

# Nutritional status of children under five years of age in *Rondônia*, Brazil Northern region and in Brazil: 2008 to 2019

## *Estado nutricional das crianças menores de cinco anos em Rondônia, região Norte e Brasil: 2008 a 2019*

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### ABSTRACT

#### Objective

To describe the nutritional profiles of children under five years of age in the state of *Rondônia*, comparing them with those from the Northern Region of Brazil and from Brazil.

#### Methods

This was a time series ecological study. Data were collected from the Food and Nutrition Surveillance System. The information concerned Body Mass Index by age, gender and place of residence. A time-trend analysis was performed

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using linear regression applying the Prais-Winsten technique and serial autocorrelation verification using the Durbin and Watson test in Stata®16.0.

## Results

There was an annual increasing trend for the thinness, risk of overweight, overweight and obesity regardless of gender, age and location and for extreme thinness, with the exception of girls and for the age of 2 to 5 years, which revealed a stationary trend. Among boys and children of both genders under two years of age, annual growth trends were higher for non-eutrophic nutritional status when compared to the other groups. The growth rates of nutritional disorders found in the Northern region were higher than in the state of *Rondônia* and in Brazil.

## Conclusion

It is necessary to review health policies aiming at the promotion and prevention of nutritional problems considering the current situation where extreme conditions such as thinness and obesity coexist, with special attention to male children under 2 years of age.

**Keywords:** Child. Nutritional status. Nutritional surveillance. Time series studies.

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## RESUMO

### Objetivo

*Descrever o perfil nutricional de crianças menores de cinco anos no estado de Rondônia comparando com dados da Região Norte e do Brasil.*

### Métodos

*Estudo ecológico do tipo série temporal. Os dados foram coletados do Sistema de Vigilância Alimentar e Nutricional e utilizou-se o Índice de Massa Corporal por idade, sexo e local de moradia. Foi realizada análise de tendência temporal por meio de regressão linear aplicando a técnica de Prais-Winsten e verificação de autocorrelação serial por meio do teste de Durbin e Watson no Stata®16.0.*

### Resultados

*Houve tendência anual crescente para a magreza, risco de sobrepeso, sobrepeso e obesidade independente do sexo, idade e local, e para a magreza extrema com exceção das meninas e para a idade de dois a cinco anos, que tiveram tendência estacionária. Entre os meninos e crianças menores de dois anos, as tendências de crescimento foram mais elevadas para o estado nutricional não eutrófico quando comparado aos outros grupos. As taxas de crescimento de agravos nutricionais encontradas na região Norte foram superiores ao estado de Rondônia e ao Brasil.*

### Conclusão

*É necessário rever as políticas de saúde visando a promoção e prevenção de agravos nutricionais considerando a atualidade e onde coabitam extremos como a magreza e obesidade, com atenção especial às crianças com menos de dois anos e do sexo masculino.*

**Palavras-chave:** Criança. Estado nutricional. Vigilância nutricional. Estudos de séries temporais.

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## INTRODUCTION

In Brazil, despite an 87% reduction in infant deaths due to malnutrition between the years 1990 and 2015, the struggle against malnutrition did not occur homogeneously. The levels of child malnutrition remained high in the populations with lower purchasing power, occupying the ninth rank among the ten main causes of death in the North and Northeast regions [1]. However, the coexistence of overweight and nutritional deficits appears as an aggravating factor in the national scenario, which has been a cause of concern and challenge for professionals and researchers in the health area [2,3].

A country's child nutritional status is an excellent indicator of the population's health conditions and quality of life [4]. A relevant point regarding the verification of nutritional deviations in childhood refers to the emergence of harmful effects on growth and development and the risk of its extension into adulthood,

contributing as a risk factor for chronic diseases [3]. Therefore, the early diagnosis of these deviations allows adequate interventions and the prevention of complications.

In Brazil, the *Sistema de Vigilância Alimentar e Nutricional* (SISVAN, Food and Nutrition Surveillance System) provides information to monitor the nutritional status and food consumption of individuals served by the Health Care Establishments, Family Health Strategy and beneficiaries of the *Bolsa Família* Program [5]. The data available in SISVAN are valuable for monitoring the food and nutritional profile of the population, but those data are underused and there are few studies aimed at elucidating the evolution, characteristics, implications and determining factors of the nutritional problems that affect the population [6].

In a literature review, only three studies were identified with SISVAN data or on the anthropometric profile of children in the Northern region of Brazil [6-8]. The state of *Rondônia* has a population composed of immigrants from all regions of the country who came to *Rondônia* mainly in the 1970s to occupy the land, in addition to local people such as indigenous and riverbank dwellers, thus making the *Rondônia* population one of the most diverse in Brazil. In addition to population diversity, the state faces problems in accessing health services, as the capital of *Rondônia*, *Porto Velho*, is the municipality with the largest geographic extension in Brazil and many rural communities in the state can only be accessed by river. The sociodemographic challenges faced by the population of Northern Brazil, including the State of *Rondônia*, have a direct impact on children nutritional status. The *Estudo Nacional de Alimentação e Nutrição Infantil* (ENANI-2019, National Survey of Food and Child Nutrition) evaluated 14,558 children and found that the prevalence of minimal feeding in the North region was the lowest compared to other regions, including the consumption of foods rich in iron as well as high prevalence of non-consumption of fruits and vegetables [9].

Considering the sociodemographic differences and the differences in the access to basic services existing in the State of *Rondônia*, the objective of this study was to describe the nutritional profile of children under five years of age in the State of *Rondônia* comparing their data with data from the North Region of Brazil and from Brazil.

## METHODS

This is an ecological time series study that allows verifying the development of the disease distribution evolution in the population with the purpose of planning actions capable of improving the current scenario [10].

Data were collected from the SISVAN, through the website <<http://sisaps.saude.gov.br/sisvan/>>, in December 2020 and refer to the period 2008 to 2019. The year 2020 was not included in the review, due to the Covid-19 pandemic, which significantly altered nutritional surveillance actions in health services, which could cause an important bias in the analysis of the series.

The State of *Rondônia* is located in the Northern Region of Brazil and is composed of 52 municipalities with an estimated population of 1,796,460 inhabitants in 2020 [11]. About 73% of the state's population resides in urban areas; the Human Development Index in 2020 was 0.756 and infant mortality was 22.4 per thousand Live Births (LB), slightly above the national average (22/1,000 LB). In May 2020, the territorial coverage of the Family Health Strategy was 68.93% [12].

To assess the nutritional profile of children under five years of age, the Body Mass Index (BMI) for age collected from SISVAN was used. This parameter considers the body mass (in kilograms) divided by the square of height (in meters), taking as a reference the cutoff points of the World Health Organization, used by SISVAN considering the critical values – extreme thinness (<0.1 percentile; <z-score -3), thinness ( $\geq 0.1$

percentile and <3 percentile;  $\geq z$ -score -3 and  $\leq z$ -score -2), risk of overweight (>85th percentile and  $\leq 97$ th percentile;  $\geq z$ -score +1 and  $\leq z$ -score +2), overweight (>97th percentile and  $\leq 99.9$ th percentile;  $> z$ -score +2 and  $\leq z$ -score +3) and obesity (>percentile 99.9;  $> z$ -score +3)[5]. Information on the population was obtained from the *Instituto Brasileiro de Geografia e Estatística* (Brazilian Institute of Geography and Statistics) based on censuses and projections for the period under review [11].

Coverage rates were calculated by dividing the number of individuals who have a nutritional status record in SISVAN by the population of resident children according to the assessed category and the result was multiplied by 100. The BMI classification rates was obtained by dividing the number of individuals classified in the SISVAN by the population of resident children according to the assessed category and the result was multiplied by 1,000 [6]. The average rate for the period was calculated considering the year-to-year rate and then the average of the results and the population Standard Deviation (SD) were calculated. In order to characterize the children's profile, nutritional profile data were generated in SISVAN in an Excel® form taking into account gender, age group and location per year. Other variables available in the system, such as skin color, were not included in this study due to missing data, a fact that would jeopardize the results of the study.

For the time-trend analysis, the rate of increase was estimated, defined as stationary, decreasing or increasing according to 95% confidence intervals (95% CI). Linear regression was performed using the Prais-Winsten technique, after verification of serial autocorrelation using the Durbin and Watson test [10]. The analyses were performed using the statistical package Stata® 16.0. This study is linked to the matrix research project entitled "Evaluation of Child Health Care in Porto Velho-RO", which was submitted to the Research Ethics Committee of the Federal University of *Rondônia*, and was approved under CAAE n° 58744716.5.0000.5300.

## RESULTS

In the first years evaluated, the coverage rate of nutritional information in the State of *Rondônia* was close to the rate in the North and national regions. As of 2013, the coverage rate of *Rondônia* continued to increase, but it did not proportionally follow the growth of Brazil and of Brazil Northern region (Table 1).

**Table 1** – Nutritional information coverage rate of SISVAN among children under five years of age in *Rondônia* in the Northern region and in Brazil, 2008 to 2019.

Years	<i>Rondônia</i>	North of Brazil	Brazil
	%		
2008	12.87	13.02	13.19
2009	15.35	15.40	17.06
2010	17.54	20.71	21.19
2011	15.04	18.94	20.74
2012	19.46	19.37	20.50
2013	20.36	29.07	27.67
2014	20.50	33.53	28.70
2015	24.05	36.82	31.47
2016	26.26	38.59	32.81
2017	25.42	39.92	32.45
2018	24.22	42.05	34.16
2019	22.94	41.68	33.40
M	20.33	29.09	26.11
SD	4.22	10.51	6.92

Source: Instituto Brasileiro de Geografia e Estatística [11], Secretaria de Atenção Primária à Saúde [12].

Note: M: Mean; SD: Standard Deviation.

The average rate of extreme thinness and thinness was higher among girls, among children aged 2 to 5 years and the average rate of *Rondônia* was lower than that found in Brazil and in Brazil Northern region (Table 2). The North region with rates that approached 10 per 1,000 children and Brazil with an average rate of extreme thinness of 11.14 per 1,000 children (SD=1.56) stand out.

**Table 2** – Rate for the classification of extreme thinness and thinness per 1,000 children under five years of age in *Rondônia*, in the Northern region of Brazil and in Brazil, 2008 to 2019.

Years	Male	Female	<2 years	2 to 5 years	<i>Rondônia</i>	North	Brazil
Extreme thinness (%)							
2008	5.14	5.10	2.22	6.96	5.12	6.00	5.97
2009	6.49	5.35	3.16	7.70	5.94	6.59	7.30
2010	7.40	6.60	3.97	8.95	7.01	8.95	9.22
2011	5.74	7.58	2.58	9.27	6.64	7.75	8.45
2012	6.72	9.56	4.87	10.23	8.11	7.36	7.86
2013	6.44	8.00	4.08	9.28	7.20	11.70	10.66
2014	6.72	8.29	4.53	9.52	7.49	12.47	10.83
2015	7.56	7.08	5.42	8.65	7.32	11.84	9.77
2016	8.59	8.41	7.38	9.27	8.51	13.51	11.07
2017	8.42	7.72	7.63	8.38	8.08	12.36	9.73
2018	7.01	6.62	5.64	7.62	6.82	11.19	9.36
2019	8.82	8.68	7.00	9.93	8.75	14.92	11.14
M	7.09	7.42	4.87	8.81	7.25	10.39	11.14
SD	1.08	1.27	1.73	0.95	1.01	2.81	1.56
Thinness (%)							
2008	4.78	4.84	1.58	6.86	4.81	4.83	4.49
2009	5.14	5.56	2.07	7.43	5.35	5.49	5.66
2010	6.57	6.63	2.91	8.97	6.60	7.70	7.23
2011	5.05	6.69	1.52	8.65	5.85	6.93	6.81
2012	6.64	9.82	3.56	11.23	8.20	7.13	6.69
2013	6.29	9.12	3.22	10.65	7.67	10.42	8.86
2014	5.93	8.32	3.31	9.69	7.10	11.24	9.04
2015	7.83	8.67	5.10	10.43	8.24	12.75	9.65
2016	7.76	8.65	6.61	9.29	8.20	12.78	10.05
2017	8.73	8.98	6.07	10.72	8.85	14.35	9.95
2018	8.30	8.17	5.60	10.01	8.24	12.67	9.85
2019	9.52	9.24	7.11	10.92	9.38	16.67	11.90
M	6.88	7.89	4.06	9.57	7.37	10.25	8.35
SD	1.48	1.51	1.89	1.33	1.38	3.61	2.07

Source: Instituto Brasileiro de Geografia e Estatística [11], Secretaria de Atenção Primária à Saúde [12].

Note: M: Mean; SD: Standard Deviation.

Regarding the risk of overweight, the average rate in the period reviewed was also higher among girls and children aged 2 to 5 years. In *Rondônia*, the average rate was lower than in the North (49.51 per 1,000 children) and lower than Brazil (47.70 per 1,000 children; Table 3). Regarding overweight, the average rate of boys and girls was approximately 14 per 1,000 children. *Rondônia* remains with the lowest annual rate when compared to the data of Brazil and to the northern region. Regarding obesity, boys had a higher mean rate (14.04 per 1,000 boys/SD=3.05) and children aged 2 to 5 years had a higher mean rate when compared to children under 2 years of age. Brazil and the northern region had an average rate of approximately 20 per 1,000 children higher than the rate found in *Rondônia* (13.54; SD=2.62).

**Table 3** – Rate for classification of overweight risk, overweight and obesity per 1,000 children under five years of age in *Rondônia* in the Northern region of Brazil and in Brazil, 2008 to 2019.

Years	Male	Female	<2 years	2 to 5 years	<i>Rondônia</i>	North	Brazil
Overweight risk (%)							
2008	21.62	19.17	9.56	27.33	20.42	21.15	23.29
2009	24.05	23.49	13.36	30.41	23.78	25.56	30.68
2010	28.66	26.66	16.42	34.91	27.68	34.56	37.94
2011	20.79	25.27	9.87	31.46	22.98	32.91	37.76
2012	25.78	36.55	20.21	38.14	31.04	31.67	36.75
2013	30.65	37.95	24.52	40.71	34.21	48.92	50.62
2014	31.93	36.13	23.75	40.97	33.98	58.81	53.03
2015	38.48	41.59	35.20	43.35	40.00	65.48	59.32
2016	46.95	43.61	46.25	44.68	45.32	65.76	60.14
2017	44.64	40.73	38.24	45.74	42.73	69.03	60.85
2018	44.74	42.81	37.77	47.87	43.80	75.79	65.08
2019	37.40	36.24	32.65	39.68	36.83	64.43	56.98
M	32.97	34.18	25.65	38.77	33.56	49.51	47.70
SD	8.91	7.98	11.72	6.23	8.17	18.47	13.19
Overweight (%)							
2008	8.59	7.38	4.88	9.98	8.00	8.80	10.33
2009	10.79	9.33	7.12	11.95	10.07	10.85	13.84
2010	12.49	10.24	8.79	13.06	11.39	14.32	17.41
2011	8.55	11.32	5.42	12.80	9.90	13.01	17.23
2012	11.36	16.51	10.53	16.07	13.88	13.39	16.61
2013	13.22	16.76	11.44	17.30	14.95	22.35	23.71
2014	13.89	15.18	11.78	16.39	14.52	26.30	25.23
2015	20.45	18.34	18.85	19.81	19.42	28.25	27.82
2016	19.46	18.01	20.24	17.73	18.75	30.35	27.93
2017	21.06	19.88	19.30	21.28	20.48	30.93	28.26
2018	19.58	18.49	18.52	19.41	19.05	32.92	30.04
2019	17.13	16.38	15.01	17.95	16.76	28.49	26.12
M	14.71	14.82	12.66	16.12	14.76	21.66	22.04
SD	4.43	3.97	5.36	3.34	4.04	8.56	6.32
Obesity (%)							
2008	9.03	6.89	4.93	9.92	7.98	10.02	10.53
2009	13.43	11.30	7.88	15.26	12.39	12.31	13.51
2010	12.80	10.81	8.51	13.96	11.83	15.43	17.08
2011	9.06	10.19	5.02	12.58	9.61	14.06	16.79
2012	11.64	14.64	9.75	15.30	13.11	12.96	15.69
2013	12.39	14.87	11.07	15.29	13.60	22.61	23.70
2014	14.33	14.54	11.97	16.11	14.43	27.28	25.57
2015	18.21	16.11	18.89	16.00	17.19	24.44	23.78
2016	17.14	14.59	15.02	16.50	15.90	28.93	26.60
2017	17.58	14.26	14.35	17.03	15.96	24.51	23.13
2018	16.73	14.15	14.49	16.14	15.47	25.22	23.62
2019	16.12	13.92	13.03	16.41	15.05	25.77	23.22
M	14.04	13.02	11.24	15.04	13.54	20.29	20.27
SD	3.05	2.54	4.04	1.93	2.62	6.48	5.03

Source: Instituto Brasileiro de Geografia e Estatística [11], Secretaria de Atenção Primária à Saúde [12].

Note: M: Mean; SD: Standard Deviation.

In the annual trend analysis, in the period from 2008 to 2019, only the extreme thinness classification among girls and among children of both genders aged 2 to 5 years remained stationary. For all other classifications, regardless of gender, age or region assessed, there was an increasing trend towards non-eutrophic

nutritional status (Table 4). For all BMI classifications, boys had a slightly higher rate of increase than girls. In this study, children under two years of age exhibited the highest annual increase rates; however, the annual increase of the state of *Rondônia* was lower than that of Brazil and of the North region.

**Table 4** – Trend analysis per 1,000 children under five years of age in *Rondônia*, Northern region of Brazil and in Brazil, 2008 to 2019.

Group	Annual increment rate (95% CI)	Trend
Extreme thinness		
Male	3.42 (1.64; 5.21)	Growing
Female	3.06 (-0.55; 7.93)	Stationary
<2 years	10.24 (7.14; 13.43)	Growing
2 to 5 years	1.61 (-1.22; 4.52)	Stationary
<i>Rondônia</i>	3.23 (1.21; 5.29)	Growing
North	7.78 (4.62; 11.05)	Growing
Brazil	4.26 (1.48; 7.12)	Growing
Thinness		
Male	5.82 (4.66; 7.00)	Growing
Female	5.30 (1.27; 9.49)	Growing
<2 years	14.65 (11.08; 18.33)	Growing
2 to 5 years	3.42 (0.86; 6.04)	Growing
<i>Rondônia</i>	5.31 (3.53; 7.12)	Growing
North	11.23 (8.62; 13.89)	Growing
Brazil	7.77 (5.43; 10.18)	Growing
Overweight risk		
Male	7.00 (3.70; 10.40)	Growing
Female	6.44 (2.42; 10.62)	Growing
<2 years	14.18 (8.56; 20.09)	Growing
2 to 5 years	4.33 (2.49; 6.21)	Growing
<i>Rondônia</i>	6.85 (4.19; 9.58)	Growing
North	11.74 (7.42; 16.24)	Growing
Brazil	8.61 (5.23; 12.10)	Growing
Overweight		
Male	8.06 (4.28; 11.97)	Growing
Female	7.79 (2.74; 13.11)	Growing
<2 years	12.92 (7.74; 18.37)	Growing
2 to 5 years	5.89 (3.58; 8.25)	Growing
<i>Rondônia</i>	7.98 (4.94; 11.10)	Growing
North	12.44 (7.38; 17.74)	Growing
Brazil	8.93 (5.06; 12.96)	Growing
Obesity		
Male	5.47 (2.21; 8.84)	Growing
Female	5.12 (1.26; 9.14)	Growing
<2 years	10.24 (4.60; 15.71)	Growing
2 to 5 years	3.00 (1.45; 4.57)	Growing
<i>Rondônia</i>	5.15 (2.61; 7.76)	Growing
North	9.33 (4.58; 14.30)	Growing
Brazil	7.17 (2.76; 11.77)	Growing

Source: Instituto Brasileiro de Geografia e Estatística [11], Secretaria de Atenção Primária à Saúde [12].

## DISCUSSION

The results of this study indicate an increasing annual trend towards non-eutrophic nutritional status among children under five years of age, regardless of gender, age group and region – *Rondônia*, North

region or Brazil – with the exception of extreme thinness among girls aged 2 to 5 years that exhibited a stationary trend.

The nutritional profile of Brazilians has been changing in recent years; most studies on nutrition carried out in the last century focused on aspects of malnutrition and today they are focused on overweight and obesity [13]. The annual increment rate for the risk of overweight, overweight and obesity grew in *Rondônia* as well as in the North region of Brazil and in Brazil. The growth of obesity in the population is mainly related to changes in the dietary pattern, which today values ultra-processed products, which contain high levels of sodium, sugar and saturated fats and high energy density, compared to homemade preparations and fresh or minimally processed foods. Among children, the early introduction of ultra-processed foods is one of the main causes of overweight and obesity in early childhood, when breast milk is still recommended [14].

However, concomitant with this scenario, this study also detected the annual rate growth of extreme thinness and thinness nutritional status. Brazil was excluded from the hunger map in 2014 by the United Nations for having achieved some of the millennium goals and for having invested heavily in public policies, integrating different government agencies, aiming to remove hunger in Brazil [15]. However, Brazilian regions with worse sociodemographic conditions still live with chronic malnutrition, like in the State of Maranhão, where 70.4% children were food insecure [4]. In *Rondônia*, the annual growth rate of extreme thinness in the period assessed was 3.23% (95%CI: 1.21; 5.29) and for thinness it was 5.31% (95%CI: 3.53; 7.12), therefore, one cannot deny the fact that a risk of malnutrition still exists.

The growth in cases of thinness concomitant with the increase in child weight points to the maintenance of social inequality, arising from different situations of local vulnerability such as absence or low access to health and self-care services [16,17]. Although the state of *Rondônia* has shown a trend of growth in the rates of non-eutrophic nutritional status just like Brazil and the Northern region of Brazil, the differences between *Rondônia* and the North region indicate inequality within the same region.

Although the average rates in the period by BMI classification were higher among girls, the annual growth trend was higher among boys when compared to girls and this finding corroborates an international study that included data from more than two thousand population-based studies carried out between 1975 and 2016 with youth from 5 to 19 years of age, where boys presented an unfavorable situation for growth in countries with worse economic conditions, indicating a greater vulnerability in this group [18].

A higher annual growth rate was also found for non-eutrophic children under two years of age and this may be linked to the decrease in exclusive breastfeeding in the first six months of life and the introduction of unhealthy foods that can lead to higher levels of body fat [19].

The SISVAN coverage rate in the state of *Rondônia* was lower than in Brazil and specifically in the Northern region. Information on nutritional status comes mainly from the *Bolsa Família* Program records, given the mandatory anthropometric records required to maintain the benefit for families. The coverage of the *Bolsa Família* Program is greater in the North and Northeast regions and this may be related to the prioritization of certain policies on health, poverty and child malnutrition more present in those regions than in other regions in Brazil [20].

A study that evaluated the temporal trend of SISVAN Web coverage in children under five years of age in the North showed that all states in the region exhibited an increasing trend in this coverage in the period studied, but the smallest annual variations were found in *Rondônia* (8.9%; 95%CI: 7.4;10.4) and Roraima (8.6%; 95%CI 4.9;12.5) [6]. According to this same study, the main aspects that hinder the advancement and consolidation of SISVAN include problems regarding the physical structure, lack of equipment and internet access to feed the system with the data collected and continuous change in the technical staff, both at the local and national level [6].

This study provided a broad view of the nutritional situation of children under five years of age in the state of *Rondônia*, compared with the regional and national conditions. It is also worth noting the fact that the data were obtained from a low coverage of SISVAN (less than 30%) and that the information source is mostly from the *Bolsa Família* Program, which can impact the representativeness of the data with regard to local reality. Although SISVAN has a standardized data collection and recording, it is known that there could exist problems in the quality of the records, but this fact does not preclude the use of these data as a research source for decision-making by managers regarding action programs.

## CONCLUSION

In *Rondônia*, an increasing annual trend towards non-eutrophic nutritional status was found, as in the North Region of Brazil and in Brazil. The annual increase trend was higher among boys and among children under two years of age. The SISVAN coverage rate in the state of *Rondônia* was lower than in the North region and in Brazil throughout the study period. Hence, it is necessary to review the SISVAN data collection process, review health policies aimed at promoting and preventing nutritional problems, considering the current scenario with increasing rates in cases of overweight and obesity, but maintaining increasing rates also in the extreme thinness classification and thinness and strengthen health education actions with regard to the introduction of healthy foods for children under two years of age, especially boys.

As gaps still to be filled out, it is suggested to better investigate nutritional inequality within the Northern region itself. Despite the growing trend of non-eutrophic nutritional status throughout Brazil, *Rondônia* presented lower rates than Brazil itself and specifically the Northern region. On the other hand, the low coverage of SISVAN in *Rondônia* when compared to the Northern region should also be investigated in order to find out the situations that prevent a more efficient data monitoring in the State.

## CONTRIBUTORS

All authors of the manuscript made substantial contributions. LIMA PT and PEREIRA PPS contributed substantially to the conception, design, analysis and interpretation of data, review and approval of the final version of the article. FREITAS JLG; OLIVEIRA LML; FIGUEIREDO ACMG contributed in data analysis and interpretation, review and approval of the final version of the article.

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