Review Article

# Food transition of premature infants admitted to the Kangaroo Unit: systematic review

## Transição alimentar de prematuros internados na Unidade Canguru: revisão sistemática

## Transición alimentaria de prematuros internados en la Unidad Canguro: revisión sistemática

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## Abstract

**Objective:** To analyze the available evidence on the transition from orogastric tube feeding to breastfeeding directly from the breast with premature infants admitted to hospital units.

**Methods:** Systematic literature review with search in the following databases: PubMed/MEDLINE, Web of Science, EMBASE, Scopus, Cochrane CENTRAL, CINAHL, with the inclusion criteria: experimental studies, without temporal restrictions and in Portuguese, Spanish and English. The methodological assessment was carried out using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) and Revised Cochrane risk-of-bias tool for randomized trials (RoB 2.0) tools and consisted of two stages: methodological quality and the risk of bias of the studies.

**Results:** 10 papers were identified, all randomized clinical trials. The techniques used in transitioning the premature babies' diet were: finger tube and syringe, cup and finger tube, cup and bottle, spoon and non-nutritive sucking, non-nutritive sucking, non-nutritive sucking and oral stimulation, behavior of premature babies, and smell of breast milk.

**Conclusion:** The demonstrated techniques allowed the transition of the diet in a shorter period, reducing the length of hospital stay, increasing weight gain 1and proved to be safe, as long as the premature baby is mature enough to undergo the procedure. However, bottle feeding was not recommended due to the occurrence of episodes of desaturation, increased heart rate and nipple confusion.

## Resumo

**Objetivo:** Analisar as evidências disponíveis sobre a transição alimentar de sonda orogástrica para aleitamento materno diretamente na mama com prematuros internados em unidades hospitalares.

**Métodos:** Revisão sistemática da literatura com busca nas bases de dados PubMed/MEDLINE, *Web of Science*, EMBASE, Scopus, *Cochrane* CENTRAL, CINAHL, com os critérios de inclusão: estudos experimentais, sem restrição temporal e nos idiomas português, espanhol e inglês. A avaliação metodológica foi realizada por meio das ferramentas *Grading of Recommendations Assessment, Development and Evaluation* (GRADE) e *Revised Cochrane risk-of-bias tool for randomized trials* (RoB 2.0) e consistiu em duas etapas: qualidade metodológica e o risco de viés dos estudos.

**Resultados:** Foram identificados 10 artigos, todos ensaios clínicos randomizados. As técnicas utilizadas na transição da dieta dos prematuros encontradas foram: sonda-dedo e seringa, copo e sonda-dedo, copo e mamadeira, colher e sucção não-nutritiva, sucção não-nutritiva, sucção não-nutritiva e estimulação oral, comportamento dos prematuros, cheiro do leite materno.

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**Conflicts of interest:** nothing to declare.

**Conclusão:** As técnicas evidenciadas permitiram a transição da dieta, em um período mais curto, reduzindo o tempo de internação, aumentando o ganho de peso e se mostraram seguras, desde que o prematuro tenha maturidade para ser realizada. Contudo, a mamadeira foi desaconselhada, pela ocorrência de episódios de dessaturação, aumento da frequência cardíaca e confusão de bico.

## Resumen

**Objetivo:** Analizar las evidencias disponibles sobre la transición alimentaria de sonda orogástrica a lactancia materna directamente de la mama con prematuros internados en unidades hospitalarias.

**Métodos:** Revisión sistemática de la literatura con búsqueda en las bases de datos PubMed/MEDLINE, *Web of Science*, EMBASE, Scopus, *Cochrane* CENTRAL, CINAHL, con los siguientes criterios de inclusión: estudios experimentales, sin restricción temporal y en idioma portugués, español e inglés. La evaluación metodológica se realizó por medio de las herramientas *Grading of Recommendations Assessment, Development and Evaluation* (GRADE) y *Revised Cochrane risk-of-bias tool for randomized trials* (RoB 2.0) y consistió en dos etapas: calidad metodológica y riesgo de sesgo de los estudios.

**Resultados:** Se identificaron 10 artículos, todos ensayos clínicos aleatorizados. Las técnicas utilizadas para la transición de la dieta de prematuros fueron: dedo-jeringa y jeringa, vaso y dedo-jeringa, vaso y mamadera, cuchara y succión no nutritiva, succión no nutritiva, succión no nutritiva y estimulación oral, comportamiento de los prematuros, olor de la leche materna.

**Conclusión:** Las técnicas observadas permitieron realizar la transición de la dieta en un período más corto, con reducción del tiempo de internación y mejor aumento de peso y demostraron ser seguras, siempre que el prematuro tenga madurez para realizarlas. No obstante, se desaconseja la mamadera por la presencia de episodios de desaturación, aumento de la frecuencia cardíaca y confusión tetina-pezón.

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## Introduction

In premature newborns, human milk prevents diseases related to free radicals, including necrotizing enterocolitis, retinopathy of prematurity and bronchopulmonary dysplasia. It has positive effects on the brain, benefiting the visual and cognitive development of premature newborns (PTNB).[1,2]

Breastfeeding (BF) is considered the gold standard for infant nutrition. It has proven benefits, such as reducing infant morbidity and mortality rates, improving the immune system, providing calories in the ideal quantity compatible with neonatal nutritional needs.[1]

Feeding low-weight premature babies is seen as a complex process, involving physical, neurological, cognitive and emotional aspects. This process, when not carried out properly, brings nutritional complications that interfere with the baby's survival, adult life, social interaction and attachment formation.[3]

In this context, the Kangaroo Method strategy or Kangaroo Neonatal Intermediate Care Unit (UCINCa) is a model of qualified, humanized care, with strategies for including the PTNB's family in their care. Furthermore, it promotes BF and skin-to-skin contact, through the kangaroo position, favoring the emotional bond broken with premature birth and hospitalization.[3]

Health professionals provide strategies/techniques that enable the growth and development of this population group,[4] mainly in relation to ways to start eating.

Initially, food is administered intravenously (total parenteral nutrition) or through an orogastric tube until clinical stability and gastrointestinal maturity are reached and there is coordination between sucking, swallowing and breathing. One of the biggest challenges for premature babies is this transition from gastric to oral feeding, as it requires maturity that they do not have due to early birth.[5]

There is no consensus among professionals regarding the criteria for starting the dietary transition. This decision is based on weight assessment, corrected gestational age, clinical stability, sucking ability and behavioral criteria such as oral reflexes and alertness. It is worth remembering that clinically stable premature infants, when stimulated through non-nutritive sucking (NNS), are able to coordinate sucking, swallowing and breathing before the 34$^{th}$ week of corrected age.[1,5]

There are techniques performed directly on the breast that favor the nutritional transition, such as relactation and translactation. Techniques such as cup, spoon and finger probe are described as safe and favor the transition of feeding until sucking directly on the breast is possible.[5]

Considering the lack of standardization among professionals in hospital units regarding the ways to evaluate and initiate the dietary transition of prema-

ture babies, it is appropriate to analyze in the literature how research mentions these stages and which techniques allow the initiation, maintenance and continuation of the transition. AM, given the high rates of early weaning among premature babies.

Therefore, the objective was to analyze the available evidence on the transition from orogastric tube feeding to breastfeeding directly from the breast with premature infants admitted to hospital units.

## Methods

This is a systematic review of the literature, following recommendations from the Cochrane Manual for Systematic Review of Interventions.[6] Collection began after the construction, registration and publication of the protocol in PROSPERO.

The research question came from the acronym PICOS (P – population/problem; I – intervention; C – comparison; O – outcomes; S – study design).[6,7] Considering the Population/problem – premature infant admitted to Hospital Units; Intervention – techniques that allow the transition from the gavage diet (finger probe, spoon, cup, translactation to relactation); Comparison – two groups: control and intervention; Outcomes – premature babies who were on an orogastric tube diet and switched to breastfeeding after the techniques and Study design – Randomized Controlled, Non-Randomized and Quasi-experimental Clinical Trials (non-randomized clinical trial). Therefore, the search question remained: for premature infants admitted to Hospital Units, what are the effects of techniques that allow the transition from the orogastric tube to breastfeeding directly in the breast?

The inclusion criteria were: experimental studies, without time restrictions and in Portuguese, Spanish and English. Exclusion criteria: studies with patients with malformations, studies that did not detail dietary interventions, non-randomized clinical trials, uncontrolled trials and observational studies (ecological, cohort, case-control, case reports, editorials, comments, reviews and qualitative research).

The search was carried out in databases via the Periodical Portal of the Coordination for the Improvement of Higher Education Personnel (CAPES): PubMed via MEDLINE, Web of Science, EMBASE, Scopus, COCHRANE Library, Cumulative Index to Nursing and Allied Health Literature (CINAHL -EBSCO).

The descriptors were selected from the Medical Subject Headings Section (MeSH), Descriptors in Health Sciences (DeCs), and adapted for each database. It was decided to add the total number of articles obtained in each of equations 1, 2 and 3, to include the largest possible number of findings in each base. Parentheses, brackets, quotation marks, among others, were used, as shown in chart 1.

The search in the databases is illustrated in figure 1, detailing the process of identification, screening, eligibility, inclusion and exclusion. 10 papers were identified, all randomized clinical trials, which used techniques to assist the transition of premature babies' diets in hospital units.

The papers were grouped using the EndNote Web® reference and bibliography manager (Clarivate Analytics, PA, USA), removing duplications and then forwarded to the Rayyan software (Qatar Computing Research Institute, Doha, Qatar). The search in the databases took place between April and May 2021, being updated in February 2022.

At this stage, a form prepared with guidelines from the Cochrane Collaboration[6] was used with the variables: study identification (authors, journal, title, year), objectives and method (randomization, blinding, allocation sequence, sample size, criteria inclusion and exclusion groups, intervention group and comparator control group, data analysis and outcomes). Other information was added: country, base, place of intervention, justification, corrected age, weight, scale for assessing readiness, technique used to transition the diet and definition of the technique.

To ensure the quality of the systematic review, the search was carried out in two stages: 1) two independent reviewers examined titles and abstracts applying the selection criteria, 2) the same reviewers read in full and reached a consensus, listing the included papers. In divergent cases, a third reviewer was called.

**Chart 1.** Search expression in PubMed and other searched databases

| | | |
|---|---|---|
| #1 | "breast feeding" [MeSH Terms] OR "Breast Milk Expression" [Text Word] OR "Breast Feeding, Exclusive +" [Text Word] OR "Exclusive Breast Feeding" [Text Word] OR "Breastfeeding, Exclusive +" [Text Word] | |
| #2 | "Infant, Premature" [MeSH Terms] OR "infant, extremely premature" [Text Word] OR "infant, newborn+" [Text Word] OR "infant, low birth weight" [Text Word] OR "infant, small for gestational age+" [Text Word] | |
| #3 | "Kangaroo-Mother Care Method" [MeSH Terms] OR Care Method, Kangaroo-Mother [MeSH Terms] OR "Kangaroo Mother Care Method" [Text Word] OR" Methods, Kangaroo-Mother Care" [Text Word] | |
| #4 | "Feeding Behavior" [MeSH Terms] OR "Bottle Feeding" [MeSH Terms] OR "Breast Feeding" [Text Word] OR" Breast Milk Expression" [Text Word] OR "Translactation" OR "Relactation" | |
| #5 | "randomized controlled trial" [Publication Type] OR "controlled clinical trial" [Publication Type] OR "random allocation" [MeSH Terms] OR "double blind method" [MeSH Terms] OR single blind method [MeSH Terms] OR "clinical trial" [Publication Type] OR single* [Text Word] OR double* [Text Word] OR treble* [Text Word] OR triple* [Text Word] random* [Text Word] | |
| Equation 1 | #1 AND #2 AND #3 AND #4 AND #5<br>"breast feeding" [MeSH Terms] OR "breast milk expression" [Text Word] OR "breast feeding, exclusive +" [Text Word] OR "exclusive breast feeding" [Text Word] OR "breastfeeding, exclusive +" [Text Word] AND "infant, premature" [MeSH Terms] OR "infant, extremely premature" [Text Word] OR "infant, newborn+" [Text Word] OR "infant, low birth weight" [Text Word] OR "infant, small for gestational age+" [Text Word] AND "kangaroo-mother care method" [MeSH Terms] OR "care method, kangaroo-mother" [MeSH Terms] OR "kangaroo mother care method" [Text Word] OR" methods, kangaroo-mother care" [Text Word] AND "feeding behavior" [MeSH Terms] OR "bottle feeding" [MeSH Terms] OR "breast feeding" [Text Word] OR "breast milk expression" [Text Word] OR "translactation" OR "relactation" AND "randomized controlled trial" [Publication Type] OR "controlled clinical trial" [Publication Type] OR "random allocation" [MeSH Terms] OR "double blind method" [MeSH Terms] OR "single blind method" [MeSH Terms] OR "clinical trial" [Publication Type] OR single* [Text Word] OR double* [Text Word] OR treble* [Text Word] OR triple* [Text Word] random* [Text Word]". | TOTAL<br>26 |
| Equation 2 | #1 AND #2 AND #3 AND #4<br>"breast feeding" [MeSH Terms] OR "breast milk expression" [Text Word] OR "breast feeding, exclusive +" [Text Word] OR "exclusive breast feeding" [Text Word] OR "breastfeeding, exclusive +" [Text Word] AND "infant, premature" [MeSH Terms] OR "infant, extremely premature" [Text Word] OR "infant, newborn+" [Text Word] OR "infant, low birth weight" [Text Word] OR "infant, small for gestational age+" [Text Word] AND "kangaroo-mother care method" [MeSH Terms] OR "care method, kangaroo-mother" [MeSH Terms] OR "kangaroo mother care method" [Text Word] OR "methods, kangaroo-mother care" [Text Word] AND "feeding behavior" [MeSH Terms] OR "bottle feeding" [MeSH Terms] OR "breast feeding" [Text Word] OR "breast milk expression" [Text Word] OR "translactation" OR "relactation". | 170 |
| Equation 3 | #2 AND #4 AND #5<br>"infant, premature" [MeSH Terms] OR "infant, extremely premature" [Text Word] OR "infant, newborn+" [Text Word] OR "infant, low birth weight" [Text Word] OR "infant, small for gestational age+" [Text Word] AND "feeding behavior" [MeSH Terms] OR "bottle feeding" [MeSH Terms] OR "breast feeding" [Text Word] OR "breast milk expression" [Text Word] OR "translactation" OR "relactation" AND "randomized controlled trial" [Publication Type] OR "controlled clinical trial" [Publication Type] OR "random allocation" [MeSH Terms] OR "double blind method" [MeSH Terms] OR "single blind method" [MeSH Terms] OR "clinical trial" [Publication Type] OR single* [Text Word] OR double* [Text Word] OR treble* [Text Word] OR triple* [Text Word] random* [Text Word]. | TOTAL<br>1448 |
| Sum of the results of the equations | RESULTS OF EQUATION 1 + RESULTS OF EQUATION 2 + RESULTS OF EQUATION 3= | 1644 |

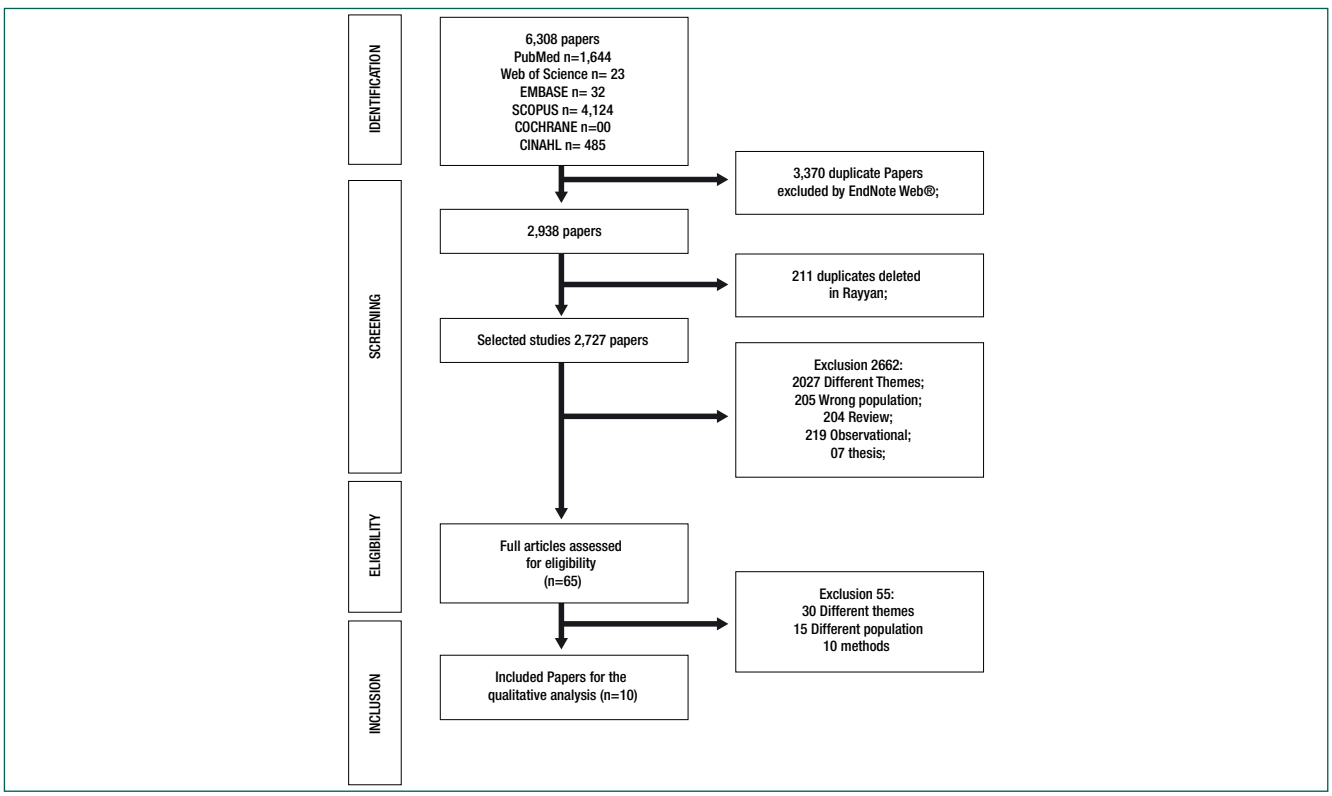


**Figure 1.** PRISMA flowchart for selecting articles for the systematic review

Methodological quality was assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) to grade the quality of evidence, strength of recommendations and risk of bias using the Revised Cochrane risk-of-bias tool for randomized trials (RoB 2.0 )[8-10] with the scores: 1) selection bias: generation of the randomization sequence and allocation concealment, 2) performance bias: evaluation of blinding of participants, researchers involved and evaluation of results, 3) attrition bias : assessment of systematic differences of participants involved in studies between compared groups, 4) reporting bias: assessment of systematic differences between reported and unreported findings, 5) other sources of bias: sample assessment, size and power calculations test used in the reported results.

Trials were given the concept "low risk of bias" and "low overall risk of bias" and other trials "high overall risk of bias". Using the online GRADE, it was possible to determine the strength of the recommendation for health care as "high", "moderate", "low" or "very low".[8,11]

The meta-analysis was not performed, as the studies analyzed presented methodological differences, such as: place of hospitalization of the premature baby and/or heterogeneous specialties of the researchers, corrected age of the babies, different interventions and clinical outcomes. Therefore, this review presents the evidence qualitatively.

## Results

The findings will be presented descriptively and presented in figures and tables. The years of publication ranged from 2001 to 2020, with 02 articles published in 2014[17,18] and 2019,[19,20] and one publication in each of the years: 2001,[12] 2002,[13] 2008,[14] 2010,[15] 2011,[16] 2020.[21] They were developed in the following countries: 04 in Turkey,[16,17,19,21] 02 Brazil,[14,20] 01 in Canada,[14] 01 in China,[18] 01 in the United States of America (USA),[12] 01 in India.[15] Regarding the premature infant's hospitalization unit, 09 were in the NICU[12,13,14, 16,17,18,19,20,21] and 01 in the intermediate care unit.[15] Chart 2 summarizes the main descriptive characteristics of the included studies.

Among the techniques used in the transition of premature babies' diets are: finger probe and syringe,[21] cup and finger probe,[20] cup and bottle,[12,13,17] spoon and non-nutritive sucking (NNS),[15] SNN,[19] SNN and oral stimulation (EOS),[18] observation of the behavior of premature babies[14] and the smell of breast milk.[16] As a result, the time interval between feedings is perceived (2h or 3h)[19] necessary for uncomplicated feeding and digestion for the baby, and observation of the behavior of premature babies in assessing the ability to transition the diet from the orogastric tube to breast stimulation[14]. One article showed that the food transition time, using NNS, was similar between the 3h and 2h diet interval groups,[19] another combined NNS with oral stimulation (EOS) [18] to aid the food transition. The use of a bottle was present in three articles,[12,13,17] this technique did not bring benefits to premature babies when compared to using a cup, in addition to allowing the occurrence of desaturation episodes during the administration of the diet. Another intervention was the smell of breast milk,[16] carried out with gauze soaked in breast milk during gavage, which made it possible to achieve oral feeding four days earlier than the control group, in addition to reducing the length of hospital stay. It is important to highlight that all techniques in the intervention groups (cup, EO, NNS, spoon, finger probe and smell of milk) allowed for shorter hospital stays and adherence to BF. The use of observation of the premature baby's behavior allowed the health professional to guide the choice and technique of dietary transition. Regarding the quality of evidence assessed through GRADE, 02 papers received the concept of high quality;[15,18] the others, moderate quality of evidence as they did not mention blinding,[12- 21] and one article[16] the investigator The main one was not blind, but the others were. Regarding blinding, one article[21] received a high risk of bias, as the method mentioned a non-blind study, and in the other[14] the researchers were not

**Chart 2.** Characterization of the ten articles included according to authors, country, objectives, technique used and results

| Author<br>Year<br>Journal<br>Country<br>Inpatient unit | Objective | Used Technic<br><br>Intervention and control Group | Age | Results |
|---|---|---|---|---|
| Marinelli, K. A et al[12]<br><br>2001<br><br>Nature- Journal of Perinatology<br><br>USA<br><br>ICU | To compare the safety of cup feeding, an alternative feeding method, with bottle feeding, the current standard of artificial feeding in the USA, in premature infants whose mothers intend to breastfeed. | Cup and bottle<br><br>The order of the first two oral feedings off the breast was randomized to a cup and a bottle.<br>GI= 25 babies (cup)<br>GC= 25 babies (bottle) | ≤ 34 corrected gestation weeks | HR (p<0.0001) and RR (p<0.0001) increased and SatO2 decreased (p=0.0002) during cup and bottle feeding compared to pre-feeding baselines. The fraction of SatO2 <90% during baseline was different between these two methods (p=0.02). There was a 10-fold increase in desaturations <90% during bottle feeding. Comparing periods of cup and bottle feeding, HR were higher (p=0.009) and SatO2 lower (p=0.02) during bottle feeding. There were no differences between methods in RR, choking, spitting or apnea and bradycardia. The volumes removed were smaller (p=0.001) and the duration of feedings was longer (p=0.002) in the cup group. |
| Rocha, N. M. N et al[13]<br><br>2002<br><br>J Hum Lact<br><br>Brazil<br><br>ICU | Examine the impact of cup or bottle feeding on weight gain, oxygen saturation, and breastfeeding rates in premature infants. | Cup and bottle<br>The babies were divided according to 3 birth weights: 500 g to 999 g, 1000 g to 1499 g and 1500 g to 1699 g, and were randomly assigned to one of the feeding groups.<br>GI= 44 babies for the cup;<br>GC=34 babies to the bottle. | Postconceptional age ranged from 35 to 44 weeks in the bottle group (CG) and from 34 to 42 weeks in the cup group (GI). | At the beginning of oral feeding, post-conceptional age and weight were 37.2 ± 2.2 weeks and 1676 ± 83 g for the bottle-feeding group (CG) and 37.0 ± 1.6 weeks and 1637 ± 40 g for the GI. No significant differences were found between the groups in relation to time spent eating, feeding problems, weight gain or prevalence of breastfeeding at discharge or at the 3rd month of follow-up. When feeding with a cup, the incidence of desaturation episodes was lower (13.6% vs 35.3%, GI vs CG, P = 0.024) and the prevalence of breastfeeding at the 3rd month was higher among those who were still breastfeeding at the first follow-up appointment (68.4% vs 33.3%, GI vs CG, P = 0.04). |
| Puckett, B. et al[14]<br><br>2008<br><br>Am J Perinatol<br><br>Canada<br><br>ICU | To determine whether an unscheduled feeding protocol led infants to alter behavior during feeding and, as such, whether feeding based on behavioral assessment would result in decreased hospital stay. | Behavior of premature babies<br><br>The intervention group received gavage feeding, which was discontinued at study entry and began to be fed orally;<br>The control group was fed with an initial combination of scheduled gavage and bottle feeding and then on demand.<br>GI=39<br>GC=40 | Postconceptual age (PCA) of 32 weeks | There was no difference between groups in average weight gain; in the control group the average weight gain was 12.5 g/kg/day and in the intervention group 12.1 g/kg/day (p = 0.83). The average length of stay in the control group of 14.5 days was significantly longer than the 10.0 days in the intervention group (p = 0.009). The average total number of adverse events in the control group (12.5 events) was significantly higher than in the intervention group (3.5 events; p= 0.007). The average post-conceptual age at study entry was 34.4 weeks in both groups and at exit 36.5 weeks in the control group and 35.8 weeks in the intervention group, a significant difference (p = 0.02) . The intervention group showed 2.8 behavior/eating. |
| Kumar, A et al[15]<br><br>2010<br><br>Nature - Journal of Perinatology<br><br>India<br><br>Intermediate Care Unit | To evaluate the suitability and feasibility of spoon feeding in terms of physical growth and transition to breastfeeding in low birth weight (LBW) newborns discharged early from hospital. | Non-nutritive spooning and sucking (SNN)<br><br>Trial I, infants were gradually transitioned from nasogastric feeding and spoon feeding to breastfeeding in the hospital. In Trial II, babies transitioned from spoon feeding to BF in the hospital and at home.<br>GI: 79 newborns;<br>GC: 65 newborns. | Gestational age ≥ 32 weeks to ≤ 36 weeks corrected age. | The average weight gain in Trial I was 4.72 (4.68) g kg-1 per day in the NG-feeding group and 4.47 (3.14) g kg-1 per day in the spoon-feeding group ( P = 0.8836). Similarly, spoon-fed infants gained 7.06 (4.26) g kg-1 per day in the hospital group, while they gained 7.56 (3.31) g kg-1 per day in the home group (P = 0 .5984) during the 28-day study period. After randomization, the transition time to BF was 12.31 (3.32) days and 14.39 (4.10) days (P = 0.0201) in Trial I, while 3.55 days and 9 .81 days (P = 0.0000) in Trial II in the two groups, respectively. In Trial II, the average duration of hospital stay was 14.58 (2.83) days in the hospital group and 10.19 (2.26) days in the home group (P = 0.0000). |
| Yildiz, A. et al[16]<br><br>2011<br><br>Journal of Nursing Scholarship,<br><br>Turkiye<br><br>ICU | To investigate the effect of applying the smell of breast milk to premature infants during gavage feeding in the transition period to full oral feeding. | Smell of breast milk soaked in gauze during gavage.<br>GI= 40 infants;<br>GC= 40 infants. | Born after the 28th or before the 34th week of gestation. | The results indicated that premature babies who were stimulated by the odor of breast milk during gavage feeding achieved oral feeding 3 days earlier than controls. Furthermore, the average length of stay for these infants was 4 days shorter. |
| Yilmaz, G. et al[17]<br><br>2014<br><br>Journal of Human Lactation<br><br>Turkiye<br><br>ICU | To determine the effect of bottle and cup feeding on breastfeeding rates in late preterm infants 32 to 35 weeks during their hospital stay, as well as at discharge and at 3 and 6 months later. | Cup and bottle<br><br>GI=254 cup fed;<br>GC=268 bottle-fed. | 32 to 35 weeks | Infants randomized to cup versus bottle were more likely to be exclusively breastfed at discharge and at home (relative risk [RR], 1.58; 95% confidence interval [CI], 1.36-1.83), 3 months after discharge (RR, 1.64; 95% CI, 1.42-1.89), and 6 months after discharge (RR, 1.36; 95% CI, 1.14-1.63). The average hospital stay was 25.96 ± 2.20 days in the bottle group and 25.68 ± 2.22 days in the cup group. There was no significant difference between groups for time spent eating, feeding problems or weight gain in hospital. |
| Zhang, Y. et al[18]<br><br>2014<br><br>Neonatal Intensive Care<br><br>China<br><br>ICU | To compare and evaluate the effectiveness of non-nutritive sucking (NNS) and oral stimulation (EO), applied alone or in combination, to improve oral feeding in premature newborns. | Non-nutritive sucking (NNS) (pacifier) and oral stimulation (EO)<br><br>One hundred and twelve preterm infants were divided into three intervention groups (SNN, EO and SNN + EO combined) and a control group.<br>28 babies per group. | Born between 29 and 34 weeks of GA | The transition time was reduced in the three intervention groups compared to the control group (p< 0.001). The milk transfer rate in the three intervention groups was higher than in the control group (F3,363=15.37; p<0.001). The proficiency in the SNN and EO groups did not exceed that of the control group, while the proficiency in the SNN + EO group was higher than that in the control group at the stage in which the infants started oral feeding (p=0.035). Among all groups, no significant difference was found in weight gain and length of stay. |

Continue...

Continuation.

| Author<br>Year<br>Journal<br>Country<br>Inpatient unit | Objective | Used Technic<br><br>Intervention and control Group | Age | Results |
|---|---|---|---|---|
| Unal, S. et al[19]<br><br>2019<br><br>Nutrition in Clinical Practice<br><br>Turkiye<br><br>ICU | To investigate the impact of 2 feeding intervals, i.e., 3 hours or 2 hours, on the transition time from gavage to full oral feeding in premature babies. | Non-nutritive sucking (NNS)<br><br>G1= 50 babies (2h)<br>G2= 50 babies (3h) | Post-conceptional age ≤ 32 and <36 weeks of gestation | Gestational age: 29 [28–31] weeks, birth weight: 1205 [1040–1380] g. The postconceptional age to achieve full oral feeding was 35 (35–37) weeks in the 3-hour interval group and 35 (34–36) weeks in the 2-hour interval group, P = 0.131. The duration of the dietary transition was similar between the groups. |
| Nunes, J. D. et al[20]<br><br>2019<br><br>CoDAS<br><br>Brazil<br><br>ICU | To evaluate oxygen saturation (SatO2), heart rate (HR), length of stay and weight of preterm newborns (PTNBs) in a Neonatal Intensive Care Unit, when offering a diet using cup feeding techniques and finger probe, simultaneously with AM. | Cup and finger probe<br>8 PTNBs who received the cup diet (GCP)<br>17 received the diet through the finger probe (GSD) | Gestational age (GA) of 35 to 36 weeks (Capurro method) | Regarding the SatO2 and HR variables, no statistically significant differences were observed between the groups, but, in the group versus time factor, the groups showed non-continuous differences in the SatO2 variable. In relation to weight, a statistically significant gain was found for both groups. However, in GCP, their weight gain is due to the longer hospital stay. The GSD had a shorter hospital stay. |
| Buldur, E. et al [21]<br><br>2020<br><br>Breastfeeding Medicine<br><br>Turkiye<br><br>ICU | To compare finger tube feeding and syringe feeding on the sucking ability of premature babies in the first days of life. | Syringe and finger probe<br><br>Preterm infants were randomized to receive the routine diet (syringe technique) and the intervention (finger tube feeding).<br>GI = 35<br>GC = 35 | Group 1 was ≥ 31 to ≤ 34 weeks; Group 2 was 30-35 weeks | Comfort and distress scores were determined using the COMFORTneo scale. Babies in the intervention group had better comfort than those in the CG (p = 0.000). The transition time to breastfeeding was significantly shorter than in the CG (19.4 – 15.0 days versus 29.7 – 10.2 days, p = 0.000). The GI had less milk loss during feeding and its average weight gain at the end of the 10th day was significantly higher (322.1 – 82.3 g versus 252 – 108.4 g, p = 0.004). They were also discharged before the GC (25.8 – 17.4 days versus 35.9 – 13.0 days, p = 0.001). |

SatO2– oxygen saturation; HR – heart rate; RR – respiratory rate; GA – Gestational age; NICU – Neonatal Intensive Care Unit

blinded. Eight studies[12-21] were classified as having an uncertain general risk, as they had insufficient information to judge whether or not there was impairment. Two articles[15,18] received low risk of bias in the 6 domains evaluated. Four articles[13,16,19,20] had problems in sample allocation, generation of the random sequence and allocation concealment. Figure 2 illustrates the risk of bias of articles included in the research using Rob 2[6] for randomized clinical trials.

## Discussion

The period of food transition from gavage to breast stimulation is considered a milestone in the baby's development, and aspects such as: gestational age, weight gain, oral motor pattern with coordination of sucking, swallowing and breathing and rhythm must be evaluated. Food can be offered on demand, supplemented or supplemented using a cup/spoon/bottle.[22,23]

Observation of the premature baby's behavior is an important factor in starting the diet transition.[14] However, the readiness to breastfeed, presence of oral reflexes, characteristics of the stomatognathic system, caloric balance, rooting reflex during retrieval must be assessed. of the mother's breast for guidance and choice of feeding technique.[22]

On the other hand, another RCT, which studied the behavioral changes of premature infants during nasogastric tube feeding, found that "hand-to-mouth, mouth gestures, seeking suction and sucking" were more evident in the group whose parents administered the diet, showing the importance of family interaction with the baby.[24]

The use of the smell of milk allowed the maturation of the premature baby due to the activation of ingestion behavior, such as rooting and NNS.[16] Preterm babies are able to differentiate the smell of their mother's milk, thanks to the presence of olfactory sensitivity, the use of this low-cost technique favors the chemosensory experience, interrupted by premature birth.[16]

In relation to NNS through the "gloved finger",[18,20] which is part of oral stimulation programs in premature babies, it must be evaluated by profes-

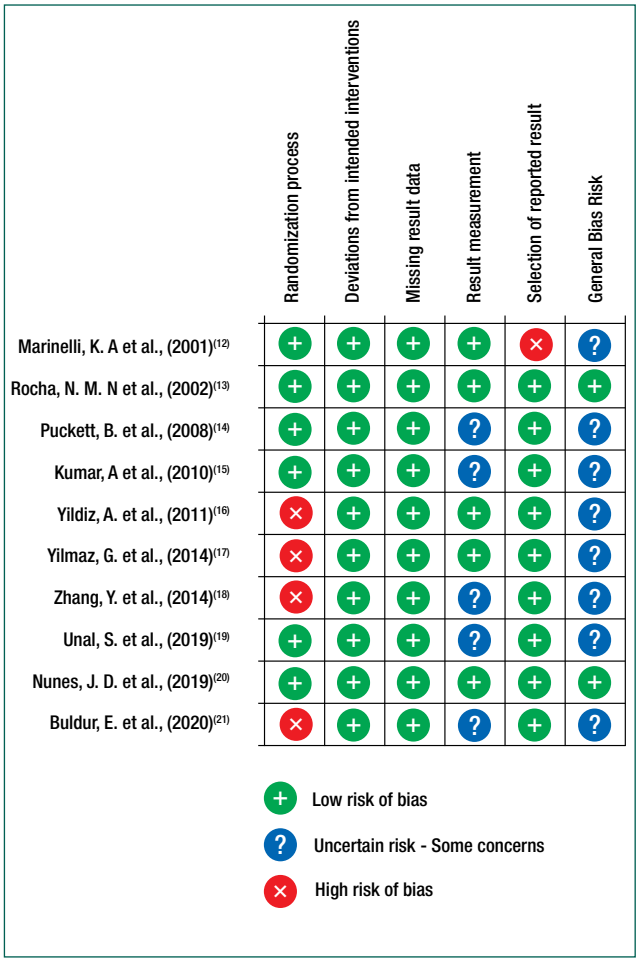


**Figure 2.** Individual assessment of the risk of bias of Randomized Controlled Clinical Trials according to RoB 2 (n=10)

sionals regarding the existence of sucking patterns, tone and muscle mobility to then be stimulated in the emptied breast.[22]

When NNS techniques and oral or perioral stimulation are combined, the authors state that they are interventions that facilitate and stimulate oral motor skills, having a positive effect on the transition from gavage to complete oral feeding, reducing hospitalization time.[25]

Another RCT evaluated NNS intervention directly on the breast, three times a day for 5 minutes, comparing routine care (NNS by finger probe during gavage), observing that the intervention group showed a faster NNS transition (P=0.05) and had more sucks during breastfeeding (P = 0.06). The early onset of NNS in the "empty" breast was considered a safe intervention, facilitating the maturation of behavior, sensory experience and weight gain in the premature baby, in addition to enabling maternal participation and autonomy.[25]

The use of a cup[17] during the diet transition, in turn, reduces the "nipple confusion" caused by the bottle and the consequent weight loss in premature babies.[22] Corroborating this finding, an integrative review showed that patterns such as FC , oxygen saturation, weight gain, breastfeeding rates and their continuation at 3 and 6 months were more stable compared to bottle feeding.[26]

For spoon feeding, an RCT evaluated the effect of oromotor stimulation compared to routine care in the transition from gavage.[15] The time between the end of partial/full spoon feeding and the beginning of breastfeeding was significantly shorter in the intervention group, there were fewer episodes of desaturation, aspiration, apnea, hypothermia, bradycardia and a greater number of babies were discharged on BF.[27]

The finger probe technique, as it is widely used in neonatal services, needs studies for its standardization and indication. A research carried out comparing the finger probe to the cup at the beginning of the food transition in 53 premature infants of gestational age < 37 weeks observed that the experimental group lost less milk offered, presented fewer adverse events, proving to be an option for professionals.[28]

Complementing the findings, the syringe and finger probe, in the quasi-experimental study that compared the supply of diet in relation to the amounts offered and spilled, found that the finger probe provided less milk loss when compared to the 20mL syringe.[29]

Cup and bottle showed that the bottle increased episodes of desaturation, elevated heart rate, significant increase in hospital stay, nipple confusion causing sore nipples, reduced maternal milk production, making the transition to breast-feeding difficult, contributing to weaning early.[12,13,17]

The use of the cup and the finger probe proved to be safer, given the physiological conditions and clinical stability of the baby, they allowed a lower incidence of desaturation episodes, lower energy expenditure, greater weight gain on the 10$^{th}$ day and shorter transition time. for breastfeeding.[12,13,17,21]

It was also seen that, during cup feeding, the baby projects his tongue forward, over the lower alveolar ridge to sip the milk, helping in the subsequent development of tongue movements, respecting his breathing and swallowing, leading to latch. adequate when chest stimulation is performed.[13]

All techniques allowed evolution in the transition of the premature baby's diet, whether alone or in combination. However, a sine qua non is to evaluate the corrected age, considering that the sucking pattern of premature babies at 33-34 weeks is similar to that of full-term babies. The harmful effects of prolonged tube feeding are evident, such as oral hypersensitivity, crying, refusal to eat and esophageal and/or pharyngeal inflammation, and the transition is essential for maturity.[30]

This review included studies that highlighted techniques that allow nurses to act in the transition of the diet, observing the administration and behavior of the premature baby to initiate breast stimulation. Among the limitations, there is the heterogeneity of studies in methodology, in the area of hospitalization of premature babies (NICU and UCINCa) and/or different specialties, profile of participants, sample size and techniques, making data meta-analysis impossible.

Heterogeneity was observed between the included studies, both in the location (NICU, UCINCa and Intermediate Care Unit – UCINCo), techniques used, analysis of the feeding transition time and professionals. The variation may probably be due to methodological differences, limiting generalizations. However, despite the impossibility of generalizing the findings due to heterogeneity, the importance of using stimulation techniques to transition the premature baby's diet was observed, reducing early weaning and reducing the length of hospital stay.

Another point highlighted was the fragility of the method. Although the ten articles were RCTs, blinding, allocation and randomization led to a greater risk of bias. It is suggested that studies be carried out seeking broader evidence and proving other feeding transition techniques in premature babies, which include translactation and relactation.

## Conclusion

Based on this systematic review, it was possible to see that the techniques used allowed the feeding transition from the orogastric tube to premature infants admitted to hospital units. The feeding transition must be started in the NICU, using the smell of breast milk during gavage, and observing the premature baby's behavior. Techniques such as EO, SNN, finger probe, cup and spoon allowed the transition of the diet in a shorter period, reduced the length of hospital stay, increased weight gain and proved to be safe, as long as the premature baby is mature enough to be carried out. As for bottle feeding, it was not recommended due to the occurrence of episodes of desaturation, increased heart rate and nipple confusion. When analyzing the variables of the studies, it became clear that the feeding transition process and the importance of evaluating the weight, corrected age and behavior of the premature baby, help health care teams, enabling recognition of the ideal and safe moment to start transitioning from probe to AM.

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## References

1. Fallahi M, Shafiei SM, Taleghani NT, Shariati MK, Noripour S, Pajouhandeh F, et al. Administration of breast milk cell fractions to neonates with birthweight equal to or less than 1800 g: a randomized controlled trial. Int Breastfeed J. 2021;16(1):63.

2. Pontes SR, Gomes ALM, Machado MED, Gomes SF, Rodrigues EC, Christoffel MM. Direitos protetivos à prática do aleitamento materno de mães de recém-nascidos prematuros: estudo transversal. Rev Enferm UERJ. 2021;29:e61446.

3. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Ações Programáticas Estratégicas. Atenção humanizada ao recém-nascido: Método Canguru: manual técnico. Brasília (DF): Ministério da Saúde; 2017. [citado 2022 mar 10];340 p. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/atencao_humanizada_metodo_canguru_manual_3ed.pdf

4. Walty CM, Duarte ED. O aleitamento materno de recém-nascidos prematuros após a alta hospitalar. Rev Enferm Centro-Oeste Mineiro. 2017;7:e1689.

5. Pessoa-Santana MC, Silveira BL, Santos IC, Mascarenhas ML, Dias EG. Métodos Alternativos de Alimentação do Recém-Nascido Prematuro: Considerações e Relato de Experiência. Rev Bras Ciênc Saúde. 2016;20(2):157–62.

6. Higgins J, Green S, editors. Cochrane handbook for systematic reviews of interventions version 5.1.0 Chichester. John Wiley & Sons; 2011.

7. Huang X, Lin J, Demner-Fushman D. Evaluation of PICO as a knowledge representation for clinical questions. AMIA Annu Symp Proc. 2006;2006:359–63.

8. Guyatt G, Oxman AD, Akl EA, Kunz R, Vist G, Brozek J, et al. GRADE guidelines: 1. Introduction-GRADE evidence profiles and summary of findings tables. J Clin Epidemiol. 2011;64(4):383–94.

9. Sterne JA, Savović J, Page MJ, Elbers RG, Blencowe NS, Boutron I, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ. 2019;366:l4898.

10. Brasil. Ministério da Saúde. Secretaria de Ciência, Tecnologia, Inovação e Insumos Estratégicos em Saúde. Departamento de Gestão e Incorporação de Tecnologias em Saúde. Diretrizes metodológicas: elaboração de revisão sistemática e meta-análise de ensaios clínicos randomizados Brasília (DF): Ministério da Saúde; 2021. 93p. [citado 2022 mar 10]. Disponível em: https://rebrats.saude.gov.br/phocadownload/diretrizes/20210622_Diretriz_Revisao_Sistematica_2021.pdf

11. Brasil. Ministério da Saúde. Secretaria de Ciência, Tecnologia e Insumos Estratégicos. Departamento de Ciência e Tecnologia. Diretrizes metodológicas: Sistema GRADE – Manual de graduação da qualidade da evidência e força de recomendação para tomada de decisão em saúde Brasília (DF): Ministério da Saúde; 2014. 72p. [citado 2022 mar 10]. Disponível em: https://bvsms.saude.gov.br/bvs/ct/PDF/diretriz_do_grade.pdf

12. Marinelli KA, Burke GS, Dodd VL. A comparison of the safety of cupfeedings and bottlefeedings in premature infants whose mothers intend to breastfeed. J Perinatol. 2001;21(6):350–5.

13. Rocha NM, Martinez FE, Jorge SM. Cup or bottle for preterm infants: effects on oxygen saturation, weight gain, and breastfeeding. J Hum Lact. 2002;18(2):132–8.

14. Puckett B, Grover VK, Holt T, Sankaran K. Cue-based feeding for preterm infants: a prospective trial. Am J Perinatol. 2008;25(10):623–8.

15. Kumar A, Dabas P, Singh B. Spoon feeding results in early hospital discharge of low birth weight babies. J Perinatol. 2010;30(3):209–17.

16. Yildiz A, Arikan D, Gözüm S, Taştekın A, Budancamanak I. The effect of the odor of breast milk on the time needed for transition from gavage to total oral feeding in preterm infants. J Nurs Scholarsh. 2011;43(3):265–73.

17. Yilmaz G, Caylan N, Karacan CD, Bodur İ, Gokcay G. Effect of cup feeding and bottle feeding on breastfeeding in late preterm infants: a randomized controlled study. J Hum Lact. 2014;30(2):174–9.

18. Zhang Y, Lyu T, Hu X, Shi P, Cao Y, Latour JM. Effect of nonnutritive sucking and oral stimulation on feeding performance in preterm infants: a randomized controlled trial. Ped Crit Care Med. 2014; 15(7):608-14.

19. Unal S, Demirel N, Bas AY, Arifoğlu İ, Erol S, Ulubas Isik D. Impact of feeding interval on time to achieve full oral feeding in preterm infants: a randomized trial. Nutr Clin Pract. 2019;34(5):783–8.

20. Nunes JA, Bianchini EM, Cunha MC. Oxygen saturation and heart rate in premature: comparison between cup and finger feeding techniques. CoDAS. 2019;31(6):e20180221.

21. Buldur E, Yalcin Baltaci N, Terek D, Yalaz M, Altun Koroglu O, Akisu M, et al. Comparison of the finger feeding method versus syringe feeding method in supporting sucking skills of preterm babies. Breastfeed Med. 2020;15(11):703–8.

22. Medeiros AM, Ramos BK, Bomfim DL, Alvelos CL, Silva TC, Barreto ID, et al. Tempo de transição alimentar na técnica sonda-peito em recém-nascidos baixo peso do Método Canguru. CoDAS. 2018;30(2):e20170092.

23. White-Traut R, Pham T, Rankin K, Norr K, Shapiro N, Yoder J. Exploring factors related to oral feeding progression in premature infants. Adv Neonatal Care. 2013; 13(4):288-94.

24. Angot F, Van Vooren V, Castex C, Glorieux I, Casper C. Behavioral changes in preterm children during nasogastric tube feeding. Comparative study of manual administration by parents versus mechanical administration via electric syringe pump. Early Hum Dev. 2020;149:105151.

25. John HB, Suraj C, Padankatti SM, Sebastian T, Rajapandian E. Nonnutritive sucking at the mother's breast facilitates oral feeding skills in premature infants: a pilot study. Adv Neonatal Care. 2019;19(2):110–7.

26. Penny F, Judge M, Brownell E, McGrath JM. Cup Feeding as a Supplemental, Alternative feeding method for preterm breastfed infants: an integrative review. Matern Child Health J. 2018;22(11):1568–79.

27. Bala P, Kaur R, Mukhopadhyay K, Kaur S. Oromotor stimulation for transition from gavage to full oral feeding in preterm neonates: A Randomized controlled trial. Indian Pediatr. 2016 Jan;53(1):36–8.

28. Moreira CM, Cavalcante-Silva RP, Fujinaga CI, Marson F. Comparison of the finger-feeding versus cup feeding methods in the transition from gastric to oral feeding in preterm infants. J Pediatr (Rio J). 2017;93(6):585–91.

29. Araújo VC, Maciel AC, Paiva MA, Bezerra AC. Volume derramado, saturação de oxigênio e frequência cardíaca durante a alimentação de recém-nascidos prematuros: comparação entre dois métodos alternativos de oferta. CoDAS. 2016;0(3):212-20.

30. Wang YW, Hung HY, Lin CH, Wang CJ, Lin YJ, Chang YJ. Effect of a delayed start to oral feeding on feeding performance and physiological responses in preterm infants: a randomized clinical trial. J Nurs Res. 2018;26(5):324–31.