RIS and TSA adjusted boundary value cannot be calculated due to limited information size. So whether OMI was effective for weight gain on preterm infants, it still needs more researches to establish.

Publication Bias

We performed a funnel plot to examine the publication bias in all of the included studies. The outcome from the funnel plot analysis is shown in Figure 12, which shows symmetry, thereby indicating that no publication bias possibly exists in the included trials.

DISCUSSION

Advances in reproductive technologies brought out the significant improvements for survival rate of preterm infants in recent years.³⁹ The underdevelopment of cardiopulmonary system, central nervous system, and oral muscle tissue is responsible for lack of the ability of coordination of SSB for preterm infants, which often results in oral feeding difficulties and oral feeding ineffectiveness,^{40–44} prolonged LOS, and increased burden of family and eventually the whole society.⁴⁵ Achievement of oral feeding is a primary criterion for discharge for healthy preterm infants.⁴⁶ Hence, successfully and effectively transitioned feeding approach from tube to oral feeding is the important target for health care staffs.

To generate reasonable and reliable pooled results, we selected the Cochrane risk of bias tool to critically assess the methodological quality. As the domain of incomplete outcome data, 4 included studies were judged with high risk of bias. Although reported the dropouts, intention-to-treat (ITT) was not undertaken. So, we cannot judge whether the dropouts may impair the pooled results. In blinding of outcome assessment,

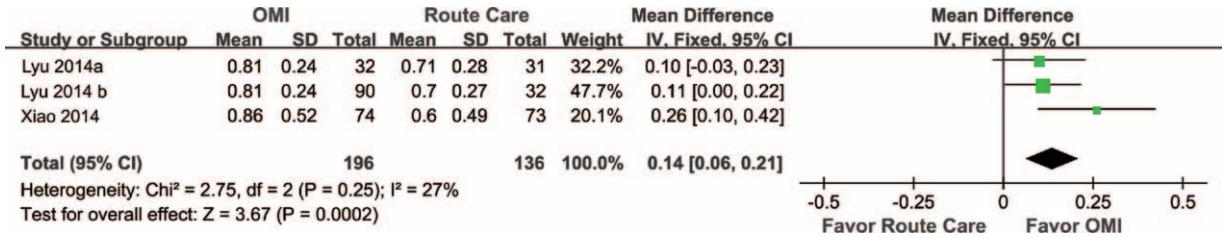


FIGURE 9. Meta-analysis on intake of milk: OMI approach mildly increased the intake of milk of preterm infants compared to route NICU care regime, fixed-effect model. OMI = oral motor intervention.

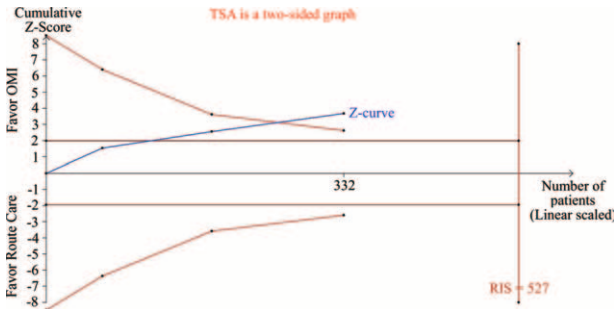


FIGURE 10. TSA on summarized result of intake of milk: although cumulative sample size less than RIS of 527, the Z-curve across the adjusted monitor boundary. RIS = required information size, TSA = trial sequential analysis.

one research was evaluated high risk of bias, which may result from inappropriate design for blinding, and 7 were unclear risk of bias, obvious information about blinding of outcome assessment cannot be identified in these researches, and may lead to evaluation bias. For blinding of participants and personnel, 7 studies were termed as unclear risk of bias, and specific explanations for this domain were not found. Impertinent blinding may lead to results away from true value and produce measurement bias. Implementing blinding for participants or not will not negatively or positively affect the process of whole study due to the target population included in our study is premature infant. Owing to all outcomes were objective, it cannot influence the outcomes in a large extent for whether implement blinding for personnel. For the domain of allocation blinding, 6 researches were judged unclear risk of bias. Insufficient allocation concealment may cause overestimating effect of intervention. Hence, we should evaluate the reliability of pooled results with prudence. In order to draw a more reliable

conclusion, we hope that researchers could emphasize on blinding, allocation concealment, and complete outcome data in further studies. Among 11 studies included in this research, only 1 study was eligible for all domains of quality of methodology. Low-quality researches have greater bias in quality control and will affect the results of this study to some extent.

The meta-analysis results revealed that OMI can effectively improve the condition of transition time, LOS, feeding efficiency, and intake of milk related to route care. But no difference was identified in weight gain between both groups. We summarized the evidence to promote clinical use and further research on this topic in Table 2. The success exploration of OMI and its operation process reflect the limitations of traditional care for preterm infants. We hope that clinical staffs can improve and update their old care manner and make use of the direction of evidence-based nursing theory. Published evidences suggested that early OMI has effects on oral feeding in preterm infants and can shorten the LOS. However, the conclusion is still controversial with some drawbacks, such as small sample size, which can lead to low power regarding the effects of OMI for premature infants. Lack of power may result to get false-negative results, whereas this work combined with TSA to test whether this pooled results were robust and have credibility. And owing to time goes by, techniques of this intervention also improve; so it is needed to explore whether it is effective after about decade years. In addition, this systematic review included studies published between 1960 and 2007, whereas only English literature is eligible for its inclusion criteria¹¹ and the outcomes may be impaired by selection bias. So it is imperative to do this meta-analysis.

Our meta-analysis has only searched the PubMed, the Web of Science, EMBASE, the Cochrane Library and CNKI, but not SpringerLink, ScienceDirect, Chinese Biomedical Literature Database, and other relevant electronic database and unpublished sources, so there is a risk of incomplete retrieval. In addition, this study included only literature published in English

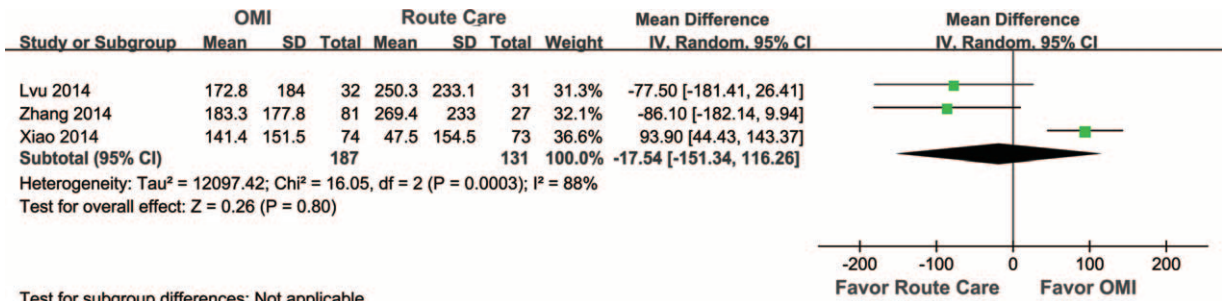


FIGURE 11. Meta-analysis on weight gain: no significant difference was detected between OMI and route NICU care regime in terms of weight gain, random-effect model. OMI = oral motor intervention.

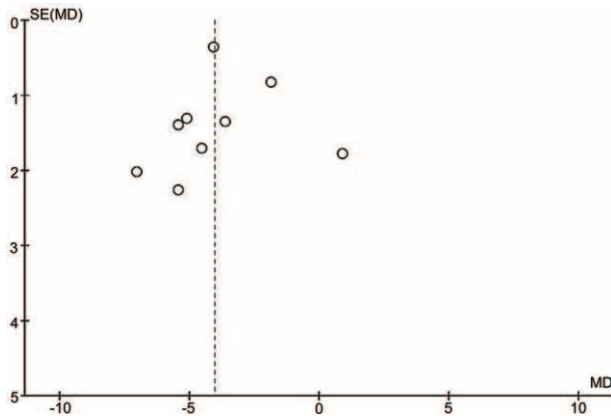


FIGURE 12. Funnel plot of publication bias.

and Chinese language, and the language restriction may result in selection bias, which affects the credibility of the pooled results of our meta-analysis.

OMI is beneficial for oral feeding in preterm infants, but it still has some questions for clinical promotion. For example, the positive function of NNS has formed a consensus, but the application of the time and intensity of NNS not yet formed unified regulations. OMI for preterm infants should be more standardized and systematic. So, more studies need to do to further explore a standard operational approach. In recent years, due to a different mechanism of NNS and oral stimulation, foreign scholars began to explore the influence of the combined use of oral feeding and NNS in premature infants, as well as to determine whether the combination intervention regime is superior to one of all alternatives alone. Some of outcomes for included results were significant. However, they cannot use the pooled analysis for lacking of enough information. But these outcomes have significant value for assessing sucking ability and worth to use in future studies. So, we hope researchers do more studies to provide more standardized, scientific, rationalized approach for clinical use. Although the included studies

TABLE 2. Linking Evidence to Clinical Use or Future Research

Linking Evidence to Clinical Use or Further Research
OMI including oral stimulation and/or nonnutritive sucking and/or oral support.
OMI lead to shorter transition time (ie, from bottle to total oral feeding) for preterm infants.
OMI have the efficiency to shorten the length of hospital stays in premature infants.
OMI can better the feeding efficiency for preterm infants.
OMI have the potential to increase the intake of milk for preterm infants.
We cannot get credible conclusion about whether OMI could improve the weight gain for premature infants, and thus more randomized controlled trials with large-scale and high-quality based on RIS are warranted to further investigate the effectiveness of OMI for this problem and may explore whether it has the potential for other variable on preterm infants such as later growth and development, which longer duration need time to observe.
OMI = oral motor intervention, RIS = required information size.

have differences in the definition of GA for preterm infants, but the sensitivity analyses showed heterogeneity and have little effect on the pooled results. This study uses TSA to calculate the RIS of α of 0.05 and β of 0.2, and it showed credibility for these pooled results.

CONCLUSION

In conclusion, OMI can effectively improve the condition of transition time, LOS, feeding efficiency, and intake of milk, so it is worthy to be used widely in hospitals to improve the clinical outcomes of preterm infants. While RCTs with large-scale and high-quality based on RIS are warranted to further investigate the effectiveness of OMI for weight gain and may explore whether it has the potential for other variable on preterm infants such as later growth and development.

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