DO CHILDREN UNDER 5 YEARS OLD STILL DIE FOR MALNUTRITION?

CRIANÇAS MENORES DE 5 ANOS AINDA MORREM POR DESNUTRIÇÃO?

¿NIÑOS MENORES DE 5 AÑOS TODAVÍA SE MUEREN POR DESNUTRICIÓN?

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ABSTRACT

Objective: to analyze the mortality trend due to malnutrition in children under 5 living in Brazil. **Method:** this is an ecological time-series study on mortality due to malnutrition in Brazilian children under five years of age, from 2003 to 2016. Data were collected in May 2018 through the Mortality Information System. Polynomial regression and trend analyzes were performed. The results are shown in tables and figures. **Results:** there was a decreasing mortality trend due to malnutrition in all regions of Brazil ($p < 0.001$). The North and Northeast regions had the highest mortality rates, while the South and Southeast regions had the lowest mortality rates. The highest indices were in the states of Mato Grosso do Sul, Alagoas and Pernambuco (2003-2007); Roraima, Amazonas and Acre (2008-2012 and 2013-2016). **Conclusion:** there was a downward trend in infant malnutrition in Brazil, but with regional differences, indicating the need to pay attention to the specificities of each region. **Descriptors:** Malnutrition; Infant Mortality; Public Policy; Child Nutrition Disorders; Child Health Services; Child Health.

RESUMO

Objetivo: buscou-se analisar a tendência da mortalidade por desnutrição em menores de 5 anos residentes no Brasil. **Método:** trata-se de estudo ecológico, de séries temporais, sobre mortalidade por desnutrição em crianças brasileiras menores de cinco anos, de 2003 a 2016. Coletaram-se os dados em maio de 2018 pelo Sistema de Informações sobre Mortalidade. Realizaram-se análises de tendência e regressão polinomial. Apresentam-se os resultados em tabelas e figura. **Resultados:** verificou-se tendência decrescente da mortalidade por desnutrição em todas as regiões do Brasil ($p < 0,001$). Averiguou-se que as regiões Norte e Nordeste apresentaram as maiores taxas de mortalidade, enquanto as regiões Sul e Sudeste as menores. Constatou-se que os maiores índices estaduais foram Mato Grosso do Sul, Alagoas e Pernambuco (2003-2007); Roraima, Amazonas e Acre (2008-2012 e 2013-2016). **Conclusão:** observou-se tendência decrescente da desnutrição infantil no Brasil, mas com diferenças regionais indicando a necessidade de atenção às especificidades de cada região. **Descritores:** Desnutrição; Mortalidade Infantil; Política Pública; Transtornos da Nutrição Infantil; Serviços de Saúde da Criança; Saúde da Criança.

RESUMEN

Objetivo: se buscó analizar la tendencia de la mortalidad por desnutrición en menores de 5 años residentes en Brasil. **Método:** se trata de un estudio ecológico, de series temporales, sobre mortalidad por desnutrición en niñas brasileiras menores de cinco años, de 2003 a 2016. Se recogieron los datos en mayo de 2018 por el Sistema de Informaciones sobre Mortalidad. Se realizaron análisis de tendencia y regresión polinomial. Los resultados se presentaron en tablas y figuras. **Resultados:** se verificó una tendencia decrescente de la mortalidad por desnutrición en todas las regiones de Brasil ($p < 0,001$). Se averiguó que las regiones Norte y Nordeste presentaron las mayores tasas de mortalidad, mientras las regiones Sur y Sudeste tuvieron las menores. Se constató que los mayores índices estaduales fueron Mato Grosso do Sul, Alagoas y Pernambuco (2003-2007); Roraima, Amazonas y Acre (2008-2012 y 2013-2016). **Conclusión:** se observó una tendencia decrescente de la desnutrición infantil en Brasil, pero con diferencias regionales indicando la necesidad de atención a las especificidades de cada región. **Descriptores:** Desnutrición; Mortalidad Infantil; Política Pública; Trastornos de la Nutrición del Niño; Servicios de Salud del Niño; Salud del Niño.

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How to cite this article

Rissi GP, Shibukawa BMC, Goes HLF, Oliveira RR de. Do children under 5 years old still die for malnutrition?. J Nurs UFPE on line. 2019;13:e23889 DOI: <https://doi.org/10.5205/1981-8963.2019.239889>

INTRODUCTION

Malnutrition is considered a serious public health problem, especially when the child population is the protagonist. Overall, malnutrition is estimated to be the leading cause of death in pre-school children¹, and accounts for almost half of all child deaths in the world.²

Around 80% of the world's undernourished children are distributed in 20 countries, of which India has the highest prevalence, corresponding to 54% of deaths of children under five due to malnutrition.³ In Latin America, about 9 million children under five years are malnourished. In addition, the same proportion of children are at high risk of malnutrition due to the socioeconomic situation.⁴

A study carried out in regions lacking emergency support found that 45% of child deaths in 2011 were directly related to malnutrition.⁵ This same study was revealed that malnutrition is likely responsible for up to 23% of infant mortality in refugee populations.⁵

In summary, malnutrition is the imbalance between the need for nutrients and the intake of nutrients, and there may be a lack, excess, or disproportion of certain nutrients in the organism, resulting in deficits in energy, protein, or micronutrients. This may be a result of metabolic deficiencies in which there is a decrease in nutrient absorption or of irregular consumption of nutrients.^{1,4,6}

The etiology of malnutrition is classified into three dimensions, which are immediate, underlying, and structural. The immediate causes are related to insufficient diet in quality and quantity and to some routine diseases of the pediatric period. The underlying factors are related to access to health services and basic sanitation conditions. Finally, the structural aspects are mainly associated with poverty.⁴

There are great risks related to the child's health when the issue is malnutrition, especially if the cultural and family context in which the child is exposed contributes to it.⁷ These risks include difficulty in growth and cognitive development, predisposition to diseases, delays in recovery, and, above all, a higher risk of mortality.^{1,5,8}

In this context, child malnutrition manifests several negative effects, with a great impact on the child's quality of life, directly affecting education and productivity and maintaining poverty and inequality.⁴

Therefore, public policies should prioritize the fight against child malnutrition because, although this subject has been approached for a long time, it needs a close look since it is, at the same time, a current public health problem.⁴

OBJECTIVE

- To analyze the mortality trend due to malnutrition in Brazilian children under five years old.

METHOD

This is an ecological, time-series study on mortality due to malnutrition in Brazilian children under five years of age from 2003 to 2016.

The study period is justified for analyzing the trend since the Zero Hunger Program, a public policy implemented in Brazil in January 2003, which aimed to ensure the population's accessibility to food, basic human rights, and fight against poverty.⁹ The year 2016 was the last year with data informed by the national platform, in which the data collection took place. The data were collected on May 2018.

For the collection, the Mortality Information System (SIM) was used, in which the geographical scope of Brazil was selected by regions and federation units. In the mortality option, the general population was selected. We included all deaths of children living in Brazil, aged under one year and from one to four years, between the period 2003 to 2016, whose basic cause of death as that found in Chapter IV of the 10th revision of the International Statistical Classification of Diseases and Health-Related Problems (ICD-10), in the grouping Malnutrition (E40 to E46), as available on the platform of the Department of Informatics of the Brazilian National Health System (Datasus).

Data from the Brazilian Institute of Geography and Statistics (IBGE) were also used for calculating malnutrition mortality rates to verify the population living in Brazil, whose mortality rates per 10,000 population were calculated for each macroregion and federation units. Regions and federation units' rates were grouped in quinquennia (2003-2007 and 2008-2012) and quadrennium (2013-2016) in order to provide a better visualization of the deaths in the aforementioned population.

Trend analysis was performed using polynomial regression modeling, considering the mortality rate as the dependent variable (y) and the years of study period as the independent variable (x). The "year" variable was centralized by the midpoint of the historical series and, afterwards, the simple linear regression models and the second and third order models were tested, when necessary. The most suitable model was considered as the one that presented residue without vices, statistical significance ($p < 0.05$) and better measure of precision (r^2), adopting the principle of parsimony. Statistical Package for the Social Sciences (SPSS®), version 20.0, was used for

the statistical analyzes and the results were presented in tables and figure.

The data analyzed in this study are in the public domain and are available on the Datasus website. Due to this, the study was exempted from ethical appreciation, under Official Letter No. 09/2018 of the Standing Committee on Ethics in Research Involving Humans (COPEP/UEM).

RESULTS

There were 9,028 deaths due to malnutrition in Brazilian children under five years of age. It was found that, in Brazil, mortality rates went from

1.0 deaths per 10 thousand inhabitants in 2003 to 0.2 in 2016.

The North and Northeast regions had the highest mortality rates of children aged under five due to malnutrition when compared to other regions of the country, 1.1 and 1.7 in 2003, respectively, to 0.6 and 0.3 in 2016. Also, when compared to the national rate, both regions presented higher values, corresponding to an increase of 0.1 and 0.7 in 2003 and 0.4 and 0.1 in 2016, respectively, in contrast to the South and Southeast regions (Figure 1).

Figure 1. Mortality rates due to malnutrition in children under five according to region. Brazil, 2003 to 2016.

The polynomial regression analysis showed that there was a decreasing trend in mortality rates for malnutrition in children under five years of age in all the major Brazilian regions, especially in the

North region, which had the highest average death rate due to malnutrition in the period (0.76), and the Northeast region, which had the highest mean reduction (-0.009 per year, $p < 0.001$) (Table 1).

Table 1. Trend models of mortality rates for malnutrition among children under five years of age. Brazil, 2003 to 2016.

	Model	r ²	p	Trend*
Brazil	0.39-0.05x	0.81	<0.001	↓
North	0.76-0.05x	0.87	<0.001	↓
Northeast	0.60-0.09x	0.81	<0.001	↓
Midwest	0.45-0.05x	0.71	0.001	↓
Southeast	0.17-0.02x	0.77	<0.001	↓
South	0.16-0.02x	0.81	<0.001	↓

*↓ Decreasing.

Although the trend is decreasing in all regions of Brazil, the North and Midwest regions did not show a decrease at the beginning of the studied period, declining only in 2006 and 2005, respectively. In the following years, these regions presented alternation between rise and decline in mortality rates.

The analysis of the data by federation units, separated in quinquennial and quadrennium, showed that in the period 2003-2007, the state that presented the highest mortality rate due to

malnutrition in children under five was Mato Grosso do Sul (10.1), corresponding to 222 children's deaths, followed by the state of Alagoas (10.0), with 353 deaths, and Pernambuco (7.9), with a total of 669 deaths due to malnutrition.

In the same quinquennium, the states that showed the lowest mortality rate in this period were the Federal District, São Paulo and Santa Catarina, corresponding to 0.8 (17), 1.1 (374) and 1.3 (59) deaths per 10,000 inhabitants, respectively (Table 2).

Table 2. Mortality due to malnutrition in children under five according to federation units.

Brazil, 2003 to 2016.

	2003 to 2007		2008 to 2012		2013 to 2016	
	n	Rate	n	Rate	n	Rate
North	924	5.1	553	3.1	379	2.3
Rondônia	49	3.0	25	1.6	8	0.6
Acre	59	6.6	41	4.6	52	6.0
Amazonas	259	6.2	203	4.9	130	3.2
Roraima	34	6.3	31	5.8	36	7.1
Pará	429	5.1	206	2.5	122	1.6
Amapá	14	1.7	15	1.8	12	1.5
Tocantins	80	5.4	32	2.3	19	1.4
Northeast	2881	5.4	984	2.0	513	1.1
Maranhão	406	5.3	183	2.5	103	1.5
Piauí	103	3.2	47	1.6	32	1.2
Ceará	261	3.1	77	1.0	36	0.5
Rio Grande do Norte	164	5.5	62	2.2	36	1.4
Paraíba	167	4.7	52	1.5	35	1.1
Pernambuco	669	7.9	183	2.3	79	1.1
Alagoas	353	10.0	102	3.1	48	1.6
Sergipe	141	6.7	48	2.5	16	0.9
Bahia	617	4.5	230	1.8	128	1.1
Midwest	436	3.6	183	1.6	125	1.1
Mato Grosso do Sul	222	10.1	45	2.1	32	1.5
Mato Grosso	122	4.4	104	3.8	69	2.7
Goiás	75	1.5	24	0.5	22	0.5
Distrito Federal	17	0.8	10	0.5	2	0.1
Southeast	992	1.5	360	0.6	200	0.4
Minas Gerais	358	2.2	132	0.9	64	0.5
Espírito Santo	82	2.7	18	0.6	10	0.4
Rio de Janeiro	178	1.5	76	0.7	37	0.4
São Paulo	374	1.1	134	0.4	89	0.3
South	338	1.6	109	0.5	51	0.3
Paraná	156	1.8	49	0.6	29	0.4
Santa Catarina	59	1.3	28	0.6	12	0.3
Rio Grande do Sul	123	1.5	32	0.4	10	0.1

A decline in the mortality rate due to malnutrition in the five-year period 2008-2012 was observed, with the highest rates being in Roraima (5.8), with a total of 31 deaths, followed by the Amazon (4.9), with 203 deaths, and Acre (4.6), with 41 deaths. It was found, in this period, that the lowest rates were represented by São Paulo and Rio Grande do Sul (0.4), corresponding to 134 and 32 deaths, respectively.

The analysis of the following four years revealed that the Federal District and Rio Grande do Sul presented the least expressive rates (0.1), corresponding in due order, to two and 10 deaths due to malnutrition in children under five years of age. The states of Roraima, Acre, and Amazonas led, once again, the highest mortality rates, equivalent to 7.1 (36), 6.0 (52), and 3.2 (130), respectively. All states with the highest rates belong to the North region (Table 2).

DISCUSSION

Mortality due to malnutrition in children under five years in the period from 2003 to 2016 presented a decline throughout the Brazilian scenario. However, there are regional differences, with the highest rates concentrating in the North and Northeast regions, which ratifies other studies with similar results.¹⁰⁻²

A study conducted in India confirms the results found, as it states that mortality due to malnutrition in pre-school children has declined in recent years.^{3,13} However, although malnutrition has been largely reduced in recent years, it remains among the main factors of morbidity and mortality in children under five years of age worldwide, especially in African countries.¹⁴⁻⁵

In Brazil, there has been great progress in the child's nutritional situation, with a decline of more than one-fourth in the indicators of height-for-age deficit in children under five, which reflected the prior fulfillment of the first millennium goal of eradicating poverty and hunger. However, child malnutrition still remains an obstacle in health services in the Northern region, demarcating the interregional and social inequalities present in the country.¹⁰

In a national level, the North region is responsible for the highest mortality rates due to malnutrition in children under five, presenting double the national average rate and slow regression in mortality when compared to the Northeast region, which evidences improvements concerning infant nutrition.¹¹⁻²

Difficulties with transportation, the constancy of negative socioeconomic indicators, and the

great concentration of the national indigenous population are possible factors contributing to the high mortality rates in children under five due to malnutrition in the Northern region of the country.¹⁰

The state of Acre presents a marked difference in the prevalence of malnutrition in relation to Latin America, to the Brazilian scenario, and even to the North region. It has similar indices to those registered more than 30 years ago in the country, representing a significant delay when compared to the national context.¹⁰

Several factors may be related to the high mortality rate in the state of Amazonia, such as the geographical and populational situation, which significantly influence the development of this territory.¹⁰

Although the state of Alagoas had a high mortality rate of children under five due to malnutrition in the five-year period 2003-2007, it showed a significant decline in rates for the following years, which may possibly be justified by the drop in indicators of poverty and income inequality in the state.¹²

Mato Grosso do Sul had the highest infant mortality rate due to malnutrition in the period 2003-2007. However, a study in that state found that children enrolled in the Bolsa Família Program (PBF), which aims to promote the immediate relief of poverty, showed a higher prevalence of low weight in regions with high levels of income inequality, and the most predominant regions were the wetlands.¹⁶

The South and Southeast regions contrast to this scenario, since they have low malnutrition rates, as well as the country's lowest poverty rates.¹¹ Only the South, Southeast, and Midwest regions showed a reduction in the growth of poverty and partiality in income distribution in recent years.¹⁷

Regardless of interregional diversities, Brazil has been facing an economic crisis since 2015. This has favored an increase in poverty and fiscal austerity, resulting in a reduction of the expenses with programs of social assistance, which presumably impacts on health inequalities and infant mortality.¹⁸

In view of the above, the importance of income transfer programs should be considered, given the resources allocated to food and health care that they provide due to their conditionalities, since they influence the nutritional status of the infant population.¹¹

Among these programs, there is the Zero Hunger Program (PFZ), which was implemented in January 2003 and was aimed mainly at fighting hunger, malnutrition, and poverty. In October of the same year, the PFZ was replaced by the PBF, which was incorporated into the Ministry of Social Development (MDS), created in 2004 with the

purpose of improving the management and clarifying the public benefited, substituting and concentrating all public policies aimed at this purpose.¹⁹⁻²⁰

Public policies, especially the PBF, are considered to be decisive in reducing social inequality and poverty. The rapid growth and coverage of the families benefiting from the program are indicative of this reduction.²⁰

The results of this study suggest that the reduction of mortality of children aged under five due to malnutrition may be linked to the creation and implementation of such social protection programs. Therefore, it becomes essential to invest and strengthen policies that address this serious public health problem.

CONCLUSION

Infant malnutrition presented a downward trend in all regions of Brazil in recent years. However, some regions of the country, especially the North and Northeast regions, still have high mortality rates due to malnutrition in children under five years of age, signaling the need for intensification of measures to reduce it.

In this sense, government programs to combat hunger and poverty have shown a positive impact in reducing child mortality due to malnutrition. However, it is important to combat this paradigm through public policies aimed at comprehensive care to this vulnerable population.

This study has some limitations related to the existence of the challenges to be overcome regarding the quality of information available in secondary databases. However, information systems are essential tools for understanding the health limitations of the population, since they allow the realization of studies of national scope in a country with continental dimensions.

FINANCING

This work was carried out with the support of the Coordination of Improvement of Higher Education Personnel - Brazil (CAPES) - Financing Code 001.

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Submission: 2018/02/21

Accepted: 2019/04/09

Publishing: 2019/06/06

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