

Incidence Of Malnutrition In Children Under Five Years Of Age Related To Growth Curves. San Simón Parish

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Abstract: This study assessed the prevalence and severity of malnutrition in children under 5 years old in the Parish of San Simón, Guaranda canton, Ecuador, from October 2023 to February 2024, using the World Health Organization (WHO) growth curves as a reference. A quantitative approach with a non-experimental, cross-sectional, and descriptive design was employed. The studied population included 65 children, without establishing a representative sample. Sociodemographic characteristics, anthropometric measurements, and nutritional status were analyzed using the z-scores of the WHO growth curves. The results revealed a chronic malnutrition prevalence of 30.77%, global malnutrition of 4.62%, and a combined prevalence of overweight and obesity of 10.77%. A higher proportion of boys with stunted growth compared to girls was observed. Additionally, the coexistence of problems of both deficit and excess weight in the studied population was evidenced. These findings highlight the importance of implementing effective prevention and treatment strategies for malnutrition, as well as addressing overweight and obesity, considering the community's particularities and promoting healthy eating habits and appropriate physical activity.

Keywords: Child malnutrition, prevalence, San Simón Parish, WHO growth curves, nutritional interventions, overweight, obesity, Ecuador. *Conservan el orden del idioma principal.*

INTRODUCTION

Malnutrition during the early stages of life is a significant global challenge, adversely affecting children's physical and cognitive development. According to the UNICEF/WHO/World Bank Joint Child Malnutrition Estimates (2023), in 2022, approximately 22.3% of children globally—around 148.1 million—experienced stunted growth. In Ecuador, this issue is equally concerning; the National Child Malnutrition Survey (ENDI) for 2022–2023 reported that 20.1% of children under two years and 17.5% of those under five years suffer from chronic malnutrition. In Bolívar province, the second-highest national rate of chronic malnutrition in children under two years (30.3%) and the third-highest in children under five years (28.1%) were recorded (Mendoza et al., 2023).

In an initial exploration at the San Simón Health Center, located in the parish of the same name, a high incidence of children with signs of malnutrition was detected. This finding highlights the considerable prevalence of this issue in the region and indicates the urgent need for studies that allow early identification and intervention. Considering that approximately 241 children are attended in this health unit, the absence of corrective actions could result in increased childhood morbidity and mortality rates in the area and perpetuate a cycle of poverty and health deterioration within the community.

Malnutrition represents a systemic and nonspecific pathological condition arising from inadequate nutrient intake and assimilation needed to meet essential energy and nutritional demands. This condition is characterized by clinical manifestations, alterations in anthropometric measurements such as low weight and reduced height, and biochemical disorders due to a lack of macro and micronutrients essential for proper growth and functioning of the body (Moreta et al., 2019). Diagnosis relies on assessing three main anthropometric alterations: wasting (low weight for height), stunting (low height for age), and underweight (low weight for age).

Malnutrition is a multifactorial disorder. Although it has been historically linked to poverty and food insecurity, it can also result from food intolerances or allergies, recurrent infections, and various socioeconomic factors (Cortez & Pérez, 2023). To comprehensively understand the causes and effects associated with malnutrition, a detailed analysis of the multiple levels of contributing factors is crucial, allowing targeted interventions to address this public health issue effectively.

Malnutrition can be classified according to factors varying in immediacy and context, including immediate, underlying, basic, child-related, and environmental factors (Chimborazo & Aguaiza, 2023; Urrego et al., 2022; Bourne & Rueda, 2022; Tirano et al., 2020). Immediate factors include poor nutrient intake and infectious diseases; underlying factors include food insecurity, lack of access to basic services, and inadequate maternal care; basic factors encompass poverty, limited education, and unfavorable geographical location; child-related factors include insufficient breastfeeding, early weaning, and congenital biological conditions.

Malnutrition manifests through a range of physical and functional effects that compromise well-being, such as low weight and height for age, dry and flaky skin, hair loss or changes, abdominal distension, lower limb edema, and muscle atrophy (Cortez & Pérez, 2023). Additionally, it can lead to significant delays in cognitive and motor development, learning and memory issues, irritability, apathy, behavioral changes, difficulties in language acquisition, and poor motor coordination (Quintana et al., 2020).

Malnutrition profoundly affects the immune system, reducing the body's natural defenses against pathogens and increasing vulnerability to infections, resulting in more severe and prolonged disease episodes (Morales et al., 2023). Metabolically, malnutrition can lead to growth arrest, anemia, hypoproteinemia, alterations in carbohydrate and protein metabolism, and vitamin and mineral deficiencies, which further compromise health and development (Kelsey et al., 2021).

Child malnutrition requires appropriate and specific nutritional interventions to prevent permanent consequences on growth and development. Periodic nutritional assessments are essential to classify the condition, determine its severity, and design prevention and treatment strategies, as well as to monitor the effectiveness of nutritional programs to ensure optimal development and well-being during childhood (Khaliq et al., 2022).

Various studies have examined child malnutrition in Ecuador. Mejia (2023) found that nearly a quarter of children under five suffer from malnutrition, particularly severe in the Sierra and among indigenous communities. Juma (2022) reported a notable stunting prevalence of 22.64% among preschoolers in Tulcán. Sumba and Vásquez (2022) observed that a significant percentage of children under two experienced underweight or global malnutrition, with nearly half suffering from chronic malnutrition in Sucúa. Gómez (2022) identified a 46.15% prevalence of child malnutrition at a health center in Guayaquil, with higher incidence in infants aged 0–7 months, highlighting the urgency of early interventions and nutrition education.

Based on this information, this study proposes to evaluate the prevalence and severity of malnutrition in children under five years in the San Simón Parish from October 2023 to February 2024 using the World Health Organization growth charts as a reference.

MATERIALS AND METHODS

The study covers a population of 65 children aged 0 to 5 years who attended the San Simón Health Center, located in the parish of the same name in Guaranda canton, Ecuador, between October 2023 and February 2024. All children who visited the center during this period were included in the study to provide a comprehensive and detailed analysis of the nutritional status within this cohort (INEC, 2024). The statistical analysis was conducted with a 95% confidence level and an error margin of 2–5% to ensure data reliability for this population size.

The variables analyzed in this research include:

1. **Sociodemographic characteristics:** age in years, gender (male/female), and self-identified ethnicity (Indigenous/Mestizo).
2. **Anthropometric measurements:** weight in kilograms and height in centimeters.
3. **Nutritional status:** WHO growth curve z-scores for indicators such as height-for-age, weight-for-age, BMI-for-age, and weight-for-length or height.

Sociodemographic and anthropometric data were collected using the Health Care Registration Platform (PRAS). These data were used to develop tables and graphs representing the current nutritional status of the patients, using WHO growth curves as a reference (WHO, 2006; de Onis et al., 2007).

Data analysis was conducted using SPSS software. Cross-tabulation analyses were performed to correlate age with variables such as self-identified ethnicity, gender, BMI, and weight-for-length or height. Additionally, measures of central tendency (mean, median, mode) and measures of dispersion (range) were calculated for the quantitative variables of weight and height within each age group.

Nutritional status assessment was determined using WHO growth curve z-scores, applying the following indicators and cut-off points: height-for-age (normal, monitoring, stunting, severe stunting), weight-for-age (normal, monitoring, underweight), BMI-for-age (normal, monitoring, wasted, overweight), and weight-for-length or height (normal, monitoring, wasted, overweight, obesity) (WHO, 2006; WHO, 2009).

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki for research involving human subjects. Participation was voluntary, ensuring the confidentiality of all data collected. This project received approval from the Ethics Committee of the institution affiliated with the researchers.

RESULTADOS Y DISCUSIÓN

Results are presented in the same order as described in the methodology.

Table 1 summarizes the sociodemographic characteristics of children aged 0 to 5 years in the San Simón parish, according to records from the Health Care Registration Platform. This information is essential for understanding the demographic composition of the child population studied.

Table 1. Sociodemographic Characteristics

Variables		Count	Percentage
Sex	Man	33	50.77%
	Woman	32	49.23%
Age	0	25	38.46%
	1	16	24.62%
	2	8	12.31%
	3	5	7.69%
	4	7	10.77%
	5	4	6.15%
Self-identification	Indigenous	21	32.31%
	Mestizo	44	67.69%

Source: San Simón Parish Health Care Registration Platform

The sex distribution among the children is nearly equal, with 50.77% male and 49.23% female. The majority of children (38.46%) are under one year of age. Regarding self-identified ethnicity, 67.69% identify as mestizo, while 32.31% identify as Indigenous, reflecting the cultural diversity of the region. This aligns with findings indicating that ethnic and cultural diversity can influence nutritional and health outcomes in early childhood (Gatica-Domínguez et al., 2020, Black et al., 2013).

Table 2 presents a detailed analysis of the anthropometric measurements of children aged 0 to 5 years in the San Simón parish. This dataset provides a comprehensive overview of nutritional status through various indicators such as weight, height, and multiple z-scores, including height-for-age, weight-for-age, BMI-for-age, and weight-for-height or length, which are essential for accurately assessing growth and malnutrition in pediatric populations (de Onis et al., 2007).

Table 2. Anthropometric Measurements and Nutritional Status Indicators

Years	Weight	Size	Size / Age / Z	Size / Age / Z	BMI / Age / Z	Weight / size or length / Z
0	8.8	69.5	-2.15	-0.61	0.9	0.69
0	6.8	61.5	-1.16	-0.26	0.56	0.73
0	3.5	50	-0.49	0.09	0.49	0.56
0	8.4	67.6	-1.37	-0.24	0.76	0.78
0	8	65.7	0.83	1.16	0.91	0.88
0	8	65	-2.93	-0.88	1.16	1.15
0	9	68	-2.41	-0.21	1.62	1.45
0	8.8	67.2	-2.27	-0.18	1.56	1.46
0	7.4	70	-2.16	-2.28	-1.41	-1.61
0	9.8	69.8	-0.39	1.18	1.84	1.85
0	9.9	70	-0.9	0.97	1.96	1.91
0	4.1	50	-2.33	-0.54	1.12	2.26
0	9.2	65	-1.72	1.07	2.71	2.75

0	6.7	62.5	-4.18	-2.27	0.47	0.34
0	5.9	57	-3.22	-1.31	0.82	1.59
0	7.8	62.2	-1.65	0.49	1.92	2.05
0	8.4	61.7	-1.81	1.13	2.89	2.98
0	7.6	68	-0.91	-0.66	-0.2	-0.21
0	7	62	-2.97	-1.12	0.88	1.01
0	8.4	66.7	-0.91	0.43	1.27	1.27
0	8.5	67	-1.46	0.19	1.39	1.3
0	10.4	71	-0.75	1.39	2.45	2.3
0	8.6	64	-0.97	1.22	2.36	2.39
0	4.4	50	-2.65	-0.4	1.57	2.85
0	5.7	53.2	-2	0.73	2.63	3.49
1	8.4	69.8	-3.37	-1.69	0.51	0.03
1	9.9	76	-0.65	-0.1	0.4	0.24
1	9.6	74.5	-2.45	-0.95	0.77	0.25
1	9	71.6	-2.21	-0.85	0.64	0.3
1	9.2	70.9	-2.08	-0.45	1.06	0.77
1	9.5	76	-1.84	-1.03	0.14	-0.26
1	8.8	73	-2.91	-1.68	0.16	-0.39
1	9.2	76.8	-1.92	-1.5	-0.46	-0.84
1	10.9	77	-1.24	0.32	1.45	1.14
1	9.0	78	-0.28	-1.16	-1.4	-1.39
1	8	69.1	-1.91	-0.92	0.27	0.03
1	9.7	76.4	-1.87	-0.64	0.7	0.19
1	9	75.5	-2.81	-1.65	0.22	-0.45
1	9.4	73	-2.21	-0.45	1.2	0.76
1	9.5	73.4	-1.57	-0.12	1.1	0.78
1	9.8	72	-1.63	0.35	1.77	1.45
2	12	84	-1.81	-0.56	0.86	0.59
2	10.5	82.4	-1.55	-1.28	-0.46	-0.64
2	12	90	0.3	-0.42	-0.95	-0.9
2	11.5	84.5	-2.74	-1.58	0.34	-0.05
2	12	86.6	-0.82	-0.45	0.06	-0.07
2	12.6	89	0.18	0.3	0.23	0.18
2	11.5	87	-1.68	-1.2	-0.2	-0.38
2	12	85.2	-1.7	-0.55	0.74	0.53
3	14.6	98.6	-0.87	-0.74	-0.28	-0.31
3	15	93.3	-1.65	-0.14	1.29	1.18
3	11.5	86.1	-2.5	-1.59	0.1	-0.17
3	15	93.3	-1.76	-0.21	1.29	1.18
3	18	100.2	-0.5	0.86	1.68	1.74
4	16.5	102	-0.47	-0.02	0.42	0.42
4	15.5	101.1	-1.17	-0.81	-0.08	-0.13
4	14	98.2	-1.61	-1.46	-0.62	-0.74
4	12	97	-2.02	-2.78	-2.24	-2.46
4	15.5	102.2	-0.32	-0.38	-0.3	-0.26
4	16.2	100.5	-0.54	0.04	0.54	0.57
4	14	100	-1.71	-1.59	-0.76	-0.65
5	16.5	103.4	-1.59	-0.92	0.12	0.16
5	17	101.1	-1.78	-0.51	0.86	0.17
5	19	103.8	-1.51	0.08	1.38	0.18
5	16.2	106.	-1.06	-1.06	-0.58	0.15

Source: San Simón Parish Health Care Registration Platform

The analysis of anthropometric and nutritional data of children aged 0 to 5 years in the San Simón Parish reveals diverse patterns of growth and development as follows:

1. **Children aged 0 years** show wide variability in weight and height, with weights ranging from 3.5 kg to 9.9 kg (mean: 7.58 kg) and heights from 50 cm to 71 cm (mean: 64.92 cm). Z-scores for height-for-age, weight-for-age, BMI-for-age, and weight-for-length indicate the presence of stunting, underweight, wasting, and overweight/obesity in some cases, suggesting the coexistence of different nutritional statuses within this age group.
2. **Children aged 1 year** present weight and height distributions consistent with expectations for this age, with weights ranging from 8.0 kg to 10.9 kg (mean: 9.27 kg) and heights from 69.1 cm to 78 cm (mean: 73.95 cm). Z-scores of nutritional indicators suggest a lower prevalence of stunting and underweight compared to the 0-year group, although some cases of wasting and overweight are observed.
3. **Children aged 2 years** display anthropometric results indicating growth consistent with expectations for this age. Weights range from 10.5 kg to 12.6 kg (mean: 11.78 kg), and heights range from 82.4 cm to 90 cm (mean: 86.33 cm). Z-scores show a lower prevalence of stunting, underweight, and wasting compared to younger age groups.
4. **Children aged 3 years** exhibit notable diversity in physical development, with weights ranging from 11.5 kg to 18 kg (mean: 14.8 kg) and heights from 86.1 cm to 100.2 cm (mean: 94.32 cm). Z-scores suggest a lower prevalence of stunting and underweight, although some cases of overweight are observed.
5. **Children aged 4 years** present anthropometric results reflecting typical growth and development for this age, with weights ranging from 12 kg to 16.5 kg (mean: 14.82 kg) and heights from 97 cm to 102.2 cm (mean: 100.14 cm). Z-scores show less variability compared to younger age groups, although some cases of stunting, underweight, and wasting are noted.
6. **Children aged 5 years** demonstrate growth patterns consistent with expectations for their age, with weights ranging from 16.2 kg to 19 kg (mean: 17.18 kg) and heights from 101.1 cm to 106 cm (mean: 103.58 cm). Z-scores suggest a lower prevalence of stunting and underweight compared to previous age groups, although some cases of overweight are observed.

The assessment of nutritional status in children under 5 years of age is crucial for identifying growth and development problems. Using the z-scores of the World Health Organization (WHO) growth charts, various anthropometric indicators were analyzed in a sample of 65 children from the San Simón Parish, in the canton of Guaranda, Ecuador. These indicators included height-for-age, weight-for-age, body mass index (BMI)-for-age, and weight-for-length or height. The results of this nutritional analysis are presented below:

Table 3. Nutritional Status

Variables		Count	%Total N in table
Size for age	Normal	24	36.92%
	Normal/Tracking	21	32.31%
	Short stature	17	26.15%
	Severe Short Stature	3	4.62%
Weight for age	Normal	55	84.62%
	Normal/Tracking	7	10.77%
	Underweight	3	4.62%
BMI for age	Normal	47	72.31%
	Normal/Tracking	11	16.92%
	Emaciated	1	1.54%
	Overweight	6	9.23%
Weight for length or height	Normal	47	72.31%
	Normal/Tracking	5	7.69%
	Emaciated	1	1.54%
	Overweight	7	10.77%
	Obesity	1	1.54%

Source: San Simón Parish Health Care Registration Platform

The results of the nutritional analysis of children under five years of age in the San Simón Parish revealed important findings. Regarding height-for-age, 36.92% (n=24) of the children had normal height, while 32.31% (n=21) fell into the normal/monitoring category. However, 26.15% (n=17) exhibited stunting, and 4.62% (n=3) presented severe stunting, indicating that 30.77% (n=20) of the children had some degree of growth delay. In contrast, weight-for-age showed more favorable results, with 84.62% (n=55) of the children having normal weight, 10.77% (n=7) in the normal/monitoring category, and only 4.62% (n=3) underweight. BMI-for-age also produced varied results, with 72.31% (n=47) of the children having a normal BMI, 16.92% (n=11) in the normal/monitoring category, 1.54% (n=1) showing wasting, and 9.23% (n=6) presenting overweight. These data suggest the coexistence of both underweight and overweight issues within the studied population. Finally, the analysis of weight-for-length or height showed that 72.31% (n=47) of the children had normal weight, 7.69% (n=5) fell into the normal/monitoring category, 1.54% (n=1) exhibited wasting, 10.77% (n=7) were overweight, and 1.54% (n=1) were obese. These results confirm the presence of both undernutrition and overnutrition issues among children in the San Simón Parish.

Discussion (Integrated with Results)

The results of this study on the nutritional status of children under five years of age in the San Simón Parish, Guaranda canton, Ecuador, show findings that are both similar to and different from those reported in previous research.

Regarding the prevalence of chronic malnutrition, the present study found that 30.77% of children exhibited some degree of stunting, which is slightly lower than the 35.91% reported by Martínez et al. (2021). However, it is important to highlight that in both cases, chronic malnutrition represents a significant public health issue within the studied populations. Additionally, Ramos et al. (2020) reported a stunting prevalence of 25.4% among children, with higher rates in boys (27.34%) compared to girls (23.33%), which aligns with the present study's findings where a higher proportion of boys were observed with stunting compared to girls.

In terms of global malnutrition, this study found a prevalence of 4.62%, which is lower than the 8.98% reported by Martínez et al. (2021) and similar to the 4.6% found by Guamialamá et al. (2021). These differences may be attributed to variations in the socioeconomic and demographic characteristics of the populations studied, as well as differences in the criteria used to define global malnutrition.

Regarding overweight and obesity, this study found a combined prevalence of 10.77%, which is similar to the 11.2% reported by Bernabeu and Sánchez (2019). These findings highlight the importance of addressing not only malnutrition but also overweight in children under five years, as both conditions can have adverse short- and long-term health consequences.

CONCLUSIONS

The prevalence of chronic malnutrition (30.77%) and global malnutrition (4.62%) among children under five years of age in the San Simón Parish underscores the urgent need to address this critical public health issue. Although the results present some discrepancies compared to previous research, these can be explained by differences in the socioeconomic and demographic characteristics of the studied populations, as well as the criteria applied to define malnutrition. It is imperative to implement effective prevention and treatment strategies tailored to the specific characteristics of the community to ensure healthy child development.

This study provides a robust foundation for developing nutritional interventions specifically designed to meet the needs of children under five years in the San Simón Parish. The precise identification of age groups most vulnerable to malnutrition and overweight allows for the appropriate targeting of efforts and the optimization of available resources. Strengthening nutritional surveillance systems and child growth monitoring is vital. Additionally, it is crucial to train healthcare personnel and caregivers in the early detection and effective management of nutritional problems. Intersectoral collaboration and community participation are essential to achieving a sustainable impact in improving the nutritional status of children.

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