



# Nutritional status and anemia in children of the Shuar ethnic group: A single-center observational study

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## Abstract

**Introduction:** Nutritional status is a health condition that assesses nutritional pathologies such as anemia and malnutrition in vulnerable age groups. The objective of this study was to determine the relationship between nutritional status and anemia in the Shuar population from 6 months to 5 years of age from the Shimpis Community, Logroño Canton, Morona Santiago-Ecuador, from August 2018-August 2019.

**Methods:** The present cross-sectional study. A total of 235 samples and 163 samples were taken from Epi Info. The data were obtained from medical records and the Nutritional Food Surveillance System, and nutritional status was analyzed using WHO Anthro software. Anemia was based on hemoglobin reference values established by the World Organization and the Ministry of Public Health. The data were tabulated in the statistical program SPSS 25. Simple tables of frequency and percentage were made, and tables of association considering *P* value <0.05 statistically significant.

**Results:** A total of 163 children were included, 46.0% men and 54% women, and the predominant age group was 2-5 years, with a percentage of 56.4%. The anemia frequency was 38%. There were 42 children with anemia and chronic malnutrition, 10 with acute malnutrition, 3 with global malnutrition, 2 with overweight, and 5 with eutrophy. When relating both variables, a statistically significant *p*-value was obtained ( $P < 0.001$ ).

**Conclusions:** Age group is a predisposing factor in the alteration of nutritional status in children. It was also observed that altered nutritional status has a greater predisposition to anemia.

**Keywords:** MESH: nutritional status, body mass index, weight for age, anemia, infant, pre-school.

## Introduction

Despite the constant anthropometric evaluations in health centers, children with altered nutritional status

persist. Another pathology that prevails in the child population is anemia, caused by inadequate intake of micronutrients; it is determined biochemically as a deficit of erythrocytes or low hemoglobin values (< 11 g/dl-

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< 11.5 g/dl). Anemia and altered nutritional status are deficiency pathologies of malnutrition [1, 2].

These diseases are frequent in underdeveloped countries, which lack basic services and access to essential foods (meat, fruit, cereals, milk). In addition, they are the main problems that compromise motor and cognitive development in early childhood because it is a stage of constant growth and high nutritional requirements [3- 5].

At the national level, Morona Santiago is considered one of the provinces with the highest malnutrition rate, with low weight linked to anemia predominating in children under five. Although it is a relevant problem, studies have yet to provide current data on nutritional evaluation and the type of deficiency diseases in children from these communities [1, 6, 7].

The objective of this study was to answer the following research question through a cross-sectional study: What is the relationship between nutritional status and anemia in the Shuar population from 6 months to 5 years of age in the Shimpis community, Logroño canton, Morona Santiago-Ecuador, from August 2018-August 2019?

## Materials and methods

### Type of Study

This research work is a quantitative, analytical, cross-sectional, nonexperimental study.

### Study area

The study was carried out at the Shimpis Health Center corresponding to district 14D03, located in the Shimpis parish of the Logroño canton, Morona Santiago province.

### Universe and Sample

#### Universe

For the preparation of the study, all the children of the Shuar ethnic group from 0 to 5 years of age who attended the Shimpis health center in the period August

2018 - August 2019 were taken into account. The population has 235 children in the said health center.

### Selection and sample size

The value of the expected proportion was taken based on the ENSANUT-ECU study of 2012, where a prevalence of anemia of 25.7% was recorded [8]. The EPI-INFO program (software developed for statistical analysis) was used to calculate the study sample, with a reliability level of 95% and a margin of error of 3.75. Sample Size: 163.

### Sampling

The sampling was carried out by the discard method, taking into account the inclusion and exclusion criteria (population from 6 months to 5 years).

### Analysis and observation unit

The data were collected from the medical records and the SIVAN found in the Statistics department of said health center; they were analyzed in the SPSS version 25 program (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp). Their results were presented in frequency and percentage tables and association tables designed in Excel 2013. In case of help managing the computer system and searching for the clinical records, the collaboration of the doctors who work in said institution was relied on.

### Inclusion criteria:

Clinical histories are included with the study variables of all children from 6 months to 5 years of age of the Shuar ethnic group who attended the Shimpis health center for control by external consultation in the period August 2018 - August 2019.

### Exclusion criteria

Children with incomplete medical histories, with data that record reasons for consultation other than the reason for consultation for control.

- Children with cerebrovascular diseases

- Children with physical disabilities/other comorbidities (neoplastic, metabolic).

### Variables

Dependent variable: anemia. Intervention variables: age and sex. Independent variables: nutritional status.

### Method

Review of medical records and review of the SIVAN program (Nutritional Food Surveillance System)

### Instrument

SIVAN, medical records, data collection form, WHO Anthro software, SPSS (Statistical Package for the Social Sciences), Microsoft Excel 2013.

### Technique

Medical records that met the inclusion criteria and the SIVAN (System of Nutritional Food Surveillance), a program that records the controls of children's growth, development, and hemoglobin levels, were reviewed. Data on anthropometric measurements (weight, height) and hemoglobin values of all Shuar children from 6 months to 5 years old who attended the Shimpis health center for control were collected. These data were collected in a form prepared by the author of this work.

For the evaluation of nutritional status, the WHO Anthro software, established by the World Health Organization in 2007, was used, consisting of anthropometric indicators and z-score deviations, which were jointly analyzed to determine the nutritional status of each child. Anemia was defined based on hemoglobin reference values according to age (6 months-5 years) established by the Ministry of Public Health and the World Health Organization. The data were stored in a database created in SPSS version 25, and the tables were designed in Excel 2013. Training: The research was carried out through a bibliographic review and reviews of the work by the director and thesis tutor.

### Results analysis plan

All the study information was stored in a database created in the SPSS VERSION 25 program, where the results were analyzed.

Graphics and simple tables of frequency and percentage were used; cross tables were used to analyze and associate the study variables.

For the relationship between the variables, the chi-square test was used. Values of  $P < 0.05$  were considered statistically significant.

### Procedure to Guarantee Ethical Aspects

Once the purpose of the research was disclosed and with prior authorization, the information collected was used solely for the analysis and development of the study. The clinical histories were obtained confidentially and were not disclosed to people outside of this project.

### Biases

To avoid interviewer, information, and memory biases, the principal investigator always kept the data with a guide and records approved in the research protocol. Observation and selection bias was avoided by applying the participant selection criteria. All the clinical and paraclinical variables of the previous period were recorded. Two researchers independently analyzed each record in duplicate, and the variables were recorded in the database once their concordance was verified.

## Results

### Participants

A total of 163 patients were included in the study.

### General characteristics of the population

The group had a mean age of  $2.5 \pm 2$  years. The socio-demographic variables are presented in Table 1. The determination of anthropometric indicators is shown in Table 2. Regarding the body mass index by age, 83.4% (n=136) were average; overweight was 3.1%, and obesity was 1.2%. In length/height for age, 66.3% (n=108)

were moderate, 29.4% had growth retardation, and 4.3% had severe growth retardation. In weight for age, 55.2% (n=90) were average, followed by 39.3% (n=64) with low weight and 1.2% (n=2) severely underweight.

**Table 1.** Sociodemographic variables in the study group.

Sociodemographic variables		Frequency No.=163	Percentage
Sex	Man	75	46%
	Women	88	54%
Age group	6 -11 months	27	16.6%
	12 to 23 months	44	27.0%
	2 to 5 years	92	56.4%

**Table 2.** Determination of Anthropometric Indicators

	Frequency No.=163	%
<b>BMI/Age</b>		
Normal	136	83.4
Overweight	5	3.1
Obesity	2	1.2
Under weight	19	11.7
Low Severe Weight	1	0.6
<b>Length-Height/Age</b>		
Normal	108	66.3
Growth retardation	48	29.4
Severe delay	7	4.3
<b>Weight/Age</b>		
Normal	90	55.2
High Weight	5	3.1
Severe High Weight	2	1.2
Under weight	64	39.3
Low Severe Weight	2	1.2
<b>Weight/Height/Length</b>		
Normal	136	83.4
High Weight/Height	5	3.1
Very High	2	1.2
Weight/Height		
Low Weight/Height	19	11.7
Severe Low	1	0.6
Weight/Height		

Regarding weight for height, we have 83.4% (n=136) with average weight followed by 11.7% (n=19) with low weight for their height and 0.6% (n=1) severely low weight for height (Table 2). The nutritional status is presented in Table 3; 53.4% (n=87) presented normality, followed by chronic malnutrition with 30.7% (n=50).

**Table 3.** Nutritional status in children from 6 months to 5 years.

Nutritional condition	Frequency n=163	Percentage
Normal	87	53.4%
Acute malnutrition	14	8.6%
Chronic malnutrition	15	30.7%
Global malnutrition	5	3.1%
Overweight	5	3.1%
Obesity	2	1.25

### Anemia and degrees of severity

Thirty-eight percent of the children had anemia, of which mild anemia was the most prevalent (Table 4).

**Table 4.** Degrees of anemia in children from 6 months to 5 years.

Nutritional condition	Frequency n=163	%
Mild anemia 10.9-10.0 G /DL- 11.4-11.0 G/DL	87	53.4%
Moderate anemia 9.9-7.0 G/DL-10.9-8.0G/DL	14	8.6%
Severe anemia < 7.0 G/DL- <8.0	15	30.7%
Normal > 11.0 G/DL- > 11.5 G/DL	5	3.1%

### Bivariate analysis

When relating the variables sex with nutritional status, we found that 41 male patients had altered nutritional status, with chronic malnutrition predominating (n=24). Unlike the female sex, 35 patients presented altered nutritional status, and similarly, chronic malnutrition predominated (n=26). According to the chi-square test,

a statistically insignificant value was obtained ( $P=0.271$ ), so there was no relationship between these two variables. When relating the nutritional status with the age groups, it was accepted that between 6 months and 11 months, six patients presented chronic malnutrition, four with global malnutrition, and 4 with overweight; between 1 year and one year 11 months: 13 patients showed chronic malnutrition, eight patients with acute malnutrition and one patient with global malnutrition, and between 2 and 5 years: 31 patients had chronic malnutrition, six patients with acute malnutrition, one patient with overweight and 2 with obesity. According to the chi-square test, a statistically significant value was obtained ( $P=0.001$ ), which is why being older predisposes one to have an altered nutritional status (Table 5).

When relating sex to the degree of anemia, 34/75 male patients had anemia versus 28/88 females ( $P$

$>0.05$ ). The age group with the highest prevalence of anemia was between 2 and 5 years ( $n=34$ ), followed by between 1 and 1 year and 11 months with 19 patients, and only nine patients between 6 and 11 months presented anemia ( $P >0.05$ ).

The association between nutritional status and anemia in the population aged six months to 5 years was that of the 87 regular patients, 5 presented anemia. Of the 76 patients whose nutritional status was affected, 42 patients presented with anemia with chronic malnutrition, ten patients with anemia with acute malnutrition, three patients with anemia with global malnutrition, and 2 with overweight anemia. The significance calculated by chi-square was  $<0.001$ , a statistically significant value for which an affected nutritional status predisposes to anemia (Table 6).

**Table 5.** Association between nutritional status, sex and age.

variables	Nutritional condition						P
	Normal No.=87	acute mal- nutrition No.=14	Chronic malnutrition No.=50	Global Mal- nutrition no=5	Over- weight no=5	Obesity N=2	
Sex	Man	3.4	9	24	4	3	0.271
	Women	53	5	26	1	2	
Age	6-11 months	13	0	6	4	4	<0.001
	12-23 months	22	8	13	1	0	
	2-5 years	52	6	31	0	1	

**Table 6.** Association between nutritional status, sex, and age.

Variables	Anemia		P	
	Yes N=62	No N=101		
Sex	Man	3.4	41	0.076
	Women	28	60	
Age	6-11 months	9	18	0.673
	12-23 months	19	25	
	2-5 years	3.4	58	
Nutri- tional condi- tion	Normal	5	82	0.001
	D.acute	10	4	
	D. chronic	42	8	
	overall D.	3	2	

Overweight	2	3
Obesity	0	2

## Discussion

Anemia and affection of the nutritional state are some of the leading dietary diseases in Ecuador, which affect vulnerable groups such as children under five years of age, becoming the most common reason for consultation in primary care institutions, mainly in cities with lower income, where poor primary sanitation conditions are reflected. When there is a mismatch between intake and nutritional requirements,

malnutrition tends to develop, causing an increase in the prevalence of infant morbidity and mortality [8].

Of the 163 children evaluated, all were indigenous, predominantly female (54.0%), and aged from 2 to 5 years, similar to the study population of Díaz et al. in children under five years, where 54.4% were indigenous, predominantly female (51.2%) and aged between 36 and 59 months. According to anthropometric indicators, this study presented a higher percentage of low weight for the period (39.3%), followed by growth retardation (29.4%), low weight for height (11.7%), overweight (3.1) and obesity (1.2%), unlike the Díaz study, where growth retardation prevailed at 52.6%, followed by 15.6% with low weight for age, 2.4% low weight for height, 2.3% overweight and 0.4% obesity [9].

According to the nutritional status, of the 163 children evaluated, 53.4% were average, followed by malnutrition (42.4%) and overweight (3.1%). When compared with the data of the study carried out by Nambiema in children under five years of age in Togo-Africa, normal nutritional status also prevails (90.2%). However, malnutrition had a low percentage (7.4%), followed by overweight (2.4%). Regarding age, the alteration in nutritional status predominated between 2-5 years, unlike the Nambiema study, where malnutrition prevailed between 6-23 months [10].

The prevalence of anemia was 38% (of the total of 163 children with hemoglobin values), similar to the majority obtained by González in children under five years of age in the population of Huancavelica-Peru (36.2%) and according to the WHO. (42.6%). According to the decreased degrees of hemoglobin, mild anemia prevailed in 32.5%, followed by moderate anemia at 4.3% and severe anemia at 1.2%. Unlike the Nambiema study, moderate anemia lasted at 42.7%, mild anemia lasted at 25.6%, and 2.6% had severe anemia [10-12].

According to the anemia-sex relationship, anemia prevailed in the male sex (n=34) compared to the female sex (n=28); the same as in the study by Francis Pérez in children under five years of age where the male

sex predominated (n=16) (female sex n=7). When relating anemia to the age group, a predominance was observed between 2 and 5 years (n=34), unlike the study by Francis Pérez, where it predominated between 6 and 23 months (n=17), and Nelly Zabaleta, who prevailed between 6 and eight months (n=25). However, when relating sociodemographic characteristics with anemia, a statistically significant value was not obtained ( $P=0.076$  and  $P=0.673$ ) [7, 13].

When relating nutritional status to anemia, according to the study by Francis Pérez, of 53 eutrophic children, ten presented anemia; of 41 malnourished children, 8 had anemia; of 5 overweight children, 1 had anemia; and of 6 obese children, 4 had anemia. When compared with my study, of 87 eutrophics, 5 had anemia; of the 69 patients with malnutrition, 55 had anemia with a high prevalence; and of the five overweight patients, 2 had anemia. According to the chi-square test, a statistically significant value was obtained ( $P < 0.001$ ), similar to the study carried out by Segarra Ortega in children from 6 to 59 months, whose relationship between nutritional status and anemia was statistically significant ( $P < 0.05$ ), suggesting that patients who present altered nutritional status are predisposed to anemia [13, 14].

## Conclusions

The sex that prevailed in the study was female, and according to age, patients between 2 and 5 years predominated. In the Shimpis community, more than half of the patients evaluated had an average weight; however, chronic malnutrition had a significant prevalence, followed by acute malnutrition, and obesity was obtained in a lower majority. When analyzing hemoglobin levels, anemia was found in less than half of the population; despite this, its prevalence is still alarming. According to the results of this study, there was a relationship between the age group and nutritional status, where it was observed that the older the age, the greater the predisposition to affect the nutritional status. However, age group was not related



to anemia. A significant relationship between nutritional status and anemia was also observed, presenting in more than half of the cases with affected nutritional status and even in eutrophic patients despite the low percentage. Patients between 6 months and five years are predisposed to present greater affectation in their nutritional status, for which greater prepregnancy, gestational, and postpregnancy control will benefit the development and growth of the pediatric patient.

### Abbreviations

WHO: World Health Organization.

### Supplementary information

No supplementary materials are declared.

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Not declared.

### Author contributions

Erika Eliana Bravo Garay: Conceptualization, data curation, formal analysis, fundraising, research, writing - original draft.

Julio César Ojeda Sánchez: Methodology, project administration, resources, software, supervision, validation, visualization, writing - review and editing.

## References

- Hurtado C, Mejía C, Mejía F. Malnutrition due to excess and deficit in children and adolescents, Antioquia, 2015. *Rev Fac Nac Salud Pública*. 2017;35(1):58-70. <http://www.scielo.co/386X-58>
- Selem -Solís JE, Alcocer-Gamboa A, Hattori-Hara M, Esteve -Lanao J, Larumbe-Zabala E. Nutrimetry : BMI assessment as a function of development. *Endocrinol Diabetes Nutr (Engl Ed)*. 2018 Feb;65(2):84-91. English Spanish. doi : 10.1016/j.endinu.2017.10.009. Epub 2017 Dec 21. PMID: 29276173 . <https://doi.org/10.1016/j.endinu.2017.10.009>
- Apaza D, Celestino S, Tantaleán K, Herrera M, Alarcón E, Gutiérrez C. Overweight, obesity and the coexistence of chronic malnutrition in children under 5 years of age. *Rev Peru Epidemiol*. 2014;18(2):1-5 . <https://www.redalyc.org/203131877005>
- Martínez L, Rodríguez M, AC, Vargas N, Peña G. Anemia as a sign of malnutrition in children in a home nutritional recovery program in Antioquia, Colombia. *Univ and Health*. 2014;16(1):103-11. <http://www.scielo.org.co/40001>
- Angarita P, Avila AM, Gomez KJ, Rodelo MC, Sandoval AV. Relationship of iron deficiency anemia with malnutrition. *Rev Biociencias*.2017;12(1):1-

Patricia Vanegas Izquierdo: Methodology, project administration, resources, software, supervision, validation, visualization.

All authors read and approved the final version of the manuscript.

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### Availability of data and materials

Data were collected from medical files and are not publicly available due to patient confidentiality but are available through the corresponding author under clearly justified academic requests.

## Statements

### Ethics committee approval and consent to participate

The Research Committee and the Ethics Committee of the Faculty of Medicine of the Catholic University of Cuenca approved this study. To start with the data collection at the Shimpis Health Center, we had the authorization of Eng. Alexandra Delgado, Director of District 14D03, and Dr. Mónica Carvajal, Director of said Health center.

### Publication Consent

Not required when patient-specific images, radiographs, and studies are not published.

### Conflicts of interest

The authors declare they have no conflicts of interest.

### Author Information

Not declared.

11.

<https://unad.edu.co/Biociencias/2215>

6. Díaz A, Palacios D, Grajeda R, Vargas R. National survey of health, nutrition and development of children under 5 years of age, belonging to the cantons of Sucúa, Taisha and Tiwintza, in the province of Morona Santiago 2017-2018 . PAHO. 2017;34(1):5-116 . <https://www.paho.org/88749>

7. Zavaleta N, Astete-Robilliard L. Effect of anemia on child development: long-term consequences. *Rev Peru Med Exp Public Health* . 2017 Oct-Dec;34(4):716-722. English. doi : 10.17843/rpmesp.2017.344.3251. PMID: 29364424. <https://doi.org/10.17843/rpmesp.2017.344.3251>

8. Feng J, Gheri F, Kepple A, Troubat N. The state of food security and nutrition in the world. Rome: Gafati; 2017. 2017. Vol 4. 3rd ed.

9. Díaz A, Arana A, Vargas-Machuca R, Antiporta D. Health and nutrition situation in indigenous and nonindigenous children in the Peruvian Amazon. *Rev Panam Public Health*. 2015; 38(1):49-55. <https://iris.paho.org/08>

10. Nambiema A, Robert A, Yaya I. Prevalence and risk factors for anemia in children aged from 6 to 59 months in Togo: analysis from Togo demographic and health survey data, 2013-2014. BMC Public Health. 2019 Feb 20;19(1):215. doi : 10.1186/s12889-019-6547-1. PMID: 30786883; PMCID: PMC6383221

<https://doi.org/10.1186/s12889-019-6547-1>

11. WHO. The global prevalence of anemia in 2011. Geneva: World Health Organization;2015.

<https://who/iris/10665>

12. Gonzáles E, Huamán L, Gutiérrez C, Aparo J, Pillaca J. Characterization of Anemia in children under 5 years of age in urban areas of Huancavelica

and Ucayali in Peru. Rev Peru Med. 2015;32(3):431-9. <http://www.scielo.org.pe/S1726>

13. Perez YF, Perez OF. Nutritional status and hemoglobin levels in children under five years of age in the health area of the "Gustavo Aldereguía Lima" polyclinic. Rev Med Cuba. 2019;44(4):1-6. <https://doi.org/10.1016/j.nefrol.2017.03.001>

14. Segarra Ortega JX, Lasso Lazo SR, Chacón Abril KL, Segarra Ortega MT, Huiracocha Tutiven M de L. Cross-sectional Study: Malnutrition, Anemia and its Relationship with Associated Factors in Children from 6 to 59 Months, Cuenca 2015. HJCA [Internet ]. 2016 Nov 28;8(3):231-7. <https://revista-medica-hjca.iess/242>

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