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Original article

Effectiveness of using a supplemental feeding device in low birth weight preterm newborns

Tatiana Cedeño Escalona I*  <https://orcid.org/0000-0003-1819-5363>Ana Delia Bavastro Osoria I  <https://orcid.org/0009-0008-4670-3074>Rafael Ferrer Montoya I  <https://orcid.org/0000-0001-5235-7675>María Cristina Cedeño Esturo I  <https://orcid.org/0000-0002-8861-3252>

¹University of Medical Sciences of Granma. Carlos Manuel de Céspedes Provincial General Hospital. Bayamo. Granma, Cuba.

* Corresponding author. Email: tatianace@infomed.sld.cu

ABSTRACT

Introduction:feeding low birth weight preterm newborns constitutes a clinical challenge due to the physiological immaturity that limits direct breastfeeding. The use of the supplementer is proposed as a strategy to promote nutrition and maintain breastfeeding.

Objective:to evaluate the effectiveness of using the supplementer as a feeding method in low birth weight preterm newborns.

Methods:An experimental, prospective, randomized study was conducted in 40 low birth weight preterm newborns, divided into two groups: 20 fed with a supplementer and 20 without a supplementer. Clinical variables and weight gain at 5, 10, and 15 days were analyzed. Statistical tests were used with a significance level of $p < 0.05$.



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Results:no significant differences were observed between the groups at baseline or at 5 days. At 10 and 15 days, the supplementer group showed greater weight gain, with statistically significant differences ($p = 0.009$ and $p < 0.001$, respectively).

Conclusions:the use of the supplementer was effective in improving weight gain in low birth weight preterm newborns, also favoring breastfeeding and constituting a safe and non-invasive alternative.

Keywords:Premature newborn; Low birth weight; Breastfeeding; Supplementer; Weight gain; Neonatal feeding.

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Introduction

Breastfeeding is the optimal nutritional strategy for newborns, providing not only essential nutrients but also immunological, bioactive, and growth-regulating factors that promote comprehensive development. (1) International organizations such as the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) recommend exclusive breastfeeding for the first six months of life, followed by continued complementary breastfeeding up to two years or beyond, due to its proven benefits in reducing infant morbidity and mortality, as well as promoting long-term health. (2,3)

However, in the context of preterm and low birth weight newborns, establishing and maintaining breastfeeding presents a significant clinical challenge. The physiological limitations inherent in neurological and gastrointestinal immaturity, along with frequent mother-child separation in neonatal intensive care units, hinder effective sucking and direct breastfeeding. Added to this are emotional, educational, and organizational factors that negatively impact adherence to breastfeeding, leading to the implementation of alternative feeding methods. (4)



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In this scenario, early and adequate enteral nutrition plays a crucial role in the clinical course of premature infants, promoting intestinal maturation, microbiome establishment, and weight gain similar to that achieved in utero. However, its introduction remains controversial due to the potential risk of complications such as necrotizing enterocolitis. Therefore, strategies have been developed to optimize feeding without interfering with the establishment of breastfeeding, among which the use of a supplemental feeding device (SFD) stands out. (5)

The supplemental nursing system, which allows the administration of breast milk while the newborn suckles directly at the breast, is presented as an alternative that promotes lactation stimulation, mother-child bonding, and the transition to exclusive breastfeeding. It has also been associated with potential benefits such as improved weight gain, reduced use of invasive devices, shorter hospital stays, and fewer neonatal complications. (6) However, evidence regarding its effectiveness in low birth weight preterm infants is still limited and heterogeneous, especially in resource-constrained healthcare settings.

From the perspective of relevance and timeliness, the study of interventions that promote breastfeeding in vulnerable populations, such as premature infants, is a public health priority, in line with global strategies aimed at improving neonatal survival and reducing health inequities. In this regard, strengthening feeding practices that integrate a humanized approach to neonatal care and the active participation of the mother is essential.

In accordance with the above, the scientific problem identified is the need to determine whether the use of a supplemental nursing system as a feeding method is effective in improving weight gain and clinical outcomes in low birth weight preterm newborns. This research is justified by its potential impact on optimizing neonatal feeding practices, promoting breastfeeding, and improving the quality of life of these patients, as well as by its contribution to evidence-based clinical decision-making.

Therefore, the objective of the study is to evaluate the effectiveness of using the supplementer as a feeding method in low birth weight preterm newborns.



Methods

Study design: An experimental, prospective, controlled, and randomized study with two parallel groups was conducted in the Neonatology Service of the Carlos Manuel de Céspedes Provincial General Hospital, Bayamo, Granma, during the period between March 1 and September 30, 2025.

Population and sample: The population consisted of preterm newborns with low birth weight admitted to the neonatal care unit. A sample of 40 newborns was selected using simple random sampling, and they were randomly assigned to two groups:

- Experimental group (n = 20): Breast milk supplementation using a breast milk feeder.
- Control group (n = 20): feeding without the use of a supplementer.

Selection criteria

Inclusion criteria

Preterm newborns (<37 weeks) with low birth weight:

- Presence of sucking and swallowing reflexes.
- Tolerance to the oral route.
- Admission to the neonatal care unit.
- Informed consent of the mother to participate in the study.

Exclusion criteria

- Newborns with major congenital malformations.
- Serious illnesses that contraindicate enteral feeding.
- Absence of maternal consent.



Intervention

In the experimental group, the breastfeeding supplementer method was applied, defined as a feeding system that allows the administration of breast milk through a tube connected to a reservoir, while the newborn sucks directly from the mother's breast, promoting the stimulation of lactation.

The procedure included (Figure 1):

- Prior extraction of breast milk by milking.
- Placing the newborn in the breastfeeding position.
- Insertion of a feeding tube (No. 5 - 6) attached to the mother's nipple, connected to a bottle with breast milk.
- Continuous supervision by nursing staff, ensuring aseptic conditions and proper suction technique.



Fig 1. Technical sample of the supplementer.

The control group received conventional feeding according to service protocols, without the use of a supplementer.

Study variables

Main outcome variable: weight gain (grams/day).

Secondary variables:

- Sex (male/female).
- Gestational age (30–33.6; 34–36.6 weeks).
- Birth weight (< 1250 g; 1250–1499 g; ≥1500 g).
- Weight assessment time (5, 10 and 15 days).
- Days of use of the supplementer.

Information gathering

The data were obtained from neonatal medical records and service records. A data collection form was designed that included clinical and anthropometric variables. Body weight was monitored serially on the established days.

Statistical analysis:

The data were processed using the IBM SPSS Statistics version 23 statistical package.

Descriptive statistics were performed using absolute and relative frequencies, means, and standard deviations. To assess initial homogeneity between groups, the chi-square test or Fisher's exact test was used for qualitative variables, and the Student's t-test for quantitative variables. To determine the effectiveness of the intervention, the Student's t-test for independent samples was used. A statistical significance level of $p < 0.05$ was considered.

Ethical considerations:

The research adhered to the ethical principles of the Declaration of Helsinki. Informed consent was obtained from the mothers or legal guardians of the newborns. Confidentiality of information and the exclusive use of data for scientific purposes were guaranteed. The study was approved by the institutional ethics committee.



Results

Forty low birth weight preterm newborns were included, distributed equally into two groups (n = 20 each).

Baseline characteristics of the sample

Regarding sex, males predominated in both groups: 12 (60.0%) in the group with a supplemental feeding device and 10 (50.0%) in the group without. Females represented 8 (40.0%) and 10 (50.0%), respectively. No statistically significant differences were observed between the groups ($p = 0.751$), demonstrating homogeneity in this variable (Table 1).

Table 1. Distribution of newborns according to sex and type of feeding.

Sex	Supplementer		No Supplement		Total	
	No.	%	No.	%	No.	%
Male	12	60.0	10	50.0	22	55.0
Female	8	40.0	10	50.0	18	45.0
Total	20	100.0	20	100.0	40	100.0

Fisher's exact test: $p = 0.751$

Regarding gestational age, no newborns were recorded with less than 30 weeks in either group. 30.0% of newborns in the group with a supplemental feeding device and 40.0% in the group without a supplemental feeding device were between 30 and 33.6 weeks of gestation, while 70.0% and 60.0%, respectively, were between 34 and 36.6 weeks. No significant differences were found between groups ($p = 0.740$), confirming their baseline comparability (Table 2).

Table 2. Distribution according to gestational age and feeding method

Gestational age	Supplementer		No Supplement		Total	
	No.	%	No.	%	No.	%
From 30 to 33.6 weeks	6	30.0	8	40.0	14	35.0
From 34 to 36.6 weeks	14	70.0	12	60.0	26	65.0



Total	20	100.0	20	100.0	40	100.0
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Fisher's exact test: $p = 0.740$

Effectiveness of the supplement on weight gain

At the start of the study, no significant differences in average weight were observed between the two groups ($p = 0.508$). Similarly, at 5 days of follow-up, the differences in weight gain remained non-significant ($p = 0.508$).

However, after 10 days, a significantly greater increase in weight was observed in the group that used a supplementer (mean: 2101.5 ± 193.1 g) compared to the control group (1936.0 ± 189.6 g), with statistically significant differences ($p = 0.009$).

This trend intensified at 15 days, where the group with supplementation reached an average weight of 2308.0 ± 171.2 g, while the group without supplementation presented 2017.0 ± 190.8 g, showing a highly significant difference ($p < 0.001$). (Table 3)

Table 3. Comparison of weight gain according to type of feed and evolution time.

Period	Groups	Weight average value (grams)	Deviation standard	p
Start	Supplementer	1685.5	223.3	0.508
	No supplement	1745.5	210.5	
5 days	Supplementer	1884.5	212.1	0.508
	No supplement	1840.5	203.7	
10 days	Supplementer	2101.5	193.1	0.009
	No supplement	1936.0	189.6	
15 days	Supplementer	2308.0	171.2	0,000
	No Supplement	2017,0	190.8	

Discussion



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The results of this study demonstrate that the use of a supplemental nursing system (SNS) as a method of breastfeeding low birth weight preterm infants is an effective strategy for improving weight gain, especially from the tenth day of life onward. This finding reinforces the importance of implementing interventions that not only ensure adequate nutritional intake but also promote the establishment and maintenance of breastfeeding in vulnerable populations.

Regarding baseline characteristics, no significant differences were observed between the groups in terms of sex or gestational age, confirming their adequate comparability. In particular, sex showed no influence on weight gain, which partially coincides with the findings of Thoene et al., who found similarities in growth and nutritional intake between boys and girls, although they described specific differences in neurological and survival outcomes adjusted for clinical variables. (7) In contrast, the present study did not show any impact of sex on the response to the feeding method, suggesting that the effectiveness of the supplementer is independent of this variable in the short term.

Furthermore, gestational age showed a direct relationship with weight gain, being greater in neonates with greater maturity (≥ 34 weeks), which is consistent with neonatal physiology. The gastrointestinal, neuromotor, and metabolic immaturity of the smallest premature infants leads to limitations in sucking, swallowing, and nutrient absorption, as noted by Squizzato et al. (8) and other authors. (9-11) This aspect partially explains the difficulties in establishing effective oral feeding and reinforces the need for strategies that facilitate the transition to breastfeeding.

In this context, several studies have described that preterm newborns experience difficulties transitioning from tube feeding to full oral feeding, which prolongs hospital stays and increases the risk of complications. (3,12) However, unlike these reports, the present study achieved earlier introduction of breastfeeding through the use of a supplemental nursing system, taking advantage of the presence of coordinated sucking-swallowing reflexes, which favored a more efficient nutritional evolution.

The findings are consistent with the evidence supporting the use of breast milk as the best nutritional alternative in premature infants, due to its dynamic composition adapted to the needs of the newborn, as noted by Llerena et al. (13). Likewise, the use of strategies that



combine enteral feeding with direct breast stimulation contributes not only to weight growth, but also to immunological and neurological development.

From a pathophysiological perspective, the immaturity of the digestive system and the incoordination of sucking, swallowing, and breathing described in premature infants justify the need for support methods such as supplemental feeding, which allows for maintaining the stimulation of breastfeeding without compromising caloric intake. In this regard, current literature supports that early initiation and appropriate progression of enteral feeding do not increase the risk of necrotizing enterocolitis and, on the contrary, are associated with better clinical outcomes, including greater growth and development of the gut microbiome. (5,6,14)

A relevant aspect is the limited evidence available specifically on the use of supplemental feeding in preterm infants, which coincides with the findings of the literature review. However, studies such as those by Tolppola et al. (15) describe related methods such as translactation, which have demonstrated benefits in weight gain and in promoting breastfeeding. This suggests that supplemental feeding could be considered an effective option within this group of interventions, although studies with larger sample sizes and multicenter designs are needed.

Additionally, the results obtained highlight the positive impact of the supplemental nursing system beyond the nutritional sphere. Its use fosters the mother-child bond, promotes skin-to-skin contact, and facilitates the implementation of the kangaroo mother care method, recognized for its benefits in hemodynamic stability, thermoregulation, and reduction of neonatal stress. (9,16) Furthermore, it strengthens the mother's active participation in the care of the newborn, which has been associated with better rates of exclusive breastfeeding and greater confidence in the parenting process.

The role of nursing staff is fundamental to the successful implementation of this method, as they ensure correct technique, adherence to aseptic measures, and educational support for the mother. In accordance with recent studies, ongoing staff training and the application of developmental programs, such as NIDCAP (17) and FiCare (18), are key to improving outcomes in premature infants.



From an economic and social perspective, the use of a supplemental nursing system (SNS) represents a cost-effective intervention, as it reduces hospital stays, decreases the use of invasive procedures, and prevents associated complications. This translates into significant savings in healthcare resources and a positive impact on the quality of life of patients and their families.

Limitations of the study include the small sample size and the lack of direct comparative studies in the literature, which limits the generalizability of the results. Nevertheless, the findings provide relevant preliminary evidence regarding the effectiveness of the supplemental feeding device in this population group.

Conclusions

The use of breast milk supplementation in low birth weight preterm newborns proved effective in improving weight gain from the tenth day onward. Furthermore, it promotes breastfeeding, strengthens the mother-child bond, and represents a safe, non-invasive, and potentially cost-effective alternative in neonatal nutritional management.

Recommendations

It is recommended to implement the use of a supplemental nursing system (SNS) as a breastfeeding support strategy for preterm newborns with sucking and swallowing ability, integrating it into standardized feeding protocols in neonatal units. The use of the mother's own breast milk and skin-to-skin contact should be actively promoted to foster the mother-child bond and humanize neonatal care. Finally, it is suggested that studies with larger sample sizes and multicenter designs be developed to confirm these findings and evaluate their long-term impact.



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Declaration of conflicts of interest

The authors declare that there are no conflicts of interest.

Authors' contributions

Conceptualization, data curation, formal analysis, research, methodology, original draft writing, validation: Tatiana Cedeño Escalona.



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Research, methodology, resources, writing – review and editing: Ana Delia Bavastro Osoria, Rafael Ferrer Montoya and María Cristina Cedeño Esturo.



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