# Chapter 104

## Children born with low weight: what factors interfere with their growth?

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## ABSTRACT

Introduction: It is known that the state of health at birth is a determining factor of greater importance for the survival and quality of life of the child. Children born with less than 2500 grams are more likely to die in the first months of life, have delays in neuro-psychomotor development, and have chronic non-communicable diseases in adulthood. As the growth process depends on the interaction between genetic load and factors extrinsic to the human being, knowing which factors interfere in the growth of children born with low weight can contribute to qualifying the child's health care. Objective: To identify in the kinetic literature the factors that interfere with the growth of children born with low weight up to two years of life. Method: The proposed systematic review was conducted according to the methodology of the Joanna Briggs Institute for systematic reviews of etiology and risk. Only studies that quantitatively addressed the factors that interfere with the growth of children born with low weight up to 2 years of age were selected. Studies involving children with congenital or perinatal pathology did not participate in this review. The data were extracted by the principal investigator and included: the author/year, objective, method, and main results of the study. Results: Of the 3433 articles identified, only 1 2 studies were included in this review. Diet, socioeconomic status, family-centered care, and genetics were identified as the main factors of interference in the growth of children born with low weight up to two years of age. Conclusions: The growth of children born with low weight is determined by several factors, especially diet and socioeconomic aspects.

**Keywords:** Child Health, Pediatrics, Low weight at birth, Growth and Development, Nursing.

## 1 INTRODUCTION

Birth weight is used as a parameter worldwide to assess the health conditions of the newborn and its risk of morbidity and mortality. The child who is born with low weight, that is, weighing less than 2,500 grams, has a greater chance of dying in the first months of life, of having delays in neuro psychomotor development, and has greater chances of presenting chronic non-communicable diseases in adult life (WHO, 2014).

Globally, about 20 million babies are born with low birth weight (LBW). Approximately 95% of these babies are born in developing countries with the highest incidence in South Central Asia, followed by Africa. The two main reasons for LBW are premature birth (<37 weeks) and intrauterine growth restriction (IUGR), which constitute risk factors for increased morbidity and mortality in newborns

(IMDAD et al, 2013). In Brazil, data from the National Survey of Demography and Health of Children and Women (PNDS-2006) indicated a prevalence of low birth weight of 6.1%, but with important regional differences.

It is worth mentioning that maternal causes, pre- and perinatal causes as well as the socio-environmental situation to which the mother is inserted (IMDAD et al, 2013) are determining factors for the infant health of the baby that will be born, as well as major influencers in the birth of babies with full-term LBW (IMDAD et al, 2013).

In addition, growth, expressed by the increase in body size, is one of the best indicators of child health and every human being has an innate genetic potential that can be achieved or not. However, for this potential to be developed there must be extrinsic (environmental) factors that are within the expected parameters to positively influence this growth. Among them, we highlight food, health, hygiene, housing, and general care with the child, which act by accelerating or delaying this process (ROMANI, 2004). In addition, the literature shows that children with LBW tend to remain with lower weight and length than those born with adequate weight, moreover, it is shown that LBW contributes to growth deficit, because these children have greater difficulty breastfeeding and are more vulnerable to diseases (OLIVEIRA, 2015).

This chapter aims to synthesize the best evidence available in the literature on the factors that interfere with the growth of children born with low weight up to two years of life, to contribute to the implementation of more qualified assistance to the health of the child.

## 2 MATERIALS AND METHODS

This is a quantitative systematic review conducted according to the Joanna Briggs Institute methodology for systematic reviews of etiology and risk. The question of the review was: what factors interfere with the growth of children born with low weight? It was based on the ICC strategy: (P-population = children up to two years of age; I-phenomenon of interest = factors that interfere with growth; Co-context = born with low weight).

We selected studies that addressed the factors that influence the weight and linear growth of children born with low weight, inserted in the home and/or hospital context, either at term or premature, up to two years of age. I included only quantitative articles, available in full, without limited access, regardless of the type of study (control c; analytical cross-sectional; case report; cohort; quasi-experimental; RCTs; systematic reviews). The languages Portuguese, English, and Spanish, published in 2015, the year of the last revision of the National Policy for Child Health Care, in addition to the UN 2030 Agenda and its 17 Sustainable Development Goals (SDGs), without the restriction of the place of publication, were considered. The exclusion criteria were: studies with children who had some congenital or perinatal pathology and studies that are part of the literature fifty.

The studies were selected from the following databases: EMBASE, PubMed, SciElo, and VHL. The

search in these databases was performed in April/2021 using the Health Sciences Descriptions (DeCS) and the Medical Subject Heading (MeSH). The search strategy was validated by a documentalist librarian. She used advanced research in the databases, with several combinations between the descriptors, in addition to verifying whether the choice of descriptors and their relationship with the theme, objective, and research question were correct (Chart 1).

Table 1. Search strategies for articles in the databases EMBASE, PubMed, ScieElo, and VHL PubMed. Salvador (BA), Brazil, 2021

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|---|
| #1: infant, low birth weight AND child health AND feeding behavior |
| #2: infant, low birth weight AND child health AND child development |
| #3: infant, low birth weight AND child health AND nutritional status AND nursing |
| #4: infant, low birth weight, AND child health AND nursing |
| #5: infant, low birth weight AND child health AND child development AND nursing |
| #6: infant, low birth weight AND child health AND feeding behavior AND nutritional status AND child development AND nursing |
| #7: Low Weight Newborn AND Child Health AND Eating Behavior AND Child Development AND Nutritional Status AND Nursing |
| #8: recién nacido de bajo peso AND salud del niño AND conducta alimentaria AND desarrollo infantil AND nutritional status AND enfermería |
| #9: Newborn Low Weight AND Child Health AND Eating Behavior |
| #10: Newborn Low Weight AND Child Health AND Eating Behavior AND Child Development |

Source: Research data, 2021

After the initial search, the information of all the articles found was uploaded to Mendeley, and the duplicates were removed via Mendeley's software and also through the review of the principal investigator. After this step, the information from the articles was exported to a spreadsheet in Microsoft Excel with the aid of the JabRef application. Then, the titles and abstracts were selected by 6 independent reviewers for evaluation of the inclusion criteria for the review. Of the selected articles, the full text was evaluated in detail with the inclusion and exclusion criteria by two independent reviewers.

The divergences among the reviewers were discussed at each stage of the selection process and, when necessary, a third reviewer was requested. The results of the research and the process of inclusion of the study were fully described in the final systematic review and are presented in a flowchart of Main Report Items for Systematic Reviews and Meta-analyses (PRISMA) (GALVÃO et al., 2015). The data were extracted from the studies and organized in an instrument prepared by the authors based on the recommendations of the JBI, containing the following information: author, objective, methodology, and main results.

The eligible studies were critically evaluated by two independent reviewers for methodological quality through JBI Instruments. After this critical evaluation, their results were reported narratively.

## 3 FINDINGS

To present the results of the research and the selection of studies in the best way, PRISMA was used (Figure 1). The following figure is a flowchart of the selection of studies based on PRISMA,

containing the step-by-step search results of the articles of all the databases used. Performing the initial search of the articles, filtering through the initial date (2015), a total of 3,433 were found, subsequently, studies with duplicity (N= 420) were excluded. The remaining studies were analyzed by six independent reviewers and excluded those that did not meet the inclusion criteria through the reading of the titles and abstracts, thus leaving 457 studies. The next step was to reread the titles and abstracts of these studies, leaving at the end 96 studies that were read in full and only 12 met the inclusion and exclusion criteria, being included in the review.

Figure 1. The selection process of the studies included in the systematic review is based on the PRISMA* recommendation. Salvador (BA), Brazil, 2021
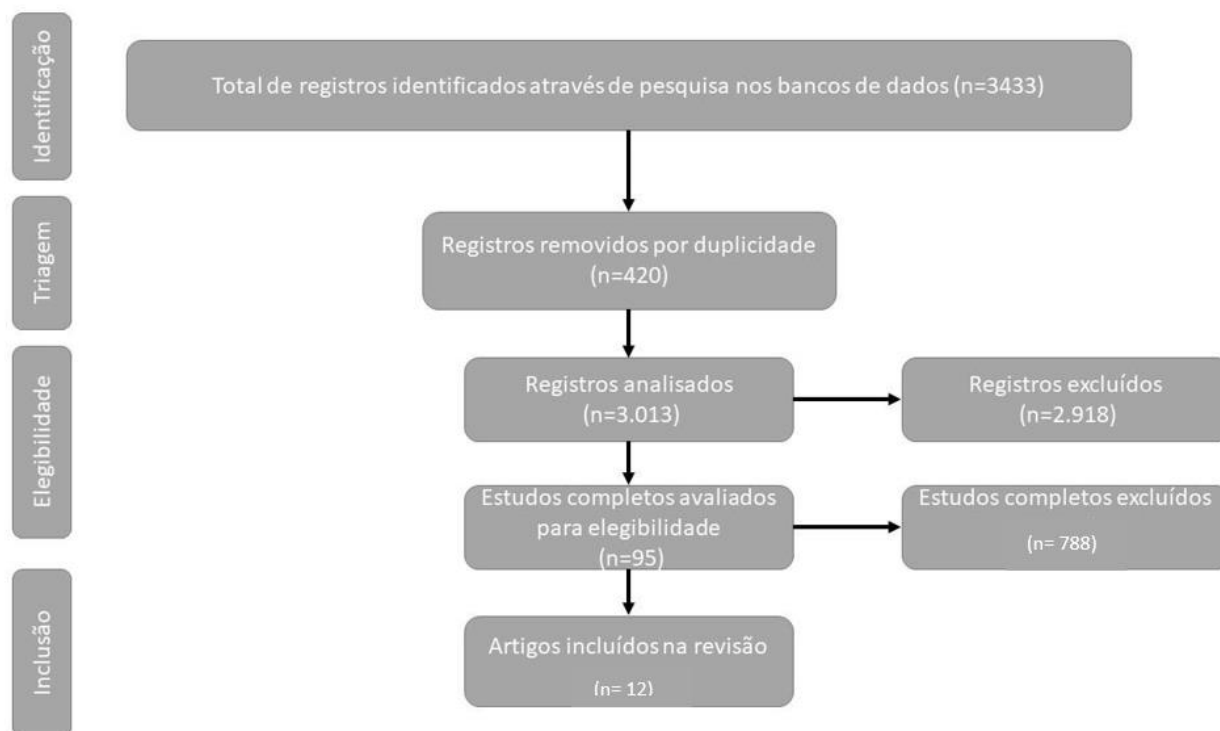


Source: Research data, 2021

*Adaptation of the Flow Diagram of the integrative review article selection process, according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

**Characteristics of the studies**

Doze studies were selected for inclusion in the systematic review: two systematic reviews, five cohort studies, three randomized controlled trials (RTC), one data analysis review of an RTC, and one quasi-experimental study. According to the years of publication, four studies were published in 2016, one in 2017, one in 2018, four in 2019, one in 2020, and one in 2021. Regarding the countries where the studies were conducted, most were conducted in India, but studies were also found in the United States, United Kingdom, Lithuania, Italy, Thailand, Poland, Hong Kong, and China. There were also two multicenter studies, one between Indonesia and Australia and one that was conducted in the United States and Canada, but with data from a multicenter cohort between India, Ethiopia, Peru, and Vietnam. Despite researching studies in the English, Spanish, and Portuguese languages, all of those included were in the English

language. Table 2 describes the studies included in this review.

Table 2. Description of the publications selected according to reference (author, title, year), objective, method, and main results with emphasis on factors that interfere with growth. Salvador, 2021

| Author/year | Goal | Method | Major results |
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| Abiramalatha et al 2021 | To evaluate the effect on growth and safety of enteral feeding with high volume versus standard volume in premature or low birth weight infants. | A systematic review that used the Neonatal Cochrane pattern as a research strategy. | In high-volume versus standard feedings with fortified human milk or formula for preterm infants, the result showed that high feeding volume improves weight gain during hospitalization. |
| Aldakauskienė et al. 2019 | To evaluate the effect of two Parenteral Nutrition application techniques (PICC and PVC) on anthropometric parameters and neurodevelopment of very low birth weight newborns (VLBP). | A prospective randomized clinical trial was conducted in VLBW and was randomized into two groups: PICC and CVP. | There were no differences observed in anthropometric parameters between subjects in the two groups in the short and long term. |
| Arun et al. 2019 | Compare the weight gain of very low birth weight babies with or without adding coconut oil to breast milk | A randomized clinical trial with 60 babies who received breast milk with coconut oil or only breast milk. | There was no difference in weight gain between the two groups. The percentage of total body fat did not differ among the groups. |
| Bellagamba et al. 2016 | To evaluate the effect on growth and neurodevelopment of increased amino acids (AA) during parenteral nutrition and protein intake during enteral nutrition in babies with extremely low birth weight, from birth to reach 1800 g of body weight. | Premature infants with a birth weight of 500 to 1,249 g were randomized to a high intake of AA/protein (HiP) or a standard of care group (StP). The primary outcome was weight gain from birth up to 1,800 g. | Weight gain from birth to 1800 g was 12.3g in StP and 12.6g in the HiP/day group. We did not find any difference in any growth parameters, neither during hospitalization nor at 2 years of corrected age. |
| Groer et al. 2020 | Evaluate the potential metabolic effects of the dysbiotic bowel of the MBPN baby on growth. | Eighty-four MBPN babies were followed for six weeks after birth with weekly stool collection. DNA was extracted from the samples and a region was sequenced. A similar database of the microbiota of full-term babies was used to compare the gut microbiome and predicted metabolic pathways. | The metabolic pathways predicted from microbiota data showed large reductions in glycan biosynthesis and metabolism and biosynthetic capacity, disruptions in amino acid metabolism, increased susceptibility to infections, and many other system deficiencies that play a role in normal gut microbiota succession and maturation, as well as growth and development. infantile. |
| Hoban et al. 2019 | To evaluate the relationship between the type of enteral feeding in the NICU and weight, length, and head circumference (CP) in very low birth weight: | A retrospective cohort compared anthropometric data at six-time points from birth to 24 months in MBP infants who received formula supplements for preterm infants (n=160) versus fortified DM (n=161). | The type of feeding was not related to long-term growth. |

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| Japakasetr et al. 2016 | To evaluate the effectiveness of the post-discharge nutrition (PIN) program in premature infants to reduce post-discharge growth restriction in Thai premature infants of MBP. | Anda prospective non-randomized interventional cohort was conducted to assess the growth of 22 MBP premature babies who received the PIN program and compared them with 22 MBP premature babies who received nutrition services. Conventional. | The intervention infants had higher body weight and head circumference. In addition, a larger proportion of the intervention group regained their weight and head circumference to the standard. Enlistment in the PIN program, therefore, resulted in a significant reduction in post-discharge growth restriction in premature MBP infants. |
| Krishna et al. 2016 | It investigates changes in the associations between birth weight and height, a measure of physical development, over different stages of life and whether greater family wealth promotes better growth for children with low birth weight (LBW). | The cohort that used Young Lives longitudinal data, analyzing the associations between birth weight and physical growth; the differences between ages and family wealth for 3,999 children from Ethiopia, India, Peru, and Vietnam. | At 6–18 months, children with LBW had shorter stature. Over time, the gap between normal children and LBW has narrowed. Prenatal experiences are most evident in establishing the largest height deficits in the first year. Even among wealthier families, there was no recovery from height for children with LBW during the first year and no growth for these children in late childhood. |
| Lok et al. 2017 | To examine the effect of breast milk and formula feeding on the growth and short-term outcomes of premature babies in Hong Kong. | A retrospective single-center cohort study included 642 premature infants aged <37 weeks with birth weight <2,200 g. | Low birth weight infants fed breast milk had better growth z scores and lower high SGA status compared to those fed predominantly preterm formula. |
| Lv et al. 2019 | To evaluate a family-centered care intervention on the clinical outcomes of very low birth weight infants. | A quasi-experimental study was conducted in a Chinese NICU. The intervention included educating parents in basic care knowledge and skills, followed by active participation in care for at least 4 hours a day. | The weight of the babies at discharge was higher in the group of interventions. Nutritional outcomes improved significantly: breastfeeding rate; days of parental nutrition; gastric feeding. |
| Sinha et al. 2018 | To determine the risk of linear growth failure and the difference in linear growth velocity in LBW infants born to short mothers (<150 cm) compared to those born to mothers with height ≥150 cm during the first year of life. | This is an analysis of secondary data from a randomized controlled trial based on the 2,052 babies born in Delhi, India. | It found that babies born to short mothers were about twice as likely to stunt and lower length Z scores for age compared to babies to mothers with height ≥150 cm, at all ages of assessment. The linear growth rate was significantly lower in babies of low mothers, especially in the first 6 months of life. |
| Young et al. 2016 | To compare the effects of nutrient-enriched formula versus standard formula on the growth and development of premature babies after hospital discharge. | A systematic view that used the standard search strategy of the Cochrane Neonatal Review Group. | Trials (N = 11) that compared infant feeding with 'post-discharge formula' found no consistent evidence of effects on growth parameters up to 12 to 18 months after term. |

# 4 DISCUSSION

The results obtained in this systematic review showed that the main factors associated with the growth of children born with low weight are: diet, physiology of the child's organism, health care, and genetics. Each of these topics will be discussed below.

Feeding

In the studies eligible for this review that fall into this category, they discuss the relationship between feeding volume and its effects on the growth of babies born with low weight. Second, Abiramalatha *et al. (2021)*, a high-volume diet with fortified human milk or formula for preterm infants, as well as unfortified human milk or formula, improves weight gain during hospitalization, but this is not true for a hospital discharge context, in which there was no statistical relevance.

For the English literature, summarized in one of the studies selected for this review, daily feeding volumes should be increased in stable infants with no signs of food intolerance. However, there is also suggestive evidence that babies who are fed diluted formula with double volume (half the strength) may have reached an adequate energy intake earlier than those who received the formula without dilution (full force) (Basuki *et al*, 2019).

In addition to this, another unfavorable evidence for high-volume feeding was that of the study by Rana (2020). For the literature, each nutrient should be prescribed, both in the parenteral and enteral diet, in the recommended amounts according to weight, gestational age, clinical conditions, and laboratory evaluation of each baby (Brasil, 2012).

Another point that has been widely addressed is the supplementation of various nutrients in the feeding of BPN babies. The increase in the supply of amino acids during parenteral nutrition (PN) and proteins in enteral nutrition did not provide significant differences in growth parameters (Bellagamba et al, 2016). Like this study, another that did not show positive results in favor of improving the growth of children with low birth weight was that of Arun et al (2019), in which the weight gain of these babies was not altered with the addition of coconut oil to breast milk.

According to the Maria Cecilia Souto Vidigal Foundation (2021), Early Childhood First in the Multiannual Plan, micronutrient supplementation should be performed as needed, in addition to the World Health Organization, for adequate infant nutrition there should be micronutrient supplementation for the child, as needed. In addition, it is also known that babies born with low birth weight, have lower nutrient stores than normal, so for adequate growth of this population, there must be a substantial intake of protein, energy, calcium, phosphorus, and vitamin D, with enteral nutrition should be started as soon as possible at the same time as there is weaning to TPN (Czech- Kowalska. 2020). Macronutrient-fortified formula, cream supplementation, and fortified human milk formula have shown a positive effect on weight gain (Rana, 2020). In addition, the study by Banait et al (2020), reinforces that supplementation of specific nutrients should be done in premature babies of very low birth weight; whereas progressive enteral feeding

from the first day of life is recommended; fortification of breast milk with multi-nutrients can be initiated in babies with <1800 g; should receive vitamin D supplements at a dose ranging from 400 to 1000 IU / day; Oral iron supplements in a daily dose of 2 to 4 mg/kg of elemental iron are recommended. This same study points out that routine docosahexaenoic acid/long-chain polyunsaturated fatty acid supplementation and routine oral or intramuscular vitamin A supplementation are not recommended for this audience. However, for the Ministry of Health (2012), there may be a need for supplementation of long-chain fatty acids w–6 (arachidonic) and w–3 (docosahexaenoic), as well as vitamins, including A, orally, from the 1st week of the introduction of the enteral diet and throughout the 1st year of life.

It is also worth mentioning the importance of breastfeeding in the nutrition of babies born with low weight. It offers all the necessary nutrients for the full growth of children, especially LBW when offered immediately after birth until 6 months of life (WHO, 2018).

This review grouped studies that address breast milk feeding for LBWs, 2 of which strongly recommend this practice. In one, breast milk was responsible for better growth z-scores and lower PIG status at discharge compared to babies fed formula for preemies (Lok et al, 2017). On the other, breast milk is strongly recommended, being in tune with the current literature that clearly and incisively exposes the importance of breast milk in the adequate nutrition of children, exclusively until 6 months of life and complemented until 2 years of life (WHO, 2018). Breastfeeding is a globally adopted strategy that aims at the proper growth and development of children, especially those born with low weight (WHO, 2018).

Finally, an important mode of feeding for this population studied is the application of parenteral nutrition (TPN), in addition to the correct management for adequate enteral nutrition. According to the Ministry of Health (2012), intravenous feeding is indicated when metabolic and nutritional needs cannot be met through enteral feeding.

A study on TPN identified that there was no difference in anthropometric parameters regarding the technique used to apply this type of feeding, either by peripherally inserted central catheter (PICC) or through a plastic polyvinyl chloride (PVC) container.


Physiology

A very different and unique approach aimed to understand how the metabolic pathways of low birth weight babies were the same or different from full-term babies. The microbiota of BPNs had major reductions in glycan biosynthesis and metabolism and biosynthetic capacity, disruptions in amino acid metabolism, and other deficiencies of this system that play a considerable role in infant growth (Groer et al, 2020). For the International Union of Pure and Applied Chemistry (IUPAC), glycan is synonymous with polysaccharides which are by definition compounds consisting of a large number of monosaccharides joined by glycosidic bonds. These compounds, as well as glycoproteins (carbohydrates bound to proteins), are very important for the maintenance of biological processes, such as cell growth, which is necessary for linear and weight growth of children to occur (SCOTT et al, 2014). Ademais, according to the nutritionist

and 1st secretary of the Brazilian Society of Food and Nutrition, Dr. Rosana Farah Toimil, the intestinal microbiota is extremely relevant in the regulation of nutrient absorption and participation in the production of vitamins, being therefore essential for adequate anthropometric growth in any human being, especially in children born with low weight. Therefore, if there is a failure in this microbiota, as was the finding of the evidence above, there will be a failure in the growth process, which shows the need to pay attention to this item for the correct management of the feeding of LBWs.

## Health care

Two studies have addressed how interventions in society can influence the growth of babies born with low birth weights. One evidenced how the enlistment of these babies in a post-discharge nutritional care program resulted in body weight and greater head circumference, in addition to achieving a significant reduction in post-discharge growth restriction (Japakasetr et al, 2016). The other, on the other hand, explained how these nutritional results can be improved and enhanced with a multidisciplinary health team care centered on the family (Lv et al, 2019).

The Nurturing Care Framework (MNC) emphasizes the importance and focus on families for the monitoring and promotion of early childhood, with nutrition being one of the main axes of this stage of life. Therefore, this focus is also on promoting an adequate Family Health Strategy network for families and children. Finally, for there to be an improvement in the nutrition of children, especially those born with low demand, these programs must encourage and promote breastfeeding, as recommended by the World Health Organization (WHO), the United Nations Children's Fund (UNICEF) and the Ministry of Health, in addition to being offered by the State food systems that provide nutritious diets, safe, accessible and sustainable for all (UNICEF, 2019).

## Socioeconomic status

Environmental factors are the most relevant for child growth according to Romani *et al.* (2004). Among them, the socioeconomic question influences this outcome in several ways, since it is it that dictates the conditions and factors related to the household, the existence or not of basic sanitation, family income, quality of maternal education, maternal eating habits, access to prenatal care, among other factors of extreme relevance in the intrauterine and postnatal growth of these babies.

For Victora et al. (1986), the number of people per room directly influences the relationship between height/age deficit. In addition, for Sousa (1992), poor basic sanitation increases the chances of contracting infectious-parasitic diseases, thus interfering with the nutritional characteristics of mothers and children. In addition, the quantity and quality of prenatal care are also influenced by socioeconomic status. According to Osis *et al.* (1993), Almeida et al. 2005 and Rosa et al. (2014), higher schooling – mainly influenced by income – and higher income positively interfere with the amount of prenatal care performed.

Given this, the evidence reinforces the need for prenatal care in the appropriate quantity and with

the correct quality in the reduction of height deficits in the first year. In addition, it shows that even in wealthier families, there was no recovery of height for children with LBW during the first year and no growth for these children at the end of childhood, evidencing that LBW is a strong predictor of height during life (Krishna *et al.* 2016).

Genetics

According to Sinha *et al*. (2018), babies born to short mothers (<1.50 m) are 2 times more likely to have short stature and lower length Z scores for age. What's more, the linear growth rate is lower in babies of shorter mothers. This evidence corroborates the literature on the possible influences of genetic components on children's growth (Westwood *et al. 1983).* The short stature of fathers, especially mothers, indicates a great positive influence on height deficit among children, that is, mothers with short stature tend to have shorter children (Ashworth *et al.* 1997).

This systematic review had some limitations due to the difficulty of access to some studies that did not have free access. However, this study advances the synthesis of evidence on the factors that interfere with the growth of sciences born with low weight.

The growth of children born with low weight is an essential subject for health professionals who deal with the care of children from pregnancy to at least two years of age of the child, as the first 1000 days are of paramount importance for child growth and development.

**5 CONCLUSION**

And this study shows that diet, physiology, health care, socioeconomic status, and genetics are factors that influence the growth of children born with low weight until 2 years of life.

These results can support timely intervention actions aimed at promoting child health and preventing the prevention of injuries related to children's growth.

# REFERENCES

ABIRAMALATHA, Thangaraj *et al*. High versus standard volume enteral feeds to promote growth in preterm or low birth weight infants. **Cochrane Database Of Systematic Reviews**, v. 3, n. CD012413, 12 mar. 2021. Wiley. http://dx.doi.org/10.1002/14651858.cd012413.pub3

ALDAKAUSKIENÉ, Ilona *et al*. Influence of Parenteral Nutrition Delivery Techniques on Growth and Neurodevelopment of Very Low Birth Weight Newborns: a randomized trial. **Medicina**, Lituânia, v. 55, n. 4, p. 82, 28 mar. 2019. MDPI AG. http://dx.doi.org/10.3390/medicina55040082.

ALMEIDA, S.D.M; BARROS, M.B.A. Eqüidade e atenção à saúde da gestante em Campinas (SP), Brasil.Rev Panam Salud Publica. 2005;17(1):15–25.

ARUN, Sumitha *et al*. An Open-label Randomized Controlled Trial to Compare Weight Gain of Very Low Birth Weight Babies with or without Addition of Coconut Oil to Breast Milk. **Journal Of Tropical Pediatrics**, Índia, v. 65, n. 1, p. 63-70, 23 mar. 2018. Oxford University Press (OUP). http://dx.doi.org/10.1093/tropej/fmy012.

ASHWORTH, A.; MORRIS, S.S.; LIRA, P.I.C. Postnatal growth patterns of full-term low birth weight infants in Northeast Brazil are related to socioeconomic *status* J Nutr 1997; 127: 1950-6.

BANAIT, Nishanth *et al*. Feeding of Low Birth Weight Neonates. **Journal Of Neonatology,** Índia, v. 34, n. 1-2, p. 28-51, jun. 2020. SAGE Publications. http://dx.doi.org/10.1177/0973217920938522.

BASUKI, Fauziah *et al*. Dilute versus full-strength formula in exclusively formula-fed preterm or low birth weight infants. **Cochrane Database Of Systematic Reviews**, [S.L.], v. 6, n. 007263, p. 0-0, 27 jun. 2019. Wiley. http://dx.doi.org/10.1002/14651858.cd007263.pub3
BELLAGAMBA, Maria Paola *et al*. One Extra Gram of Protein to Preterm Infants From Birth to 1800 g. **Journal Of Pediatric Gastroenterology & Nutrition**, Itália, v. 62, n. 6, p. 879-884, jun. 2016. Ovid Technologies (Wolters Kluwer Health). http://dx.doi.org/10.1097/mpg.0000000000000989.

Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Ações Programáticas Estratégicas. Atenção à saúde do recém-nascido: guia para os profissionais de saúde / Ministério da Saúde, Secretaria de Atenção à Saúde, Departamento de Ações Programáticas Estratégicas. – 2. ed. – Brasília: Ministério da Saúde, 4 v., 2012

CZECH-KOWALSKA, Justyna *et al*. Mineral and nutritional requirements of preterm infant. **Seminars In Fetal And Neonatal Medicine**, Polônia, v. 25, n. 1, fev. 2020. Elsevier BV. http://dx.doi.org/10.1016/j.siny.2019.101071.

GROER, Maureen *et al*. Predicted Metabolic Pathway Distributions in Stool Bacteria in Very-Low-Birth-Weight Infants: potential relationships with nicu faltered growth. **Nutrients**, Usa, v. 12, n. 5, p. 1345, 8 maio 2020. MDPI AG. http://dx.doi.org/10.3390/nu12051345.

HOBAN, Rebecca *et al*. Impact of Donor Milk on Short- and Long-Term Growth of Very Low Birth Weight Infants**.** Nutrients, Usa, v. 11, n. 2, p. 241, 22 jan. 2019. MDPI AG. http://dx.doi.org/10.3390/nu11020241.

JAPAKASETR, Suchada *et al*. Implementation of a Nutrition Program Reduced Post-Discharge Growth Restriction in Thai Very Low Birth Weight Preterm Infants. **Nutrients**, Tailândia, v. 8, n. 12, p. 820, 17 dez. 2016. MDPI AG. http://dx.doi.org/10.3390/nu8120820.

KRISHNA, Aditi *et al*. Short- and long-run associations between birth weight and children's height. **Economics & Human Biology**, [S.L.], v. 21, p. 156-166, maio 2016. Elsevier BV. http://dx.doi.org/10.1016/j.ehb.2016.02.004.

LOK, Kris *et al*. Increase in Weight in Low Birth Weight and Very Low Birth Weight Infants Fed Fortified Breast Milk versus Formula Milk: a retrospective cohort study. **Nutrients**, Hong Kong, v. 9, n. 5, p. 520, 20 maio 2017. MDPI AG. http://dx.doi.org/10.3390/nu9050520.

LV, Bo *et al*. Family-Centered Care Improves Clinical Outcomes of Very-Low-Birth-Weight Infants: a quasi-experimental study. **Frontiers In Pediatrics**, China, v. 7, p. 0, 12 abr. 2019. Frontiers Media SA. http://dx.doi.org/10.3389/fped.2019.00138.

OSIS, Maria José Duarte *et al*. Fatores associados à assistência pré-natal entre mulheres de baixa renda no Estado de São Paulo, Brasil. **Revista de Saúde Pública**, [S.L.], v. 27, n. 1, p. 49-53, fev. 1993. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/s0034-89101993000100008.

RANA, Ritu *et al*. Feeding Interventions for Infants with Growth Failure in the First Six Months of Life: a systematic review. **Nutrients**, Reino Unido, v. 12, n. 7, p. 2044, 9 jul. 2020. MDPI AG. http://dx.doi.org/10.3390/nu12072044.

ROMANI, Sylvia de Azevedo Mello *et al*. Fatores determinantes do crescimento infantil. **Revista Brasileira de Saúde Materno Infantil**, [S.L.], v. 4, n. 1, p. 15-23, mar. 2004. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/s1519-38292004000100002

ROSA, C.Q. Factors associated with lack of prenatal care in a large municipality. **Revista de Saúde Pública**, [S.L.], v. 48, n. 6, p. 977-984, dez. 2014. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/s0034-8910.2014048005283

SINHA, B. Low-birthweight infants born to short-stature mothers are at additional risk of stunting and poor growth velocity: evidence from secondary data analyses. **Maternal & Child Nutrition**, [S.L.], v. 14, n. 1, p. 12504, 25 ago. 2017. Wiley. http://dx.doi.org/10.1111/mcn.12504.

Sousa FJPS. Pobreza, desnutrição e mortalidade infantil: condicionantes socioeconômicos. Fortaleza: UNICEF; 1992. Fundação Maria Cecilia Souto Vidigal. **Primeira Infância Primeiro No Plano Plurianual**: a primeira infância no contexto dos objetivos e indicadores de desenvolvimento sustentável (ODS) e do Nurturing Care. São Paulo: Fundação Maria Cecília Souto Vidigal, 2021. 50 p.

Fundo das Nações Unidas para a Infância (UNICEF). **Situação Mundial da Infância 2019**: Crianças, alimentação e nutrição - crescendo saudável em um mundo em transformação. Usa: Unicef Office Of Global Insight And Policy, 2019. 24 p. Disponível em: https://www.unicef.org/brazil/relatorios/situacao-mundial-da-infancia-2019-crianca-alimentacao-e-nutricao. Acesso em: 28 ago. 2021.

Fundo das Nações Unidas para a Infância (UNICEF). **Nurturing care for early childhood development**: a framework for helping children survive and thrive to transform health and human potential. Índia: Unicef, 2018. 64 p. Disponível em: https://www.unicef.org/india/reports/nurturing-care-early-childhood-development. Acesso em: 28 ago. 2021.

VICTORA, C.G.; FUCHS, S.C.; FLORES, J.A.C.; FONSECA, W.; KIRKWOOD, B. Risk factors for malnutrition in Brazilian children. The role of social and environmental variables. Bull World Health Organ 1986; 64: 299-309.

YOUNG, L. Nutrient-enriched formula versus standard formula for preterm infants following hospital discharge. **Cochrane Database Of Systematic Reviews**, Reino Unido, v12, n. CD004696 13 dez. 2016. Wiley. http://dx.doi.org/10.1002/14651858.cd004696.pub5.

WESTWOOD, M.; KRAMER, M.S.; MUNZ, D.; LOVETT, J.M.; WATTERS, G.V. Growth and development of full-term nonasphyxiated small-for-gestational-age newborns: follow-up through adolescence. Pediatrics 1983; 71: 376-82.