Temporal trend analysis on nutritional status of children aged six to 23 months from 2013 to 2022

Análise de tendência temporal do estado nutricional de crianças de seis a 23 meses no período de 2013 a 2022

Bárbara Maria Renó Oliveira[1*]
Orcid: https://orcid.org/0009-0001-1755-4013

Camila Dallazen[2*]
Orcid: https://orcid.org/0000-0002-9733-9486

Joseane Carla Schabarum[3*]
Orcid: https://orcid.org/0000-0001-7116-2814

Angelica Rocha de Freitas Melhem[4*]
Orcid: https://orcid.org/0000-0003-1008-1038

Paula Chuproski Saldan[5*]
Orcid: https://orcid.org/0000-0001-7994-3375

Abstract
Introduction: Food and Nutrition Surveillance is necessary to monitor adequate development in infants aged six to 23 months. *Objectives:* To verify and analyze the temporal trend of the nutritional status of children aged six to 23 months registered and monitored in a Primary Health Care in the city of Guarapuava-PR, in the State of Paraná, in the South Region and in Brazil from 2013 to 2022. *Materials and Methods:* Ecological study based on extraction of public reports from the *Sistema de Vigilância Alimentar e Nutricional* (SISVAN) (Food and Nutrition Surveillance System) Web, according to the anthropometric indexes of weight for age (W/A), weight for height (W/H), height for age (H/A) and body mass index for age (BMI/A). Temporal trend analysis was carried out using Prais-Winsten generalized linear regression. *Results:* Elevated weight for age followed a decreasing trend in all the locations assessed. The weight for height and BMI for age indexes showed an increasing trend towards eutrophy in all locations, as well as a decrease in obesity in the city and in the country. Adequate height for age increased in Guarapuava, while low height for age decreased. *Conclusions:* A positive scenario was observed in the nutritional status of the group studied; however, actions to combat malnutrition and childhood obesity are still needed.
Keywords: Food and Nutritional Surveillance. Nutritional Status. Anthropometry. Primary Health Care. Infant Nutrition.

Resumo
Introdução: A Vigilância Alimentar e Nutricional é necessária para o acompanhamento do desenvolvimento adequado em lactentes de seis a 23 meses. *Objetivos*: Verificar e analisar a tendência temporal do estado nutricional de crianças de seis a 23 meses de idade cadastradas e acompanhadas na Atenção Primária à Saúde no município de Guarapuava-PR, no estado do Paraná, na Região Sul e no Brasil no período de 2013 a 2022. *Materiais e Métodos*: Estudo ecológico a partir da extração de relatórios públicos do Sistema de Vigilância Alimentar e Nutricional (SISVAN) *Web*, segundo os índices antropométricos de peso para idade (P/I), peso para altura (P/A), altura para idade (A/I) e índice de massa corporal para idade (IMC/I). Foi realizada a análise de tendência temporal por meio da regressão linear generalizada de *Prais-Winsten*. *Resultados*: O peso elevado para idade seguiu tendência decrescente em todas as localidades avaliadas. Os índices peso para altura e IMC para idade apresentaram tendência crescente para eutrofia em todas as localidades, além de diminuição da obesidade no município e no país. A altura adequada para idade aumentou em Guarapuava, enquanto a baixa altura para idade diminuiu. *Conclusões*: Observou-se cenário positivo no estado nutricional do grupo estudado, entretanto, ainda são necessárias ações de combate à desnutrição e à obesidade infantil.
Palavras-chave: Vigilância Alimentar e Nutricional. Estado Nutricional. Antropometria. Atenção Primária à Saúde. Nutrição do Lactente.

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[*]Universidade Estadual do Centro-Oeste (UNICENTRO), Departamento de Nutrição, Guarapuava, Paraná, Brasil.
[1] E-mail: barbarareno012@gmail.com
[2] E-mail: camiladallazen@gmail.com
[3] E-mail: joseschabarum@hotmail.com
[4] E-mail : angerocha@gmail.com
[5] E-mail: pchuproski@unicentro.br

Oliveira BMR, Dallazen C, Schabarum JC, Melhem ARF, Saldan PC

Introduction

In the early childhood period, up to the age of two, it is essential that health and development are properly promoted, as this is a critical phase for the emergence of nutritional deficiencies, growth deficits, intellectual, mental, reproductive and motor damage[1]. Therefore, a complete nutritional assessment is essential so that nutritional disorders and risk scenarios can be identified, enabling relevant treatments and interventions[2]. For the children's nutritional surveillance, the World Health Organization (WHO) and the Ministry of Health recommend the use of the following anthropometric indices: weight for age, weight for height, height for age and body mass index (BMI) for age[3].

In Brazil, the main way of storing the data obtained from *Vigilância Alimentar e Nutricional* (VAN) (Food and Nutrition Surveillance) carried out on *Atenção Primária à Saúde* (APS) (Primary Health Care) users in the *Sistema Único de Saúde* (SUS) (Public Health System) is the *Sistema de Vigilância Alimentar e Nutricional* (SISVAN) (Food and Nutrition Surveillance System), regulated by Ordinance No. 156, on August 31, 1990, and administered by the Ministry of Health. The numerous information presente on food consumption indicators and anthropometric data are kept in this system in order to carry out the evaluation and monitoring Brazilians' food and nutritional status in a quick and accessible way. Thus, this systematization method is essential to support the formulation on health promotion, protection and recovery strategies for the population, contributing to adequate and effective assistance to the individual, family and community levels[4-6]. On the other hand, although this system is very important for VAN, its coverage differs between years, ages and regions[7].

In the document entitled "*Situação alimentar e nutricional de crianças na Atenção Primária à Saúde no Brasil*"(Children's food and nutritional situation in the Primary Health Care in Brazil), which used data obtained through SISVAN evaluating the BMI for age index, was observed that 280,468 (15.5%) children under the age of two were overweight or obese and 97,221 (5.4%) had some degree of thinness in 2020, highlighting the need for nutritional interventions in the population studied[8].

In the literature consulted, no specific studies were found that analyzed the temporal trend of the nutritional status of infants aged between six and 23 months. The few studies found on the subject, focus on children aged between zero and 23 months or under five years old. These findings show that overweight, although is still high, has been decreasing over the years, in addition to the progressive increase in eutrophy[9].

Therefore, it is essential that the nutritional status of this group is analyzed, as it is a vulnerable population that needs special care to prevent the development of future diseases, as well as being an important age group for the introduction and consolidation of complementary feeding.

With this in mind, the aim of the study was to verify and analyze the temporal trend of the nutritional status of children aged six to 23 months registered and monitored at the APS in the city of Guarapuava-PR, in the State of Paraná, in the South Region and in Brazil from 2013 to 2022.

Materials and Methods

Sample and type of study

This is an ecological study of the temporal trend of the nutritional status of children aged between six and 23 months and 29 days, duly followed up in APS. The data was obtained by extracting public reports from SISVAN Web, with data collected over a 10-year period (2013 to 2022), from the following electronic address: https://sisaps.saude.gov.br/sisvan/relatorio publico/index. This data includes the reference city, the State of Paraná, the South Region and Brazil.

Research design

Considering the recommendations and cut-off points indicated by the SISVAN Technical Standard, the anthropometric indexes on weight for age (W/A), weight for height (W/H), height for age (H/A) and body mass index for age (BMI/A) were used to assess the nutritional status of the group studied[3,5].

Inclusion and exclusion criteria

The inclusion criteria included the following variables combined to generate the reports: Type of report (Nutritional status), reference years (2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021 and 2022), reference month (ALL), group by (City), State (PR), City (Guarapuava), coverage region (ALL), life stages (Child), Age (six to 23 months), Index (weight x age; weight x height; height x age and BMI x age), gender (ALL), race/color (ALL), registered follow-ups (ALL), people and community (ALL), schooling (ALL).

Procedures

The extracted data was entered into the Microsoft Excel® program for descriptive analysis, which included percentage values of the nutritional status of children aged between six and 23 months during the study period. After the descriptive analysis, a temporal trend analysis was carried out using the Prais-Winsten generalized linear regression[10]. The dependent variable was nutritional status according to the four anthropometric indexes assessed. The years of the temporal series (2013-2022) were used as the independent variable.

According to Antunes & Cardoso[10], the nutritional status of children aged between six and 23 months should be log-transformed in order to reduce the heterogeneity of variance in the residuals of the regression analysis.

The rates of annual increase in nutritional status, as well as the respective confidence intervals (CI), were obtained by applying the following formulas[11]:

$$\text{Annual rate of increase} = (-1 + 10^{\beta}) * 100\%$$

$$95\%CI = -1 + 10^{(\beta \pm t(0,05;n-1) x SE)}$$

The regression coefficient (β) and the standard error (SE) of the beta estimate were provided by the Prais-Winsten regression, and the t value was obtained from the two-tailed Student's t distribution table, with a 5% significance level,

considering the number of years in the series -1[10 11-12].

Based on the observation of the confidence interval and the p-value <0.05, the interpretation of the temporal trend was classified as stationary (interval containing the value zero), increasing (positive rate of increase) or decreasing (negative rate of increase). For the Prais-Winsten regression analysis, the IBM SPSS (Statistical Package for the Social Sciences) version 25.0 statistical program was used.

Due to the nature of the study and the use of databases in the public domain and without the possibility of identifying the individual, it was not necessary for the study to be evaluated by the Human Research Ethics Committee (COMEP), in accordance with National Health Council (CNS) Resolution 510 on April 7, 2016[13].

Results

In the 10 years analyzed, 16,597 children aged six to 23 months were assessed in the city of Guarapuava-PR, 835,894 in Paraná, 1,855,180 in the South Region and 13,267,278 in Brazil. SISVAN coverage ranged from 33.13% to 75.98% in Guarapuava-PR and from 26.85% to 47.95% in Brazil between 2019 and 2022. Coverage data prior to this period was not available.

Table 1 describes the temporal trend of the weight for age index. In the city of Guarapuava-PR, a significant decreasing trend was observed in relation to elevated weight for age (variation from 12.20% in 2013 to 4.50% in 2022), as well as in Paraná (from 9.62% to 5.93%), in the South Region (from 9.97% to 6.30%) and in Brazil (from 11.70% to 7.42%). Furthermore, in the State of Paraná, the prevalence trends for low and adequate weight for age were increasing (from 1.63% to 1.99% and from 87.85% to 91.12%, respectively). There was also a significant increasing trend in low weight for age in the South Region (from 1.61% to 1.88%) and very low and adequate weight for age in Brazil (from 1.22% to 1.44% and from 84.85% to 88.79%, respectively).

Table 1. Trends in nutritional status, according to the weight for age index in children aged six to 23 months in Guarapuava-PR, in the State of Paraná, in the South Region and in Brazil, 2013 to 2022.

Weight for age/Location	% 2013	% 2022	APV	95% CI	p-value*	Trend
Very low						
Guarapuava	0.75	1.12	0.064	-0.031; 0.168	0.169	Stationary
Paraná	0.90	0.96	0.013	-0.017; 0.046	0.360	Stationary
South Region	0.91	1.01	0.025	-0.011; 0.063	0.186	Stationary
Brazil	1.22	1.44	0.035	0.013; 0.056	0.008	**Increasing**
Low						
Guarapuava	1.13	2.33	0.030	-0.042; 0.108	0.392	Stationary
Paraná	1.63	1.99	0.023	0.002; 0.044	0.046	**Increasing**
South Region	1.61	1.88	0.018	0.002; 0.034	0.018	**Increasing**
Brazil	2.23	2.35	0.004	-0.016; 0.025	0.584	Stationary

Weight for age/Location	% 2013	% 2022	APV	95% CI	p-value*	Trend
Adequate						
Guarapuava	85.93	92.05	0.006	-0.003; 0.017	0.061	Stationary
Paraná	87.85	91.12	0.003	0.0003; 0.006	0.038	**Increasing**
South Region	87.51	90.81	0.002	-0.002; 0.007	0.077	Stationary
Brazil	84.85	88.79	0.004	0.001; 0.006	0.012	**Increasing**
Elevated						
Guarapuava	12.20	4.50	-0.106	-0.169; -0.039	0.010	**Decreasing**
Paraná	9.62	5.93	-0.045	-0.079; -0.009	0.021	**Decreasing**
South Region	9.97	6.30	-0.040	-0.074; -0.004	0.032	**Decreasing**
Brazil	11.70	7.42	-0.042	-0.072; -0.012	0.012	**Decreasing**

APV=Annual Percentage Variation; CI=Confidence Interval; *Linear regression - Prais-Winsten method.

Table 2 shows the trend results according to the weight for height index. There was a significant decreasing trend in Paraná (from 1.77% in 2013 to 1.35% in 2022), in the South Region (from 1.75% to 1.15%) and in Brazil (from 3.13% to 2.12%) for severe thinness. There was a significant increasing trend towards eutrophy in all the regions evaluated, with a variation from 53.28% to 69.28% in the city, from 61.23% to 63.48% in the State, from 60.42% to 63.49% in the macro-region and from 55.92% to 61.86% in the country. In regard to excess weight, Guarapuava-PR showed a significant decreasing trend for overweight (from 10.32% to 4.66%) and obesity (from 8.63% to 3.25%), the latter also being observed in Brazil (from 9.50% to 5.29%).

Table 2. Trends in the prevalence of nutritional status, according to the weight for height index in children aged six to 23 months in Guarapuava-PR, in the State of Paraná, in the South Region and in Brazil, 2013 to 2022.

Weight for height/Location	% 2013	% 2022	APV	95% CI	p-value*	Trend
Severe thinness						
Guarapuava	2.25	1.79	-0.020	-0.112; 0.081	0.670	Stationary
Paraná	1.77	1.35	-0.036	-0.060; -0.010	0.017	**Decreasing**
South Region	1.75	1.15	-0.051	-0.066; -0.036	<0.001	**Decreasing**
Brazil	3.13	2.12	-0.047	-0.057; -0.037	<0.001	**Decreasing**
Thinness						
Guarapuava	2.81	2.29	0.016	-0.025; 0.059	0.407	Stationary
Paraná	1.83	1.85	0.006	-0.024; 0.038	0.625	Stationary
South Region	1.82	1.78	0.002	-0.023; 0.028	0.905	Stationary

Oliveira BMR, Dallazen C, Schabarum JC, Melhem ARF, Saldan PC

Weight for height/Location	% 2013	% 2022	APV	95% CI	p-value*	Trend
Brazil	2.62	2.37	-0.009	-0.024; 0.006	0.154	Stationary
Eutrophy						
Guarapuava	53.28	69.28	0.028	0.006; 0.049	0.020	**Increasing**
Paraná	61.23	63.48	0.003	0.0002; 0.007	0.046	**Increasing**
South Region	60.42	63.49	0.005	0.0005; 0.010	0.040	**Increasing**
Brazil	55.92	61.86	0.011	0.006; 0.016	0.001	**Increasing**
Risk of overweight						
Guarapuava	22.70	18.73	-0.018	-0.038; 0.002	0.118	Stationary
Paraná	21.51	20.11	-0.011	-0.021; -0.001	0.086	Stationary
South Region	21.58	21.09	-0.004	-0.014; 0.005	0.316	Stationary
Brazil	20.12	20.14	-0.002	-0.007; 0.002	0.588	Stationary
Overweight						
Guarapuava	10.32	4.66	-0.077	-0.096; -0.058	<0.001	**Decreasing**
Paraná	7.58	7.55	0.000	-0.010; 0.010	0.988	Stationary
South Region	7.99	7.81	-0.002	-0.012; 0.008	0.753	Stationary
Brazil	8.72	8.22	-0.006	-0.017; 0.003	0.199	Stationary
Obesity						
Guarapuava	8.63	3.25	-0.050	-0.204; -0.010	0.044	**Decreasing**
Paraná	6.08	5.66	0.000	-0.055; 0.059	0.998	Stationary
South Region	6.45	4.69	-0.012	-0.073; 0.017	0.192	Stationary
Brazil	9.50	5.29	-0.025	-0.082; -0.033	0.001	**Decreasing**

APV=Annual Percentage Variation; CI=Confidence Interval; *Linear regression - Prais-Winsten method

Based on the data shown in Table 3, very low height for age showed a significant increasing trend in the South Region (from 4.59% in 2013 to 5.81% in 2022). On the other hand, only Guarapuava-PR showed a significant decreasing trend in low height for age (from 8.26% to 5.83%). Regarding to adequate height for age, Guarapuava-PR showed a significant increasing trend (from 86.30% to 90.13%), while in Paraná and in the South Region showed significant decreasing trends (from 89.74% to 86.39% and from 89.16% to 87.71%, respectively).

Table 3. Trends in nutritional status, according to the height for age index in children aged six to 23 months in Guarapuava-PR, in the State of Paraná, in the South Region and in Brazil, 2013 to 2022.

Height for age/Location	% 2013	% 2022	APV	95% CI	p-value*	Trend
Very low						
Guarapuava	5.44	4.04	-0.051	-0.122; 0.025	0.164	Stationary
Paraná	4.15	6.86	-0.006	-0.027; 0.014	0.561	Stationary
South Region	4.59	5.81	0.030	0.014; 0.046	0.002	**Increasing**
Brazil	8.28	6.80	-0.020	-0.045; 0.005	0.099	Stationary
Low						
Guarapuava	8.26	5.83	-0.068	-0.102; -0.034	0.002	**Decreasing**
Paraná	6.11	6.75	-0.006	-0.027; 0.014	0.561	Stationary
South Region	6.26	6.48	-0.011	-0.036; 0.014	0.346	Stationary
Brazil	8.21	7.52	-0.018	-0.048; 0.012	0.177	Stationary
Adequate						
Guarapuava	86.30	90.13	0.010	0.001; 0.018	0.027	**Increasing**
Paraná	89.74	86.39	-0.003	-0.004; -0.001	0.001	**Decreasing**
South Region	89.16	87.71	-0.001	-0.002; -0.000	0.042	**Decreasing**
Brazil	83.50	85.68	0.002	-0.002; 0.007	0.134	Stationary

APV=Annual Percentage Variation; CI=Confidence Interval; *Linear regression - Prais-Winsten method.

As for BMI for age, Table 4 shows results of a significant decreasing trend in Paraná (from 2.31% in 2013 to 1.73% in 2022), in the South Region (from 2.30% to 1.52%) and in Brazil (from 4.18% to 2.75%) for severe thinness. The city of Guarapuava-PR and the State showed a significant decreasing trend for risk of overweight (from 25.52% to 20.98% and from 23.95% to 21.94%, respectively), while Guarapuava-PR and Brazil showed the same trend for obesity (from 9.94% to 4.12% and from 10.93% to 6.60%). All regions showed a significant increasing trend for eutrophy (from 44.47% to 64.36% in Guarapuava, from 54.67% to 58.27% in Paraná, from 54.15% to 58.04% in the South Region and from 49.10% to 56.49% in Brazil) and decreasing trend for overweight (from 13.88% to 6.58% in the city, from 10.23% to 9.22% in the State, from 10.50% to 9.72% in the macro-region and from 11.43% to 10.01% in the country).

Table 4. Trends in nutritional status according to body mass index for age in children aged six to 23 months in Guarapuava-PR, in the State of Paraná, in the SouthRegion and in Brazil, 2013 to 2022.

BMI for age/Location	% 2013	% 2022	APV	95% CI	p-value*	Trend
Severe thinness						
Guarapuava	3.75	2.00	-0.058	-0.164; 0.061	0.305	Stationary
Paraná	2.31	1.73	-0.027	-0.047; -0.006	0.013	**Decreasing**
South Region	2.30	1.52	-0.042	-0.062; -0.022	0.002	**Decreasing**

Oliveira BMR, Dallazen C, Schabarum JC, Melhem ARF, Saldan PC

BMI for age/Location	% 2013	% 2022	APV	95% CI	p-value*	Trend
Brazil	4.18	2.75	-0.042	-0.062; -0.022	0.002	**Decreasing**
Thinness						
Guarapuava	2.44	1.96	0.035	-0.017; 0.090	0.155	Stationary
Paraná	1.86	1.97	0.018	-0.007; 0.045	0.142	Stationary
South Region	1.84	1.86	0.011	-0.009; 0.032	0.213	Stationary
Brazil	2.62	2.55	0.006	-0.008; 0.022	0.360	Stationary
Eutrophy						
Guarapuava	44.47	64.36	0.037	0.010; 0.064	0.018	**Increasing**
Paraná	54.67	58.27	0.009	0.004; 0.014	0.002	**Increasing**
South Region	54.15	58.04	0.009	0.004; 0.014	0.004	**Increasing**
Brazil	49.10	56.49	0.017	0.013; 0.022	<0.001	**Increasing**
Risk of overweight						
Guarapuava	25.52	20.98	-0.025	-0.040; -0.009	0.015	**Decreasing**
Paraná	23.95	21.94	-0.015	-0.026; -0.005	0.024	**Decreasing**
South Region	23.67	22.92	-0.006	-0.017; 0.003	0.090	Stationary
Brazil	21.47	21.59	-0.004	-0.009; 0.0006	0.221	Stationary
Overweight						
Guarapuava	13.88	6.58	-0.068	-0.092; -0.044	0.001	**Decreasing**
Paraná	10.23	9.22	-0.015	-0.031; -0.0004	0.040	**Decreasing**
South Region	10.50	9.72	-0.013	-0.023; -0.003	0.014	**Decreasing**
Brazil	11.43	10.01	-0.020	-0.030; -0.010	0.002	**Decreasing**
Obesity						
Guarapuava	9.94	4.12	-0.102	-0.178; -0.019	0.028	**Decreasing**
Paraná	6.99	6.87	0.002	-.0.038; 0.044	0.871	Stationary
South Region	7.54	5.95	-0.025	-0.055; 0.005	0.121	Stationary
Brazil	10.93	6.60	-0.053	-0.063; -0.043	<0.001	**Decreasing**

BMI=Body Mass Index; APV=Annual Percentage Variation; CI=Confidence Interval; *Linear regression - Prais-Winsten method.

Discussion

In this study, it was possible to observe promising results for the city. Guarapuava follows the same decreasing trend seen in Paraná, in the South Region and in Brazil in the classification of elevated weight for age. In addition, the weight for height and BMI for age indexes showed similar results in relation to eutrophy, with an increasing trend in all the places analyzed, and obesity, with a

decrease in both the city and the country. In the classification of risk of overweight according to BMI for age, Guarapuava followed the same decreasing trend as Paraná. The classification of overweight was reduced in Guarapuava in the weight for height index, while the BMI for age showed a decrease in the city, State, macro-region and country. With regard to the height for age index, Guarapuava did not follow the same trend observed in the other locations, but showed a positive scenario of a decrease in low height for age and an increase in adequacy.

The coverage of nutritional status assessment presented by the city in 2019 (33.13%) was low when compared to the States in the Northeast in the same year, for the age group of children under two years old. The variation ranged from 37.36% in Rio Grande do Norte to 54.07% in Paraíba[14]. On the other hand, Guarapuava showed satisfactory coverage in 2022 (75.98%), signaling an evolution in the city on VAN. Mrejen et al.[7] found that SISVAN coverage differs between age groups and regions of the country, with younger children and the North and Northeast regions being the most favored. In addition, due to the COVID-19 pandemic, the drop in data coverage in 2020 was significant compared to the increasing coverage that was observed from 2008 onwards[7]. This discrepancy in VAN coverage between young children and other stages of life may be related to the practice of childcare, considering that it is mandatory to attend at least nine appointments in the first two years of a child's life[3,5]. In addition, it may also be associated with the conditionalities for users of the *Programa Bolsa Família* (PBF) (Public Welfare Program), in which the benefit is maintained, among other measures, by complying with the national vaccination schedule and monitoring nutritional status in the public health network until the child is seven years old[15].

Based on the study carried out by Vasconcelos et al.[9] with infants aged between zero and 23 months registered with the PBF between 2008 and 2018, it was possible to observe a decreasing trend in the prevalence of elevated weight for age from 2015 onwards in Brazil and from 2013 onwards in the South Region. Despite covering infants under six months of age and a vulnerable population, these data corroborate those found in this study, in which the trend was decreasing in all the locations analyzed, according to the same index. As a result, it can be seen that overweight among Brazilian children under the age of two has been falling considerably for approximately a decade[9].

This phenomenon is extremely relevant in the nutritional field, since excess weight in children can lead to delayed neuropsychomotor development, hypertension, type 2 diabetes mellitus and the risk of future diseases such as obesity and cardiovascular diseases[16-17]. Public policies aimed in promoting healthy eating and preventing health problems for this public, such as the *Estratégia Amamenta e Alimenta Brasil* (Breastfeed and Feed Strategy), NutriSUS and the *Programas Nacionais de Suplementação de Micronutrientes* (Micronutrient Supplementation Programs), may have been extremely important in changing the nutritional status indicators observed[18-20]. On the other hand, the pandemic period that occurred during part of the study period must be taken into account. Data from the *II Inquérito Nacional sobre Insegurança Alimentar no Contexto da Pandemia de COVID-19* (II National Survey on Food Insecurity in the Context of the COVID-19 Pandemic) in Brazil[21], published by the PENSSAN Network in 2022, show alarming levels of *Insegurança Alimentar e Nutricional* (IAN) (Food and Nutritional Insecurity) strongly affected households occupied by children. In addition, the impairment of the *Programa Nacional de Alimentação Escolar* (PNAE) (National School Feeding Program) has also caused countless losses in terms of children's *Segurança Alimentar e Nutricional* (SAN)[21](Food and Nutrition Security).

Despite the provision of basic food baskets, food kits or daily meals, children's basic food needs were not adequately met[21], resulting in the possibility of weight and height deficits which may have impacted the data found in this study.

Regards to height, the document published by the Ministry of Health in 2022 shows significant data in regional and national level[8]. In 2020, 10.40% of children under the age of two were classified as very short or short for their age in the South Region and 11.50% in Paraná, while in 2022 Guarapuava had 9.87% of children in one of these classifications. In addition, the number of infants classified as having adequate height for age was 89.60% in 2020 in the Macroregion, 88.50% in the State and 90.13% in 2022 in Guarapuava, in the six to 23 month age group, showing the positive scenario of the city when compared to the regional and state panorama[8].

In this context, height for age deficit is one of the main signs of chronic malnutrition related to nutritional factors[22]. Malnutrition as a result of child poor nutrition, although the subject of numerous positive changes in recent decades, presents an alarming global scenario. It is estimated that in 2021, approximately 149 million children had growth retardation, while 340 million children under the age of five were subject to vitamin and micronutrient deficiencies[23]. Thus, positive results of Guarapuava regarding to the height for age index show that, although is still elevated, the reduction in low height for age may demonstrate a consequent reduction in the levels of chronic malnutrition in the city.

In relation to BMI for age, the *Estudo Nacional de Alimentação e Nutrição Infantil* (ENANI)[24] (National Study of Infant Feeding and Nutrition) carried out in 2019, assessed the nutritional status of children under five years old and is a current and relevant parameter on infant nutrition. In the year of the survey, 40.90% of the Brazilian infants between zero and 23 months were at risk of being overweight, 18.20% were overweight and 5% were obese[24]. In contrast, in the city of Guarapuava-PR in 2022, 20.98% of the infants between six and 23 months were at risk of overweight, 6.58% were diagnosed as overweight and 4.12% as obese, which again shows the favorable situation at a local level. The drop in overweight and the increase in eutrophy observed in the city using the BMI for age were also found using the weight for height index, since they are directly related using the same measures.

The weight for height index was evaluated using SISVAN by Andrade et al.[25], in children under two years of age registered and attended at the public health network in the city of Foz do Iguaçu-PR, in 2021. Of 3,146 infants, 2.90% were severely thin, 22.10% were at risk of overweight/overweight and 1.80% were obese. In Guarapuava, 4.07% of infants aged between six and 23 months were severely thin, 23.39% were at risk of being overweight/overweight and 3.25% were obese, figures close to those found in the study by Andrade et al.[25]. These data show that the positive results found locally are also found in other cities with a similar population density. In this sense, the drop in overweight in both indexes may be related to the changes observed in children's food in recent years.

It is known that the period between six months and two years of age is fundamental for the child's development and the consolidation of complementary feeding, since from this age onwards, breastfeeding ceases to be exclusive and new food are introduced into the child's eating routine[26]. These changes favor weight and height gain, as well as contributing to the formation of eating habits, identity, relationship with food and the social environment[26]. If adequate and healthy food is not provided in a satisfactory way, development and growth can be impaired, often leading to irreversible consequences[26].

According to Souza et al.[27], in their study based on national data extracted from SISVAN on the feeding practices of

children aged six to 24 months in the years 2008 to 2019, it was found that the consumption of ultra-processed food and sugary drinks decreased among the group studied during the period, which shows an advance in complementary feeding in the country and may have a possible relationship with the decreasing trend in overweight according to BMI for age and obesity according to weight for height in the country reported by this research. Despite this, consumption of these food is still high, as they are not recommended during the first years of childhood due to their high energy density[26-27].

The study by Silva et al.[28] in 2019, based on SISVAN food consumption reports, found that 41.80% children from Guarapuava and aged between six and 23 months consumed ultra-processed food, 27.30% consumed sweetened drinks and 27.60% consumed filled cookies, sweets or candies. These data are beneficial when compared to those found in 2016 by the same study, in which 44% of the children consumed ultra-processed food, 30.90% consumed sweetened drinks and 29% consumed filled cookies, sweets or candies, high percentages of unhealthy food consumption markers[28]. In addition, 75.50% of the infants in Guarapuava had minimal diversity in their diet, which is satisfactory as a marker of healthy eating[28]. These dietary changes observed in the city may be associated with the reduction in overweight seen in the weight for age, weight for height and BMI for age indexes, as well as the increase in eutrophy also seen in the weight for height and BMI for age indexes.

The strengths of the study are based on the evaluation of the four anthropometric indexes recommended for the VAN of infants, in city, state, regional and national levels. It also analyzes a decade long temporal trend in the nutritional status of an age group that has been little explored in studies of children. The limitations identified lie in the use of secondary data, collected by various professionals and different equipment, which can generate a bias in the results presented. The use of public data implies evaluating only users registered at APS, excluding those who use the private network and health insurance plans, also considering the underutilization of the system which does not have full coverage for children who use the public network. It was therefore not possible to cover all infants aged between six and 23 months in the city, in the State, in the region and in the country. Despite the favorable results for the city of Guarapuava, one must consider the fact that only anthropometric data was used to verify the nutritional status of children aged six to 23 months, without assessing food consumption. In addition, there are few studies of the same nature in the proposed age group, making it necessary to discuss similar studies.

Conclusion

It can be concluded that the overall nutritional status of children aged six to 23 months was positive, with a decrease in excess weight and an increase in eutrophy. However, unsatisfactory indices were observed, such as an increase in very low weight for age in Brazil and very low height for age in the South Region. For this reason, despite the optimistic results found, there is a need for continued action to combat malnutrition and childhood obesity in the country, also with a view to expanding SISVAN coverage in this and other age groups. More studies on the same subject are needed, given the limitations found in the discussion of the results.

References

p. 3

Oliveira BMR, Dallazen C, Schabarum JC, Melhem ARF, Saldan PC

1. Pan American Health Organization/World Health Organization. WHO Guideline for complementary feeding of infants and young children 6–23 months of age. Pan American Health Organization/ World Health Organization. Washington/Geneva; 2023. Disponível em: https://iris.who.int/bitstream/handle/10665/373358/9789240081864-eng.pdf?sequence=1. Acesso em: 29 fev. 2024.

2. Sociedade Brasileira de Pediatria. Avaliação nutricional da criança e do adolescente: Manual de Orientação 2ª Edição - Atualizada. Departamento Científico de Nutrologia. São Paulo: SBP; 2021. Disponível em: https://www.sbp.com.br/fileadmin/user_upload/_22962e-ManAval_Nutricional_-_2Ed_Atualizada_SITE.pdf/. Acesso em: 14 fev. 2023.

3. Brasil. Ministério da Saúde. Guia para a organização da Vigilância Alimentar e Nutricional na Atenção Primária à Saúde [recurso eletrônico]. Brasília: Ministério da Saúde; 2022. [Acesso em 2023 Fev 14]. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/guia_organizacao_vigilancia_alimentar_nutricional.pdf

4. Brasil. Ministério da Saúde. Portaria nº 1.156 de 31 de agosto de 1990. Institui o Sistema de Vigilância Alimentar e Nutricional - SISVAN. Diário Oficial da União; 1990. Disponível em: http://189.28.128.100/nutricao/docs/legislacao/portaria_sisvan.pdf

5. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Orientações para a coleta e análise de dados antropométricos em serviços de saúde: Norma Técnica do Sistema de Vigilância Alimentar e Nutricional - SISVAN. Brasília: Ministério da Saúde; 2011. [Acesso em 2023 Fev 14]. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/orientacoes_coleta_analise_dados_antropometricos.pdf

6. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Marco de referência da vigilância alimentar e nutricional na atenção básica [internet]. Brasília: Ministério da Saúde; 2015. [acesso em 2024 Fev 13]. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/marco_referencia_vigilancia_alimentar.pdf

7. Mrejen M, Cruz MV, Rosa L. O Sistema de Vigilância Alimentar e Nutricional (SISVAN) como ferramenta de monitoramento do estado nutricional de crianças e adolescentes no Brasil. Cad. Saúde Pública 2023; 39(1):e00169622. doi: https://doi.org/10.1590/0102-311XPT169622

8. Brasil. Ministério da Saúde. Secretaria de Atenção Primária à Saúde. Departamento de Promoção da Saúde. Situação alimentar e nutricional de crianças na Atenção Primária à Saúde no Brasil [recurso eletrônico]. Brasília: Ministério da Saúde; 2022. [Acesso em 2023 Fev 14]. Disponível em: http://189.28.128.100/dab/docs/portaldab/publicacoes/situacao_nutricional_criancas_aps.pdf

9. Vasconcelos LGL, Almeida NB, Santos MOA, Silveira JAC. Tendência temporal (2008-2018) da prevalência de excesso de peso em lactentes e pré-escolares brasileiros de baixa renda. Ciênc. Saúde Colet. 2022 Jan;27(1):363–75. doi: https://doi.org/10.1590/1413-81232022271.24122020

10. Antunes JLF; Cardoso MRA. Uso da análise de séries temporais em estudos epidemiológicos. Epidemiol. Serv. Saúde. 2015;24(3):565-76. doi: https://doi.org/10.5123/S1679-49742015000300024

11. Atty ATM; Guimarães RM; Andrade CLT. Tendência Temporal da Mortalidade por Câncer de Boca e da Cobertura de Atenção Primária no Estado do Rio de Janeiro. Rev. Bras. de Cancerol. 2022;68(3). doi: https://doi.org/10.32635/2176-9745.RBC.2022v68n3.2082

12. Aprelini CMO, et al. Tendência da prevalência do sobrepeso e obesidade no Espírito Santo: estudo ecológico, 2009-2018. Epidemiol. Serv. Saúde. 2021;30(3). doi: https://doi.org/10.1590/S1679-49742021000300017

13. Brasil. Conselho Nacional de Saúde. Resolução nº 510 de 07 de abril de 2016. Dispõe sobre as normas aplicáveis a pesquisas em Ciências Humanas e Sociais cujos procedimentos metodológicos envolvam a utilização de dados diretamente obtidos com os participantes ou de informações identificáveis ou que possam acarretar riscos maiores do que os existentes na vida cotidiana. Diário Oficial da União; 2016. Disponível em: https://conselho.saude.gov.br/resolucoes/2016/Reso510.pdf

14. Pessoa JT, Dias FMRS, Souza SABA, Souza NP, Leal VS, Silva SA, et al. Food and nutritional surveillance: Coverage and characterization for children under 2 years of Northeast Brazil. Res. Soc. Dev. 2021;10(5):e27810514909. doi: 10.33448/rsd-v10i5.14909.

15. Brasil. Ministério do Desenvolvimento e Assistência Social, Família e Combate à Fome. Lei nº 14.601, de 19 de junho de 2023. Institui o Programa Bolsa Família em substituição ao Programa Auxílio Brasil. Diário Oficial da União; 2023. Disponível em: https://www.planalto.gov.br/ccivil_03/_ato2023-2026/2023/lei/l14601.htm

16. Silva CFR, Pires RJS, Loss IO, Guimarães EL. Influência do peso elevado no desenvolvimento motor de lactentes: uma revisão integrativa. Rev. Fam., Ciclos Vida Saúde Contexto Soc. [Internet]. 2020 Out;8(4):933-42.

17. Cocetti M, Taddei JA, Konstantyner T, Konstantyner TC, Barros Filho AA. Prevalence and factors associated with overweight among Brazilian children younger than 2 years. J Pediatr (Rio J). 2012;88(6):503-8. doi: https://doi.org/10.1590/S0021-75572012000600010

18. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Estratégia nacional para promoção do aleitamento materno e alimentação complementar saudável no Sistema Único de Saúde [recurso eletrônico]. Brasília: Ministério da Saúde; 2015. [Acesso em 2024 Fev 29]. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/estrategia_nacional_promocao_aleitamento_materno.pdf

19. Brasil. Ministério da Saúde. Secretaria de Atenção Primária à Saúde. Departamento de Promoção da Saúde. Instrutivo da estratégia de fortificação da alimentação infantil com micronutrientes em pó – NutriSUS [recurso eletrônico]. Brasília: Ministério da Saúde; 2022. [Acesso em 2024 Fev 29]. Disponível em: http://189.28.128.100/dab/docs/portaldab/publicacoes/instrutivo_nutrisus.pdf

20. Brasil. Ministério da Saúde. Secretaria de Atenção Primária à Saúde. Departamento de Promoção da Saúde. Caderno dos Programas Nacionais de Suplementação de Micronutrientes [recurso eletrônico]. Brasília: Ministério da Saúde; 2022. [Acesso em 2024 Fev 29]. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/caderno_programas_nacionais_suplementacao_micronutrientes.pdf

21. Rede PENSSAN. II Inquérito Nacional sobre Insegurança Alimentar no Contexto da Pandemia da COVID-19 no Brasil (II VIGISAN): relatório final. Rede Brasileira de Pesquisa em Soberania e Segurança Alimentar – PENSSAN. São Paulo, SP: Fundação Friedrich Ebert: Rede PENSSAN, 2022. [Acesso em 2024 Fev 29]. Disponível em: https://olheparaafome.com.br/wp-content/uploads/2022/06/Relatorio-II-VIGISAN-2022.pdf.

22. Silva WF, Silva HP, Laura HC, Rauber JL, Mota DM. Déficit de crescimento: um estudo de demanda. Revista Acadêmica de Medicina [Internet]. 2013;7(1). Disponível em: https://periodicos.ufpel.edu.br/index.php/RAM/article/view/3064

23. Fundo das Nações Unidas para a Infância (UNICEF). Relatório Sobre Nutrição na Infância 2021. UNICEF, New York; 2021 Set. [acesso em 2023 Fev 14] Disponível em: https://www.unicef.org/media/107241/file/%20Fed%20to%20Fail%20-%20BRIEF%20-%20PORTUGUESE%20-Final.pdf

24. Universidade Federal do Rio de Janeiro. Estado Nutricional Antropométrico da Criança e da Mãe: Prevalência de indicadores antropométricos de crianças brasileiras menores de 5 anos de idade e suas mães biológicas [internet]. UFRJ: Rio de Janeiro; 2022. [Acesso em 2023 Fev 14]. Disponível em: https://enani.nutricao.ufrj.br/index.php/relatorios/.

25. Andrade LMXG, Barbosa TLA, Mombelli MA. Estado Nutricional de Crianças e Adolescentes de Foz do Iguaçu, PR. Arq. Ciênc. Saúde Unipar [Internet]. 2023 Abr;27(3):1307-21. doi: https://doi.org/10.25110/arqsaude.v27i3.2023-016

26. Brasil. Ministério da Saúde. Secretaria de Atenção Primária à Saúde. Departamento de Promoção da Saúde. Guia alimentar para crianças brasileiras menores de 2 anos [internet]. Brasília: Ministério da Saúde; 2019. [acesso em 2023 Fev 14]. Disponível em: http://189.28.128.100/dab/docs/portaldab/publicacoes/guia_da_crianca_2019.pdf

27. Souza GR, Ribeiro-Silva RC, Felisbino-Mendes MS, Silva NJ, Andrade RCS, Pedroso J, et al. Time trends and social inequalities in infant and young child feeding practices: national estimates from Brazil's Food and Nutrition Surveillance System, 2008-2019. Public Health Nutr. 2023 Sep;26(9):1731-1742. doi: https://doi.org/10.1017/s1368980023001039

28. Silva GMF, Bennemann GD, Schmitt V, Saldan PC. Marcadores de consumo alimentar de crianças de 6 a 23 meses e 29 dias acompanhadas na atenção primária à saúde no município de Guarapuava, PR, entre 2016 e 2019. Rev. APS. 2022 out.-dez.; 25(4):821-37. doi: https://doi.org/10.34019/1809-8363.2022.v25.33466

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