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Article

Risk Factors for Necrotizing Enterocolitis in Newborns Under 34 Weeks of Age in the Intensive Care Unit of the National Maternal Perinatal Institute, in the Period 2020–2022

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Abstract

The objective is to identify the risk factors associated with the development of necrotizing enterocolitis in newborns less than 34 weeks old in the INMP ICU during the period 2020-2022. The approach is basic, quantitative, non-experimental, and longitudinal, taking into account a total population of 20,371 newborns treated, but 7.95% of cases (1,620 patients) received an exclusive diagnosis of necrotizing enterocolitis (NEC). Information processing was carried out using the multiple linear regression model with NEC as the dependent variable. The results showed that in the INMP ICU, 7.95% of newborns treated were diagnosed exclusively with necrotizing enterocolitis (NEC). A multiple linear regression model was implemented using the stepwise technique, with NEC as the dependent variable and various independent variables, including maternal, neonatal, and other factors related to medical care. Several risk factors associated with the development of necrotizing enterocolitis in premature newborns under 34 weeks of age in the INMP ICU were identified. These include, among others, chorioamnionitis, neonatal sepsis, and age of occurrence. The presence of chorioamnionitis was shown to be a significant risk factor, with a 0.754-unit increase in the odds of NEC for each unit increase. Neonatal sepsis was also significantly associated with a 1.114-unit increase in the odds of NEC for each unit increase. Therefore, these findings underscore the importance of identifying and adequately managing the risk factors associated with necrotizing enterocolitis in neonatal care in the INMP ICU.

Keywords: risk factors; development of necrotizing enterocolitis; born before 34 weeks; JEL Z13

1. Introduction

Globally, the OMS [29] estimates that 15 million children are born prematurely due to risk factors that can be affected by complications [1]. Alsaied et al.[4] mention that 12% of births significantly influence a child's health, but with adequate medical care, mortality rates in premature newborns can be reduced. In addition, the OMS [29] estimates that the mortality rate in newborns is between 15% and 30%, with survivors prone to nosocomial infections, such as short bowel syndrome, growth retardation, bronchopulmonary dysplasia, and neurodevelopmental disorders [1].

In this regard, one of the most common diseases in newborns is necrotizing enterocolitis (NEC), which is defined as an inflammatory disease of the newborn's intestine. It is characterized by the invasion of a bacterium that damages the intestine, causing the intestinal walls to perforate and leading to a critical condition [2].

Due to these statistics, Risa et al. [31] state that Indonesia has recorded six million positive cases with a total of 155,000 deaths. However, the prevalence of COVID-19 has caused this statistic to increase at a rate of 4,000/5,000 per day. This association has led to an increase of 500 cases of infected women, where the development is based on an infection of the gastrointestinal tract in the newborn, with high neonatal morbidity and mortality .

In Egypt, the incidence of NEC is 9.6%, with a mortality rate of 20% to 30%, causing food intolerance and abnormal intestinal bacterial colonization [2]. For its part, NEC pathology has been linked to inflammatory involvement, abnormal flora, and intestinal hypersensitivity, which leads to increased intestinal epithelial permeability, as well as disruption of the intestinal mucosa in the transmembrane protein involved in the alteration, both in its environmental components and in systemic circulation [2]. The incidence of NEC in developed countries ranges from 5% to 12%. However, the prevalence is found in premature newborns with a gestational age of 35 weeks, but in late preterm infants, it is between 35 and 36 weeks of gestation, which is considered in children born weighing less than 1,500 grams [2]. At the regional level, Meister et al [27] note that in the United States, the prevalence of 37-week-old newborns requiring prolonged hospitalization due to NEC is 9.9%. In addition to food intolerance, these newborns may require surgery, which increases the mortality rate from 20% to 30%. The pathophysiology of NEC is multifactorial and includes chorioamnionitis and mechanical ventilation. Newborns weighing less than 1,500 grams account for 1% to 2% of births, and in South America, neonatal mortality ranges from 50% to 70%, and infant mortality from 20% to 40%. These authors have determined that risk factors can be classified as genetic predisposition, intestinal immaturity, and changes in microvascular tone (Meister et al [27]).

At the national level, the National Maternal Perinatal Institute [22] has a patient population of 1,407 births per month, with 40% of births by cesarean section and 10% of births premature.

Table 1. Indicators in the birth/abortion process.

Indicators	Figure	%	Prom. INMP
Average monthly births	1,407		1,507
Average daily births	46		50
Total, Vaginal Births	10,134	60.04	11,467
Total, of Caesareans	6,744	39.96	7,029
Total, births in the period	16,878	100.00	18,495
Births attended in Emergency	25	0.15	32
Abortions	1,146	6.79	1,530
Attended twin births	404	2.39	285
Attended births of triplets	12	0.07	0

Note. INMP.

According to the literature, the incidence of premature births is associated with various risk factors that have not yet been fully identified (OMS [29]).

At the international level, economic theories have created a series of economic models that have shaped political strategies aimed at reducing poverty. An example is Africa, where there is a direct relationship between income and poverty (52%), while in developed countries, this relationship is 10%.

Therefore, different States have found that the existence of exclusion and inequality has allowed for higher levels of poverty, generating underdeveloped economies (United Nations [UN], 2022). This commentary describes the problem of underdevelopment, whose relationship of indicators contrasts with the increasing number of poor people due to a progressive growth in inequality. Faced with this situation, theories emerge that indicate that levels of equity (income distribution) should help fill the gap through specific policy strategies.

For Kuznets (1955) (as cited in Fernández, 2018), inequality is a negative perspective on growth. In this sense, the lack of incentives for production has caused an increase in imports linked to human capital and business entrepreneurship.

In these cases, this inequality creates points of social instability, leading to a series of processes related to strikes, changes in government, demonstrations, among others.

This evidence is found primarily in the levels of violence and crime. Therefore, the concept of this acceleration model is found in growth plans defined under the concept of inclusion, also known as social inclusion. Various organizations propose this as follows:

The World Bank (WB, 2020) characterizes inclusion as the political aptitude responsible for integrating people into society through public mechanisms, which generate a series of positive expectations in a specific population. In turn, the UNESCO (2020) has defined it as equality of opportunity.

For its part, the United Nations (2020), in its tenth Sustainable Development Goal (SDG), mentions inequality of opportunity, proposing state policies that include social, economic, and political issues. The various proposed mechanisms are based on laws, policies, and measures.

Likewise, the UN (2020) also mentions that social inclusion is defined as the integration into society of people who may experience a certain level of poverty, a concept that must be observed in government policies aimed at reducing the risk of labor, educational, and cultural inequality.

On the other hand, the International Labor Organization (ILO, 2020) defines economic development as an essential condition for reducing poverty, based on regulations, laws, institutions, and practices.

Globally, according to the United Nations (2022), 30 years after the first graph of global income distribution, "the share of income received by the poorest 20% of the population remains less than 2%, while the share received by the richest 1% [is] 22%" (paragraph 3), under a scenario in which, since the 2008 financial crisis, the number of billionaires has multiplied due to rising inequality. Among the factors affecting this are a lower income share and a significant reduction in wages, given a situation in which advanced economies have been insufficient for financial markets, as is the case with automation and technological change. In Africa and Asia, the trends are more similar, with increases reaching fairly low levels. In Europe, an increase in inequality was recorded during the policy shift (UN, 2022).

An example is seen in the information from the World Bank (2020), which mentions that "sound financial systems are underpinned by economic growth and development, which is why the mission of the World Bank Group is to alleviate poverty and boost prosperity" (p. 1). While, in this context, different capital markets attract additional sources, such as projections to finance and provide financial stability, these actions create more jobs and expand productivity when it comes to investing and saving.

For this reason, the trust generated when investing provides sustainable banking systems and makes the flow of funds more productive, generating more revenue for the government and maintaining financial safety nets that accelerate payments safely. In this regard, the World Bank (2020) asserts that access to financing sources generates well-being for the population, as it offers a better alternative for opportunities and improves people's living standards. Likewise, the inclusion of people in the financial system has allowed for better management of consumption, payments, and savings, access to housing, healthcare, education, starting a small business, and using crisis insurance mechanisms.

Therefore, capital markets enable infrastructure financing in the communications (roads), energy (electricity), education (schools), health (hospitals), and housing sectors. In this context, the World Bank (2020) has created strategies that promote financial stability and diversified, efficient, and inclusive financial systems, which aim to curb global crises. In 2008, in light of the need to improve and expand standards regarding financial resilience, some groups, such as the G-20, offered some financial stability alternatives and sustainable financial development strategies that help through the United Nations.

Based on these strategies, the World Bank (2020) committed to addressing the need for one billion people to access a transaction account. Likewise, in 2014, a collateral registry was created to secure movable assets, requiring farmers and entrepreneurs to provide collateral to apply for loans. An example of this occurred in China in 2007, where nearly three and a half trillion dollars in resources were unlocked by launching an accounts receivable financing platform promoted by the People's Bank of China. This platform was adopted by 25,000 users and provided more than 6.7 billion dollars in loans secured by accounts receivable.

Similarly, the World Bank (2020) presents 64 macroeconomic indicators, among the most important being the analysis of domestic credit to the private sector (% of GDP) associated with inclusive banking, and inflation (GDP deflator, linked series, % annual) associated with the economic outlook.

2. Materials and Methods

Type and design of research

This research is framed within a basic approach, as it seeks to establish behavioral patterns related to the variables studied, specifically, the prevalence of necrotizing enterocolitis in newborns registered at the National Maternal and Perinatal Institute [22]. According to Hernández et al. (2014), the purpose of obtaining and compiling information is to build new knowledge, as is the case with the registry of clinical conditions of newborns [1]. The study was longitudinal in nature, which will require the creation of a database that allows for systematic collection of information over time, through the patients'

Various medical records.

Regarding the analysis, an associative analytical approach will be used to detect possible relationships between variables and assess the impact of certain behaviors, without directly intervening in them [1].

Population and Sample

According to the National Maternal and Perinatal Institute [22], of a total population of 20,371 newborns treated, 7.95% of cases (1,620 patients) were diagnosed exclusively with necrotizing enterocolitis (NEC). Therefore, inclusion and exclusion criteria have been established for the selection of the study sample:

Inclusion criteria:

Neonates born at the INMP during the 2020-2022 period with a gestational age of less than 34 weeks.

Exclusion criteria:

Patients referred from other hospitals.

Patients who died during the first week of life.

Patients with chromosomal abnormalities and/or major malformations.

Sample Size

Due to the large number of patients registered between 2020 and 2022, the finite population formula was used to determine the required sample size: $n = (N * Z^2 * p * q) / [(d^2 * (N - 1)) + (Z^2 * p * q)]$

Where:

N = population size (1620)

Z = confidence level (95%, 1.96)

p = probability of success or expected proportion (50%)

q = probability of failure (50%)

d = precision (maximum admissible error in terms of proportion) (10.2%)

The sample size calculation, given the population size, is:

$$n = (1620 * 1.96^2 * 0.5 * 0.5) / [(0.102^2 * (1620 - 1)) + (1.96^2 * 0.5 * 0.5)] = 93.3 = 94$$

Thus, 94 cases need to be reviewed with a 95% confidence level, a 50% probability of success (high level of uncertainty), and a precision of 10.2%.

Given the longitudinal nature of the data, probability sampling with a systematic technique and a fixed constant was used.

Technical Procedures and Data Collection Instruments

Structured and standardized surveys will be used for data collection to measure the main study variables, such as NEC prevalence, risk factors, and neonatal mortality. A probability sample of 94 cases will be used to achieve a significant representation of the study population, distributed among 47 control and observed cases.

Appropriate statistical techniques will be used for data processing and analysis, such as mean, mode, median, standard deviation, variance, and correlation between variables. In addition, trend graphs will be used to assess their evolution. A multiple linear regression analysis was performed,

which analyzed the relationship between the dependent and independent variables, and the stepwise technique was used to determine the prioritized factors. The software used for data analysis will be Microsoft Office Excel and IBM SPSS version 25, which are common tools in statistical research. Other software tools will also be considered if necessary. It is important to note that data processing and analysis will be carried out by researchers specialized in statistics and epidemiology to ensure the rigor and accuracy of the results obtained.

3. Results

Inferential Results.

For the second part of the inferential results, the multiple linear regression model was used as follows:

General Hypothesis Test

Hp. There are no risk factors associated with the development of necrotizing enterocolitis in premature infants born less than 34 weeks of gestation in the intensive care unit (ICU) of the National Maternal and Perinatal Institute [22] during the period between 2020 and 2022.

Ha. There are risk factors associated with the development of necrotizing enterocolitis in premature infants born less than 34 weeks of gestation in the intensive care unit (ICU) of the National Maternal and Perinatal Institute [22] during the period between 2020 and 2022.

To identify risk factors, the multiple regression model is applied, taking into account the stepwise technique. Maternal, neonatal, and other factors are considered, allowing for identification of any factors that influence this. When the adjusted R² is analyzed, it is shown that 93.4% of the variability analyzed as independent influences the variability of the data on the probability of NEC in newborns.

Table 2. Regression model.

Model	R	R ²	Adjusted R-Squared	Standard Error of the Estimate
	,976	,953	,934	,32275

However, when the ANOVA is analyzed in the model, it has been demonstrated that there is at least one of the factors that does affect the occurrence of NEC in newborns.

P alpha=0.05

Table 3. ANOVA.

Model	Sum of Squares	gl	Mean Square	F	Sig.
Regression	57,546	11	5,231	50,221	,000
Residue	2,813	27	,104		
Total	60,359	38			

Decisión. P value=0.05.

Conclusion. At 95% confidence, it is demonstrated that at least one of the risk factors contributes to the development of necrotizing enterocolitis in premature infants born less than 34 weeks gestation in the intensive care unit (ICU) of the National Maternal and Perinatal Institute [22] during the period 2020-2022.

P Alpha = 0.05

Table 4. Regression coefficient for maternal factors.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Desv. Error	Beta		
11 (Constant)	12,105	,999		12,111	,000
CORIOAMNIONITI	,754	,258	,161	2,922	,00

Decision. Hp is rejected.

Conclusions. At a 95% confidence level, it is shown that chorioamnionitis has influenced the incidence by 0.754 units if it increases by one unit.

Specific hypotheses.

Hp. There are no neonatal factors associated with the development of necrotizing enterocolitis in premature infants less than 34 weeks of gestation in the INMP ICU during the 2020-2022 period.

Ha. There are neonatal factors associated with the development of necrotizing enterocolitis in premature infants less than 34 weeks of gestation in the INMP ICU during the 2020-2022 period.

P Alpha = 0.05

Table 5. Regression coefficients for neonatal factors.

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Desv. Error	Beta		
(Constant)	12,105	,999		12,111	,000
SEPSIS	1,114	,169	,413	6,595	,000
Mechanical ventilation	-2,537	,300	-,450	-8,467	,000

Decision. P value = 0.00 < 0.05.

Conclusions. At 95% confidence, it is demonstrated that sepsis can increase the odds of developing NEC by 1,114 units when it increases by one unit. This means that sepsis is one of the reasons why it can influence the behavior of NEC versus odds.

Hp. The age at onset does not influence the development of necrotizing enterocolitis in premature infants with less than 34 weeks of gestation in the INMP ICU during the 2020-2022 period.

Ha. The age at onset influences the development of necrotizing enterocolitis in premature infants with less than 34 weeks of gestation in the INMP ICU during the 2020-2022 period.

P Alpha = 0.05

Table 6. Regression coefficient with respect to the age of occurrence.

Modelo	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Desv. Error	Beta		
(Constante)	12,105	,999		12,111	,000
Age at which NEC develops	,073	,011	,394	6,785	,000

Decisions. P value = 0.00 < 0.05. Hp is rejected.

Conclusions. At a 95% confidence level, it can be stated that the age at which NEC develops has a 0.073-unit influence, if it increases the probability of developing NEC by one unit. This means that the probability of developing NEC in newborns is 7.3%.

Hp. The severity of necrotizing enterocolitis in newborns under 34 weeks of age in the INMP ICU during the 2020-2022 period.

Hp. The severity of necrotizing enterocolitis in newborns under 34 weeks of age in the INMP ICU during the 2020-2022 period.

P alpha = 0.05

Table 7. Regression coefficient with respect to the degree of severity.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Desv. Error	Beta		
11 (Constant)	12,105	,999		12,111	,000
Developing age NEC	,073	,011	,394	6,785	,000

Decisions. P value = 0.00 < 0.05. Hp is rejected.

Conclusions. At a 95% confidence level, it can be stated that the age at which NEC develops has a 0.073-unit influence, if it increases the probability of developing NEC by one unit. This means that the probability of developing NEC in newborns is 7.3%.

Hp. The age at which enteral feeding begins influences the development of necrotizing enterocolitis in newborns younger than 34 weeks in the INMP ICU during the 2020-2022 period.

Ha. The age at which enteral feeding begins influences the development of necrotizing enterocolitis in newborns younger than 34 weeks in the INMP ICU during the 2020-2022 period.

P Alpha = 0.05

Table 8. Regression coefficient for the age of initiation of feeding.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Desv. Error	Beta		
11 (Constant)	12,105	,999		12,111	,000

Decisions. P value = 1.00 > 0.05. Hp is accepted.

Conclusions. At a 95% confidence level, it can be stated that the age at which whole-fat feeding begins does not influence the development of NEC.

Hp. The type of feeding influences the development of necrotizing enterocolitis in newborns under 34 weeks of age in the INMP ICU during the period 2020-2022.

Ha. The type of feeding influences the development of necrotizing enterocolitis in newborns under 34 weeks of age in the INMP ICU during the period 2020-2022.

P alpha = 0.05

Table 9. Regression coefficient for the type of diet.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Desv. Error	Beta		
(Constant)	12,105	,999		12,111	,000

Decisions. P value = 0.00 < 0.05. Hp is rejected.

Conclusions. At a 95% confidence level, it can be stated that the type of diet does not influence the development of NEC. According to the inferential results, the multiple linear regression model was used, as follows:

4. Discussion

The development of necrotizing enterocolitis (NEC) in premature neonates is a serious and multifactorial health problem that can have devastating consequences. Previous research has explored various factors associated with the incidence and severity of NEC, including maternal, neonatal, and other factors related to medical care and treatment.

The findings of Risa et al. [31] suggest that birth weight and the presence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) may be associated with an increased risk of NEC and higher neonatal mortality. These results highlight the importance of considering maternal and environmental conditions in assessing NEC risk in premature neonates.

Spinner et al. [33] and Haefeli et al. [17] found significant associations between the presence of congenital heart disease and NEC mortality in neonates, suggesting the importance of considering medical comorbidities in NEC risk assessment and clinical management.

Research by Ahmed et al. (2020) and Young and McGuire (2021) addressed aspects related to the treatment and feeding of premature neonates, highlighting the importance of appropriate enteral feeding strategies and minimizing the use of prolonged antibiotic therapy to reduce the risk of NEC.

Studies by Parvesh et al. (2020) and Eberhart et al. (2020) explored clinical and microbiological aspects related to NEC, focusing on early detection and effective disease management to improve clinical outcomes.

At the national level, studies by Vizcarra, Hinostroza, Limaymanta, Castillo, and Avalos provided relevant information on risk factors and complications associated with prematurity and NEC in specific contexts, highlighting the need to address these health issues in a comprehensive manner tailored to local conditions.

In summary, the discussion of the background and results provides a broad and up-to-date overview of the risk factors, epidemiology, and clinical implications of NEC in premature neonates. These findings are critical for guiding future research and improving the care and management of this serious condition in clinical practice.

A review of the background information provided reveals a variety of studies addressing different aspects of necrotizing enterocolitis (NEC) in neonates. For example, Risa et al. [31] focused on the association between severe acute respiratory syndrome (SARS-CoV-2) in pregnant women and infants with NEC, highlighting the importance of birth weight and other gestational factors in mortality in these cases.

Spinner et al. [33] investigated the prevalence and mortality of NEC in neonates with congenital heart disease, highlighting the importance of this comorbidity in disease progression. Ahmed et al. (2020) analyzed the relationship between prolonged antibiotic therapy and NEC prevalence, offering valuable insights into treatment practices that could influence disease progression.

Young and McGuire (2021) explored the effects of enteral feeding in premature infants at risk for NEC, highlighting the importance of feeding strategies in preventing this disease.

Haefeli et al. [17] examined risk factors in newborns with patent ductus arteriosus and their association with NEC, highlighting the need to consider other concurrent medical conditions.

Parvesh et al. (2020) investigated the detection of necrotic patches in resected intestines, revealing relevant aspects regarding the clinical outcomes and surgical management of NEC. Eberhart et al. (2020) studied the presence of NEC using fecal cultures, providing information on the intestinal microbiota in neonates affected by this disease.

Parvesh, et al. (2020). *Detection of necrotic patches in resected intestines: Clinical outcomes and surgical management of necrotizing enterocolitis*. [Nombre de la revista en cursiva], volumen, [páginas]. [https://doi.org/\[doi\]](https://doi.org/[doi])

Abou et al. (2021) evaluated the immunomodulatory effect of docosahexaenoic acid (DHA) in premature neonates, indicating potential therapeutic interventions to modulate the immune system and prevent complications such as NEC. Alsaied et al. (2020) conducted a meta-analysis on the incidence of NEC in low-birth-weight newborns, providing an overview of the prevalence of the disease in this population.

Backes et al. (2020) quantified the risk factors associated with mortality in extremely preterm newborns, underscoring the importance of identifying and appropriately managing these variables to improve clinical outcomes. Byun et al. (2020) examined risk factors for MRI and surgery in infants in the ICU, highlighting the relevance of preexisting conditions in the evolution of NEC.

Regarding the national context, the studies by Vizcarra, Hinostroza, Limaymanta, Castillo, and Avalos offer specific information on the epidemiology, risk factors, and interventions related to NEC in the local context. These studies complement international findings and provide a more complete view of the disease situation at the national level.

Compared to the results of the presented research, their specific focus on identifying risk factors associated with NEC in a population of premature newborns in a specific intensive care unit stands out. Using a quantitative design and a multiple linear regression model, several significant risk factors, such as chorioamnionitis and neonatal sepsis, were identified, along with their association with the likelihood of developing NEC. These findings add a more detailed understanding of the factors contributing to the development of the disease in this particular context, which can inform more effective prevention and management strategies in neonatal care.

5. Conclusions

1. Multiple regression analysis, with an adjusted R^2 of 93.4%, suggests that at least one of the identified risk factors (such as chorioamnionitis) influences the development of necrotizing enterocolitis (NEC) in premature infants under 34 weeks of age in the INMP ICU during the 2020-2022 period.
2. The null hypothesis was rejected, demonstrating that neonatal sepsis is associated with a significant increase in the odds of NEC of 1.114 units when the incidence increases by one unit. Therefore, special attention is recommended to prevent and control neonatal sepsis in these premature infants.
3. The age at which NEC develops was shown to have a significant influence on the odds of NEC of 0.073 units when the incidence increases by one unit. This suggests the importance of early surveillance and timely treatment to reduce the incidence of NEC in premature neonates.
4. The analysis concluded that the age at which enteral feeding begins does not have a significant effect on the development of NEC in these premature infants.
5. It was determined that the type of feeding does not influence the development of NEC in premature infants under 34 weeks of age in the INMP ICU during the 2020-2022 period.

6. Recommendations

1. Preventive measures and management protocols should be implemented to control chorioamnionitis during pregnancy and delivery, with the goal of reducing the risk of NEC in premature infants.
2. Rigorous surveillance and effective management of neonatal sepsis in the INMP ICU are recommended to minimize the risk of NEC in these premature infants.
3. Continuous surveillance of premature neonates and timely treatment are essential to reduce the incidence and severity of NEC.
4. Although no significant associations were found in this study, further research and evaluation of enteral feeding protocols and feeding type in relation to the development of NEC in premature infants is recommended.

References

1. Abiramalatha, P. (2020). *Early fortification of human milk versus late fortification to promote growth in preterm infants (Review)*. John Wiley & Sons, Ltd., India. <https://pubmed.ncbi.nlm.nih.gov/32726863/>
2. Abou, A., Abdel, A. F., y Ghaffar, S. (2021). *Impact of docosahexaenoic acid supplementation on proinflammatory cytokines release and the development of necrotizing enterocolitis in preterm neonates: A randomized controlled study*. King Saud: Faculty of Pharmaceutical Sciences & Pharmaceutical Industries. <https://pubmed.ncbi.nlm.nih.gov/34819793/>
3. Ahmed, S., O'Sullivan, N., y Miletin, J. (2020). *Pathogenesis of necrotising enterocolitis: The impact of the altered gut microbiota and antibiotic exposure in preterm infants*. Wiley, Dublin. <https://pubmed.ncbi.nlm.nih.gov/32876963/>
4. Alsaied, I., Islam, M., y Thalib, L. (2020). *Global incidence of necrotizing enterocolitis: A systematic review and meta-analysis*. College of Health Sciences, QU Health, Qatar. <https://pubmed.ncbi.nlm.nih.gov/32660457/>
5. Álvarez, L., Andino, M., y Arnúero, P. (2022). *Factores de riesgo asociados a mortalidad neonatal del servicio de neonatología*. Universidad Nacional Autónoma de Nicaragua, Nicaragua. <https://repositorio.unan.edu.ni/id/eprint/1481/1/40636.pdf>
6. Aválos, P. (2022). *Exposición prenatal a antibióticos como factor de riesgo para enterocolitis necrotizante en recién nacidos prematuros*. Universidad Privada Antenor Orrego, Trujillo. <https://repositorio.upao.edu.pe/item/69e87dea-745d-4e0e-94c2-6f47aabf1a0d>
7. Backes, C., Pavlek, L., Lindsey, M., Ball, Z. (2020). *Proactive neonatal treatment at 22 weeks of gestation: A systematic review and meta-analysis*. American Journal of Obstetrics, Iowa. https://about.nested-knowledge.com/?utm_term=systematic%20review&utm_campaign=Website%20traffic-Search-

- Systematic%20Review&utm_source=adwords&utm_medium=ppc&hsa_acc=3089868772&hsa_cam=15784721915&hsa_grp=140342092948&hsa_ad=572981843425&hsa_src=g&hsa_tgt=kwd-421273339853&hsa_kw=systematic%20review&hsa_mt=b&hsa_net=adwords&hsa_ver=3&gad_source=1&gad_campaignid=15784721915&gbraid=0AAAAABKY0Huy8jvsrwtRKPFPpRFHumVngy&gclid=EAIAIQobChMI0obNheqFkAMV7SRECB3SQxcREAAAYASAAEgIHwPD_BwE
8. Bühner, C., Fischer, B., y Wellmann, S. (2019). *Nutritional interventions to reduce rates of infection, necrotizing enterocolitis, and mortality in very preterm infants*. Pediatric Research Foundation, Berlin. <https://pubmed.ncbi.nlm.nih.gov/31645057/>
 9. Burge, D., Bergner, T., Gunasekaran, S., & Chaaban, H. (2020). *The role of glycosaminoglycans in protection from neonatal necrotizing enterocolitis: A narrative review*. University of Oklahoma Health Sciences Center, Oklahoma. <https://pubmed.ncbi.nlm.nih.gov/32093194/>
 10. Byun, H., Han, H.-B., Kee, H., Hee-Beom, H., Ham, S., Kim, J. (2020). *Risk factors of meconium-related ileus in very low birth weight infants: Patients-control study*. Scientific Reports, Korea. <https://www.nature.com/articles/s41598-020-60016-3>
 11. Calvert, J. (2020). *Necrotising enterocolitis: A 15-year outcome report from a UK specialist centre*. University of Liverpool, UK. <https://pubmed.ncbi.nlm.nih.gov/32740983/>
 12. Castillo, R. (2022). *Prematuridad y complicaciones*. Universidad Veracruzana, Veracruz. <https://repositorio.unan.edu.ni/id/eprint/1481/1/40636.pdf>
 13. Chávez, F. (1981). *Revista Peruana de Ginecología y Obstetricia*. <http://www.spog.org.pe/web/revista/index.php/RPGO/article/view/1582/1534>
 14. Eberhart, P., Grisold, M., Lavorato, D., Resech, M., Trobisch, K., y Resch, B. (2020). *Extended-spectrum beta-lactamase (ESBL) producing Enterobacterales in stool surveillance cultures of preterm infants are no risk factor for necrotizing enterocolitis: A retrospective case-control study over 12 years*. Medical University of Graz, Austria. <https://www.uptodate.com/contents/extended-spectrum-beta-lactamases>
 15. Garfinkle, Y., Alvaro, G., Nwaesei, C., Claveau, M., y Lee, H. (2018). *Trends in sex-specific differences in outcomes in extreme preterms: Progress or natural barriers?* The Canadian Neonatal Network Investigators, California. <https://pubmed.ncbi.nlm.nih.gov/31186268/>
 16. Garg, P. (2020). *Incomplete resection of necrotic bowel may increase mortality in infants with necrotizing enterocolitis*. International Pediatric Research Foundation, Miami. <https://pmc.ncbi.nlm.nih.gov/articles/PMC7679278/>
 17. Haefeli, S., Kordasz, M., Tsai, C., Hau, K., Klimek, L., Cholewa, D. (2020). *Risk factors for necrotizing enterocolitis in infants with patent arterial duct: Retrospective matched paired analysis*. Brief Research Report, Norway. <https://pubmed.ncbi.nlm.nih.gov/32411635/>
 18. Hakan, D., Demirezen, H., y Demir, S. (2020). *Developing necrotizing enterocolitis: Retrospective analysis of 1,428 preterm infants at a level-III neonatal intensive care unit over a four-year period*. Arch Argent Pediatr, Antalya. <https://pubmed.ncbi.nlm.nih.gov/33231048/>
 19. Hernández, R., Fernández, C., y Baptista, P. (2014). *Metodología de la investigación*. McGraw Hill, México. <https://www.esup.edu.pe/wp-content/uploads/2020/12/2.%20Hernandez,%20Fernandez%20y%20Baptista-metodolog%C3%ADa%20Investigacion%20Cientifica%206ta%20ed.pdf>
 20. Hinostroza, L. (2022). *Estudio clínico epidemiológico en recién nacidos prematuros menores de 1500 g*. UPLA, Huancayo. <https://repositorio.upla.edu.pe/handle/20.500.12848/4064>
 21. Huanacuni, R. (2022). *Prevalencia y resultados neonatales asociados a restricciones de crecimiento intrauterino*. Universidad Nacional Jorge Basadre, Tacna. https://alicia.concytec.gob.pe/vufind/Record/UNJB_8347d8ec54143ae372b59ee57590d4e8/Details
 22. Instituto Nacional Materno Perinatal. (2018). *Guías de práctica clínica y de procedimientos en obstetricia y perinatología*. Ministerio de Salud, Lima. <https://www.inmp.gob.pe/uploads/file/Revistas/Guias%20de%20Practica%20Clinica%20y%20de%20procedimientos%20en%20Obstetricia%20y%20Perinatologia%20del%202018.pdf>

23. Ixchel, C. (2022). *Eficacia de surfactante intratraqueal en la incidencia de displasia broncopulmonar*. Universidad Autónoma de Puebla, Puebla. <https://repositorioinstitucional.buap.mx/items/0d6f7822-6ccf-4500-aa8d-46d6d1ee969b>
24. Li, C., Sun, L., Liu, W., Wang, L., y Li, J. (2022). *Lactobacillus GG regulates the Wnt/ β -catenin pathway to reinforce intestinal barrier function and alleviate necrotizing enterocolitis*. *Journal of Functional Foods*, Shandong. <https://agris.fao.org/search/en/providers/122436/records/67597500c7a957febdf7568d>
25. Limaymanta, C. (2022). *Factores de riesgo relacionados a restricciones de crecimiento intrauterino en gestantes atendidas en el Hospital Félix Mayorca, Cerro de Pasco*. Universidad Nacional Daniel Alcides Carrión. <http://repositorio.undac.edu.pe/handle/undac/2560>
26. Ma, X., Yang, Y., Li, J., Zhang, K., y Kang, H. (2019). *Oropharyngeal colostrum therapy reduces the incidence of ventilator-associated pneumonia in very low birth weight infants: A systematic review and meta-analysis*. *Pediatric Research*, China. <https://pubmed.ncbi.nlm.nih.gov/32225172/>
27. Meister, M., Doheny, K., y Travagli, R. (2019). *Necrotizing enterocolitis: It's not all in the gut*. College of Medicine, USA. <https://pubmed.ncbi.nlm.nih.gov/31810384/>
28. Mendoza, J. (2022). *Factores asociados a enterocolitis necrotizante en recién nacidos prematuros del servicio de unidad de cuidados intensivos neonatal del Hospital Regional - Lambayeque enero-diciembre 2020*. Universidad Nacional Pedro Ruiz Gallo, Lambayeque. <https://repositorio.unprg.edu.pe/handle/20.500.12893/10567>
29. OMS (2020). *Carga mundial de morbilidad: África*. <https://iris.who.int/bitstream/handle/10665/338072/9789240011953-spa.pdf>
30. Patel, R., Ferguson, J., McElroy, S., Khashu, M., y Caplan, M. (2020). *Defining necrotizing enterocolitis: Current difficulties and future opportunities*. *Pediatric Research*, USA. <https://pubmed.ncbi.nlm.nih.gov/32855506/>
31. Risa, E., Kusumawardani, M., y Ugrasena, M. (2022). *Observational study on necrotizing enterocolitis in neonates born to SARS-CoV-2-positive mothers*. Elsevier, Indonesia. <https://www.sciencedirect.com/science/article/pii/S204908012200471X>
32. Scrivens, A., Kursell, T., y Disher, T. (2020). *Early treatment versus expectant management of hemodynamically significant patent ductus arteriosus for preterm infants*. John Wiley y Sons, Ltd., Sydney. <https://pubmed.ncbi.nlm.nih.gov/33301630/>
33. Spinner, J., Morris, K., Nandi, R., Costarino, A., Marino, B., Rossano, J. (2019). *Necrotizing enterocolitis and associated mortality in neonates with congenital heart disease: A multi-institutional study*. *Pediatric Critical Care Medicine*, Philadelphia. <https://pubmed.ncbi.nlm.nih.gov/31568264/>
34. Tobias, J., Olayasi, M., Laraway, K., Jordan, J., Dickinson, P., y Golzarri, M. (2021). *Bifidobacterium longum subsp. infantis EVC001 administration is associated with a significant reduction in incidence in very low birth weight infants*. *The Journal of Pediatrics*, Indiana. <https://pubmed.ncbi.nlm.nih.gov/35032555/>
35. Tollenaar, L., Slaghekke, L., Colmant, L., Lanna, M., Weingertner, R. (2020). *Spontaneous twin polycythemia sequence: Diagnosis, management and outcome in an international cohort*. *American Journal of Obstetrics*. <https://pubmed.ncbi.nlm.nih.gov/32730900/>
36. Velasco, P. (2022). *Uso de antibiótico empírica prolongada asociada a enterocolitis necrotizante en prematuros en el servicio de neonatología*. Trujillo. <https://dspace.unitru.edu.pe/items/4031e2b3-fa18-4764-a516-2e356bb8b027>
37. Williamson, L. (2020). *Heart attack and stroke symptoms* [Online]. American Heart Association. <https://www.heart.org/en/news/2020/09/03/lo-que-covid-19-le-hace-al-corazon-aun-despues-de-la-recuperacion>
38. Young, T., y McGuire, J. (2018). *Slow advancement of enteral feed volumes to prevent necrotizing enterocolitis in very low birth weight infants (Review)*. John Wiley y Sons, Ltd. <https://pubmed.ncbi.nlm.nih.gov/34427330/>
39. Zenga, L., Deng, L., y Guo, X. (2020). *Evaluation of parenteral nutrition-associated liver disease in surgical infants for necrotizing enterocolitis*. <https://pubmed.ncbi.nlm.nih.gov/31914027/>

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