Factors Associated with Chronic Child Malnutrition in Peru

Factores asociados a la desnutrición crónica infantil en Perú

Melanie Trujillo-Rondan[1], Luis Roldan-Arbieto[2], Jesus E. Talavera[3], Miguel A. Perez[4], Lucy E. Correa-Lopez[5], Jhony A. De la Cruz-Vargas[6]

DOI: 10.19136/hs.a21n2.4862

Research article

• Received date: December 3, 2021 • Accepted date: January 18, 2022 • Online publication: April 8, 2022

Corresponding Author:

Jhony A. De La Cruz-Vargas, Postal address: Biomedical Sciences Research Institute (INICIB), Faculty of Medicine 33, Av. Alfredo Benavides 5440, Santiago de Surco 15039, Peru.
Email: jadv.oncology@gmail.com

Abstract

Objective: To investigate factors associated with chronic malnutrition among children aged five and under in Peru.
Materials and Methods: Secondary data analysis based on the Peruvian 2018 Demographic and Family Health Survey.
Results: Child's age (PR = 1.01; 95% CI: 1.009 to 1.015) and living in a rural area (PR = 1.36; 95% CI: 1.21 to 1.54) were associated with a higher risk of chronic malnutrition in the sample. Educational level, wealth index, and not belonging to the publicly funded Comedor Popular nutrition program, were identified as protective factors to chronic malnutrition.
Conclusion: Being under five and living in a rural area was associated with an increased risk of chronic malnutrition in children residing in Peru. A higher wealth index and mother's level of education decrease the chances of chronic malnutrition in children under five years of age.

Keywords: Malnutrition; Child, Preschool; Infant; Risk factors, Public health

Resumen

Objetivo: Determinar factores asociados a la desnutrición crónica infantil en niños peruanos menores de cinco años. **Materiales y Métodos:** Estudio de tipo retrospectivo, basado en un análisis de la base de los datos de la Encuesta Demográfica y de Salud Familiar (ENDES) 2018.
Resultados: Se encontró una prevalencia nacional de desnutrición crónica del 9,7% (n=2097) con diferencias según región geográfica de residencia. Se evidenció en el modelo ajustado que la edad del niño mayor de 25 meses (PRa=1,25; IC95%: 1,13 a 1,38, p<0,001) y vivir en zona rural (PR=1,36; IC95%: 1,21 a 1,54) con desnutrición crónica. El tener un mayor nivel de instrucción, un mayor índice de riqueza y no pertenecer al programa comedor popular estuvieron asociados como factores protectores para presentar desnutrición crónica. **Conclusiones:** La edad de los niños y residir en una zona rural se asocia a mayor riesgo de presentar desnutrición crónica en los niños menores de cinco años.

Palabras clave: Desnutrición; Preescolar, Lactante, Factores de riesgo, Salud Pública

[1] Médico cirujano. Instituto de Investigaciones en Ciencias Biomédicas (INICIB), Facultad de Medicina Humana, Universidad Ricardo Palma. Lima, Perú.

[2] Investigador del Instituto de Investigaciones en Ciencias Biomédicas (INICIB), Facultad de Medicina Humana, Universidad Ricardo Palma. Escuela de Postgrado en Gestión Pública de la Universidad Tecnológica del Perú. Lima, Perú.

[3] Investigador Estudiante Junior del Instituto de Investigaciones en Ciencias Biomédicas (INICIB), Facultad de Medicina Humana, Universidad Ricardo Palma. Lima, Perú.

[4] Director Maestría en Salud Pública, Universidad Estatal de California, Fresno, EE.UU. Instituto de Investigaciones en Ciencias Biomédicas (INICIB), Facultad de Medicina Humana, Universidad Ricardo Palma. Fresno, California, USA

[5] Investigadora del Instituto de Investigaciones en Ciencias Biomédicas (INICIB), Facultad de Medicina Humana, Universidad Ricardo Palma. Lima, Perú.

[6] Director del Instituto de Investigaciones en Ciencias Biomédicas (INICIB), Facultad de Medicina Humana, Universidad Ricardo Palma. Lima, Perú.

Introduction

A child's physical and emotional development are impacted by their nutritional status; this is especially true for children under the age of five. Healthy nutrition during this formative period impacts a child's cognitive abilities, height, and prevention of certain diseases[1–5]. In an effort to promote proper nutrition among children, scientists have released recommendations for children that apply regardless of where they live. Worldwide, child nutrition is a social marker of health since children with better nutritional patterns display better academic performance and better health outcomes. Similarly, the lack of good nutrition - malnutrition - has a negative impact on the development of children. Therefore, it is not surprising that the UN Sustainable Development Goals[6] contain goals related to improving childhood nutrition.

Malnutrition refers to the lack of adequate caloric and nutrient intake and can be classified into four types: wasting, stunting, underweight, and mineral and vitamin deficiencies, each of which has a negative impact on child development. Chronic malnutrition, or growth retardation, is the result of extended nutritional deficiencies and tends to be associated with poor socioeconomic factors, inappropriate feeding or care for infants and young children, poor nutritional patterns including nutritional deficiencies, and other maternal health conditions[7]. Chronic malnutrition has also been shown to have adverse effects on mental and cognitive development of small children, to _impact intellectual performance and capacities, and can cause irreversible damage to brain development[8-10]. Furthermore, chronic malnutrition decreases the body's immune defenses which can increase the possibility of suffering from various preventable childhood diseases including childhood anemia[8, 11-13]. This is especially true for children living in low- and middle-income countries[11–18].

Despite efforts to improve childhood nutritional patterns, approximately 155 million children under five years of age suffer from chronic malnutrition, evidenced by stunting, worldwide[7]. Furthermore, around 45% of childhood deaths under five years of age are related to malnutrition[19]. This is true in low- and middle-income countries such as Peru[7]. To combat high chronic malnutrition rates in the country, PERU's Health Research Priorities for 2019-2023[20] have made this a priority topic. The purpose of this study was to determine the factors associated with chronic child malnutrition in Peruvian children under 5 years of age using data from the Encuesta Demográfica y de Salud Familiar [Demographic and Family Health Survey] (ENDES) 2018.

Materials and methods

This is a retrospective, cross-sectional analytical study based on secondary sources. The ENDES is a national population survey employing complex probabilistic, stratified, self-weighted and independent sampling broken down by departamentos [states] including both urban and rural areas. The ENDES has been implemented in Peru since 1986 by the National Institute of Statistics and Informatics (INEI) of Peru and provides a large amount of public health data in the country[21]. In addition, ENDES data are used to systematically monitor compliance with the Sustainable Development Goals (SDGs)[22]. ENDES databases are freely accessible and can be obtained from the INEI website: / in various formats. The ENDES databases are publicly accessible, and the confidentiality of the participants was taken into account. The present work was approved by the Institute for Research in Biomedical Sciences and the ethics committee of the Faculty of Human Medicine at the Universidad Ricardo Palma. The ENDES 2018 database follows the policy in Peru of "Open Data"[24].

The study population consisted of 21,585 children under 5 years of age who met the study criteria. Exclusion criteria for the study included boys and girls older than five years and those younger than five years with incomplete data in the database.

The dependent variable of the study was chronic malnutrition, which is defined as a nutritional condition where the individual is in an inadequate nutritional situation due to lack of necessary nutrients[23]. Chronic malnutrition was calculated using the WHO child growth standards, differentiating the curves by sex and age groups up to 6 months, 2 years, and 5 years. A dichotomous variable was generated for chronic malnutrition.

The independent variables for the study were the wealth index and the child's age. The wealth index was calculated based on the assets owned by the parents and was categorized into five quintiles (the first quintile represents the poorest and the fifth the wealthiest). The child's age was classified into two groups: 0-24 months and 25-60 months. Other variables included sex of the child, type of place of residence (urban, rural), age of the mother by categories, maternal level of education, and participation social programs (glass of milk, popular dining room and Wawa Wasi / Cuna más). Table 1 contains a description of the social programs.

Table 1. Social Programs in Peru

Vaso de Leche [Glass of Milk]:	A food assistance program created in 1984. Its main objective is food security for vulnerable children aged 0-6 and expectant mothers. The program is administered by the Ministry of Economy and Finance (MEF) in cooperation with and local governments of each province.
Comedor Popular [Popular Dinner]:	A program created in 1979. Its main objective is bringing together grassroots organizations and state resources managed through the Food Supplementation Program. The target population are mothers and women who serve in soup kitchens for the vulnerable population in the area.
Wawa Wasi/Cuna Más:	Created in 1999, this social program seeks to provide comprehensive early childhood care through day care for girls and boys under 3 years of age. It is administered by the Ministry of Development and Social Inclusion (MIDIS).

Source: The ENDES variables used in this study are described at https://proyectos.inei.gob.pe/endes/ [21].

Absolute and relative frequencies were used for the categorical variables and measures of central tendency and dispersion were calculated for the continuous numerical variables. The differences between the groups or associations were estimated via chi-square for the categorical variables and the student's t test to determine if there was a significant difference between the means of two groups.

Finally, a Poisson regression model with robust variances was estimated, which allowed the calculation of adjusted prevalence ratios (RPa). The accepted statistical significance value in the present study was $p < 0.05$ with 95% confidence intervals. The data were adjusted according to the expansion factor for the weight of the participants.

Results

A total of 21,585 children under 5 years of age were represented in the sample for this study. The average age was 30.43 months (2.5 years), 53% were males, and 78% lived in urban areas. Slightly over a 1/3 of the mothers (35%) were between 21 and 30 years of age. Most of the mothers had a secondary education level (61.29%), and only 33.7% of the children evaluated belonged to a wealthy socioeconomic stratum. The prevalence of chronic malnutrition was 9.7%, varying from 0.9% to 30.1% according to geographic region of residence (Table 2).

Underscoring social determinants of health in the health and wellbeing of children, findings from this study suggest that maternal health plays a role in childhood malnutrition. Material age, education, and age of children all play a significant role in malnutrition.

Children with mothers aged 12 to 20 years had a 2.8% higher frequency of malnutrition compared to mothers aged 41 to 49 years (12.1 vs 9.3; $p < 0.001$). Likewise, in mothers without education, their children had 23.9% higher frequency compared to children with mothers with higher education (27 vs 3.1; $p < 0.001$). Chronic malnutrition in families with a very poor wealth index was 20.8% more frequent compared to those with a very rich wealth index (23.5 vs 2.7; $p < 0.001$).

Older children, defined as those between 25 to 60 months, had a 1% higher frequency of having chronic malnutrition compared to those 0 to 24 months (10.1 vs 9.1; $p = 0.018$). Similarly, children residing in rural areas were 16.2% more likely to experience chronic malnutrition compared to their urban counterparts (22.3 vs 6.1; $p < 0.001$).

The data show that most of the children were not beneficiaries of social programs such as the "Glass of Milk", "Popular Diner" or "Wawa Wasi / Cuna Más." In fact, only 2% of study participants benefited from the Popular Diner program (Table 3).

Participation in social programs did not seem to insulate children from nutrition related problems. Children enrolled in the Glass of Milk program had a 8.6% higher frequency of malnutrition compared to those who did not participate in the program (15.9 vs 7.3; $p < 0.001$). In the same way, those who were beneficiaries of the Popular Diner program had 9.2% higher frequency of malnutrition compared to those who were not (18.9 vs 9.7; $p < 0.001$) and those who were beneficiaries of Wawa Wasi / Cuna more had 9.2% higher frequency of malnutrition compared to those who did not (18.9 vs 9.7; $p < 0.001$) (Table 4).

A multiple regression analysis shows that children aged 25 to 60 months had a 25% higher frequency of having chronic malnutrition compared to those aged 0 to 24 months (PR = 1.25, 95% CI: 1.13 - 1.38). Similarly, children residing in rural areas had a 36% higher frequency compared to those who resided in urban areas (PR = 1.36, 95% CI: 1.21 - 1.54).

Children with mothers aged 41 to 49 years had 11% lower frequency of malnutrition compared to those whose mothers

Table 2. General characteristics of mothers and chronic malnutrition of children under five years of age, according to ENDES 2018.

Variable	n (%)
Child's Gender	
Male	11446 (53,0)
Female	10139 (47,0)
Child's Age	
0 to 24 months	8473 (39,26)
25 to 60 months	12757 (60,74)
Child's Age*	30,43 ± 17,04 (Min 1 - Max 59) months
Residence	
Urban	16795 (77,8)
Rural	4789 (22,2)
Maternal Age	28,59 ± 9,28 (Min 12 - Max 49) years
Maternal Age	
12 to 20 years	4696 (21,8)
21 to 30 years	7594 (35,2)
31 to 40 years	6885 (31,9)
41 to 49 years	2410 (11,2)
Maternal Educacional Level	
No Education	761 (3,5)
Elementary	3999 (18,5)
Secondary	13564 (62,8)
Superior (High School)	3261 (15,1)
Wealth Index	
Very Poor	4818 (22,3)
Poor	4934 (22,9)
Medium	4556 (21,1)
Wealthy	3926 (18,2)
Very Wealthy	3350 (15,5)
Chronic Malnutrition	
Yes	2097 (9,7)
No	19488 (90,3)

* Standard Deviation Source: Authors

were between 12 and 20 years of age (PR = 0.89, 95% CI: 0.77 - 1.04). Likewise, children whose mothers had a higher education, reported a 63% lower frequency of malnutrition compared to children with mothers without education (PR = 0.37, 95% CI: 0.29 - 0.49). Chronic malnutrition in families with a very rich wealth index was 78% less frequent compared to those with a very poor wealth index (OR = 0.22, 95% CI: 0.17 - 0.29). Children who were not beneficiaries of the soup kitchen had a 27% lower frequency compared to those who were beneficiaries (PR = 0.73, 95% CI: 0.58 - 0.91) (Table 5).

Table 3. Participation in Social programs that include food for children under the age of five

Social Program	n (%)
Glass of Milk*	
Yes	6105 (28,3)
No	15480 (71,7)
Popular Diner**	
Yes	477 (2,2)
No	21108 (97,8)
Wawa Wasi/Cuna más***	
Yes	893 (4,1)
No	13988 (64,8)
Does not Apply	6704 (31,1)

* Managed by the Ministerio de Economia y Finanzas (MEF)
** Managed by the Programa de Complementacion Alimentaria que pertenece at MEF (PAC-MEF)
*** Managed by the Ministerio de Desarrollo e Inclusión Social (MIDIS) (https://www.cunamas.gob.pe/)
Source: Authors

In an analysis of malnutrition based on geographical location of the Peruvian territory, it was found that: Tacna (0.9%), Moquegua (1.7%), Arequipa (3.65), Ica (3.4%) and Lima (4.5%) had the lowest prevalence values of chronic malnutrition. Conversely, Cajamarca (23.1%) and Huancavelica (30.1%) had the highest prevalence of chronic malnutrition. The Sierra region presented the highest frequencies of malnutrition in the entire country (Figure 1).

Discussion

Results from this study suggest that children living in rural areas had the highest levels of malnutrition in Peru (PRa = 1.36; 95% CI: 1.21 to 1.54, p <0.001). Place of residence, therefore, represents a major risk factor since those areas reported 36% higher rates of chronic malnutrition. Previous studies have yielded conflicting results with some showing rurality playing a role in chronic malnutrition while others did not support those findings[26-29].

The age of the child was a risk factor as it increased the chances of presenting chronic malnutrition by 25%. In our sample, children older than 25 months had higher rates of chronic malnutrition (PRa = 1.25; 95% CI: 1.13 to 1.38, p <0.001). Prior studies support these findings. A study in Ecuador found that chronic malnutrition was more prevalent in children older than 24 months[30]. A study in Colombia reported that the age of the child increases the risk of chronic malnutrition[31]. Another study carried out in Mexico in a conflict zone showed that the age of children significantly increases the risk of suffering from chronic malnutrition[32].

Table 4. Bivariate analysis of the characteristics of children under five years of age according to chronic malnutrition, according to 2018.

Variables	Without chronic malnutrition	With Chronic Malnutrion	valor p
	n (%)	n (%)	
Child Sex			0,458*
Male	10317 (90,1)	1128 (9,9)	
Female	9171 (90,4)	969 (9,6)	
Child Age			**0,018***
0 to 24 months	7700 (90,9)	773 (9,1)	
25 to 60 months	11788 (89,9)	1324 (10,1)	
Child age in months	30,28 (± 17,19)	31,84 (± 15,42)	**<0,001****
Residence			**<0,001***
Urban	15767 (93,9)	1028 (6,1)	
Rural	3721 (77,7)	1068 (22,3)	
Maternal age			**<0,001***
12 to 20 years	4126 (87,9)	569 (12,1)	
21 to 30 years	6911 (91,0)	683 (9,0)	
31 to 40 years	6264 (90,9)	621 (9,0)	
41 to 49 years	2187 (90,7)	223 (9,3)	
Matenal Age	28,70 (± 9,24)	27,63 (± 9,66)	**<0,001****
Maternal Educational level			**<0,001***
No Education	555 (73,0)	205 (27,0)	
Primary	3205 (80,1)	794 (19,9)	
Secundary	12567 (92,6)	997 (7,4)	
Superior	3161 (96,9)	100 (3,1)	
Wealth Index			**<0,001***
Very Poor	3685 (76,5)	1133 (23,5)	
Poor	4449 (90,2)	485 (9,8)	
Medium	4306 (94,5)	251 (5,5)	
Wealthy	3787 (96,4)	140 (3,6)	
Very Wealthy	3261 (97,3)	89 (2,7)	
Vaso de leche			**<0,001***
Yes	5135 (84,1)	970 (15,9)	
No	14353 (92,7)	1127 (7,3)	
Comedor popular			**<0,001***
Yes	387 (81,1)	90 (18,9)	
No	19101 (90,5)	2007 (9,7)	
Wawa Wasi/Cuna más			**<0,001***
Yes	739 (82,8)	154 (17,2)	
No	12584 (90,0)	1404 (10,0)	

* Chi square test, significant p value p <0.05
** Fisher's exact test, significant p-value p <0.05

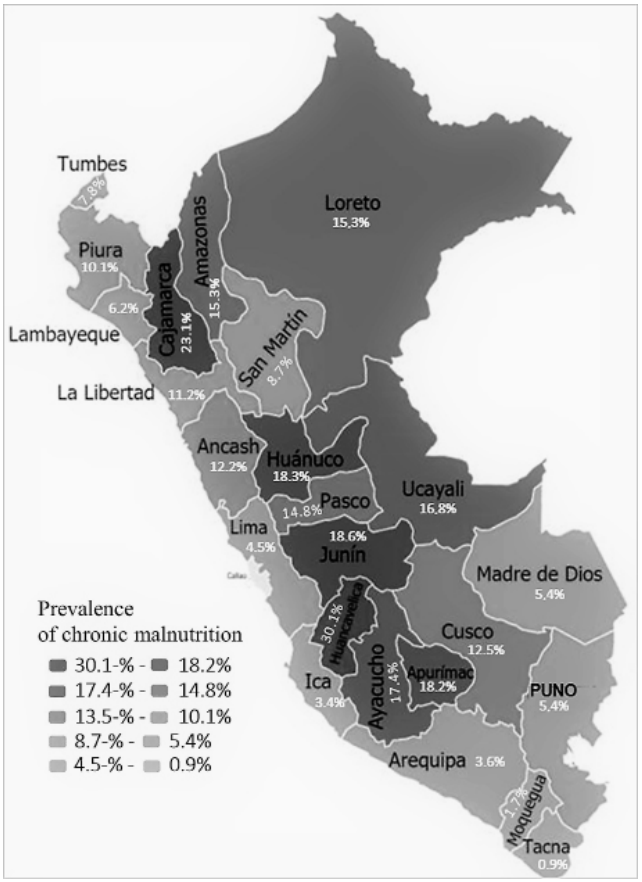
Source: Author

Table 5. Bivariate (PR) and multivariate (PRa) analysis of the factors associated with chronic malnutrition in children under five years of age, according to ENDES 2018.

Variables	Crude			Adjusted*		
	PRc	IC95%	p-value**	Rpa	IC95%	p-value**
Child Gender						
Male		Ref			Ref	
Female	0,94	0,85 a 1,02	0,135	0,97	0,89 a 1,05	0,445
Child Age						
0 to 24 months		Ref			Ref	
25 to 60 months	1,13	1,03 a 1,24	**<0,001**	1,25	1,13 a 1,38	**<0,001**
Residence						
Urban		Ref			Ref	
Rural	3,57	3,27 a 3,89	**<0,001**	1,36	1,21 a 1,54	**<0,001**
Maternal Age						
12 to 20 years		Ref			Ref	
21 to 30 years	0,77	0,68 a 0,86	**<0,001**	0,91	0,81 a 1,01	0,084
31 to 40 years	0,73	0,65 a 0,82	**<0,001**	0,98	0,87 a 1,10	0,723
41 to 49 years	0,75	0,64 a 0,88	**<0,001**	0,89	0,77 a 1,04	0,161
Maternal Education						
No education		Ref			Ref	
Primary	0,71	0,61 a 0,82	**<0,001**	0,66	0,57 a 0,76	**<0,001**
Secundary	0,27	0,23 a 0,31	**<0,001**	0,47	0,41 a 0,55	**<0,001**
Superior	0,12	0,09 a 0,15	**<0,001**	0,37	0,29 a 0,49	**<0,001**
Wealth Index						
Very Poor		Ref			Ref	
Poor	0,42	0,37 a 0,47	**<0,001**	0,59	0,52 a 0,68	**<0,001**
Medium	0,25	0,21 a 0,29	**<0,001**	0,39	0,33 a 0,47	**<0,001**
Wealthy	0,15	0,12 a 0,18	**<0,001**	0,26	0,21 a 0,33	**<0,001**
Very Wealthy	0,12	0,09 a 0,15	**<0,001**	0,22	0,17 a 0,29	**<0,001**
Glass of Milk						
Yes		Ref			Ref	
No	0,48	0,43 a 0,52	**<0,001**	0,97	0,89 a 1,07	0,636
Popular Diner						
Yes		Ref			Ref	
No	0,53	0,42 a 0,66	**<0,001**	0,73	0,58 a 0,91	**0,004**
Wawa Wasi/Cuna Más						
Yes		Ref			Ref	
No	0,58	0,48 a 0,68	**<0,001**	1,01	0,86 a 1,19	0,863

* Adjusted for all study variables
** significant p value <0.05 RP: prevalence ratio. 95% CI: 95% confidence interval
Source: Authors

Figure 1. Prevalence of chronic malnutrition in boys and girls under five years of age according to the political regions of Peru.



Source: Based on the Demographic and Family Health Survey (ENDES) 2018.

These findings are significant but can be explained since the mean linear growth is restricted from 24 months onwards, after which a zenith or status quo is observed[33]. Therefore, in children over 24 months, the possibility of showing chronic malnutrition is greater. In the geographic analysis of national chronic malnutrition in Peru, it was found that the highest prevalence of this condition is found in the political region of Huancavelica (30%). While this figure represents a small decrease from findings from a 2016 study[25] the figures are still too high. The Huancavelica region is one of the poorest regions of Peru and has one of the lowest wealth indexes in the nation[34]. This problem is aggravated by the high prevalence of childhood anemia in rural areas and its higher prevalence in the Huancavelica region[35]. Therefore, these conditions make the Sierra region a vulnerable zone for boys and girls. The higher morbidity and mortality indicates make this region a high priority area for interventions designed to minimize the impact of social determinants of health in the nutritional status of its most vulnerable population segments: its children.

Maternal educational level is one of the most studied determinants of malnutrition. In our study, the majority of mothers with low educational levels had children with higher chronic malnutrition rates. Previous studies in Peru have suggested that illiteracy or incomplete primary education of the mother increases the risk of malnutrition[36-37]. Similar findings have been reported in other Latin American countries such as Mexico, Colombia, and Brazil[38–40]. Maternal education reflects not only the family's socioeconomic status, but also is a good predictor of her ability to care for her children[36].

While social determinants of health such as low levels of material education and place of residence play a negative role in the nutritional status of children, other socioeconomic factors have a protective impact. In our study, higher educational levels, higher wealth index, and paradoxically not belonging to social safety net programs, resulted in better nutritional status of children. These findings have remained consistent on other studies based on ENDES data (26) with one notable exception based on 2014 ENDES data[27].

Conclusion

Although the results of this study suggest a reduction in chronic childhood malnutrition in Peru based on previous studies, opportunities continue exist to completely eliminate this problem in the country. Findings from this study support previous findings indicating that the age of the child, their residence, lack of participation in nutrition programs, and maternal educational level were contributing factors to chronic childhood malnutrition. These results indicate the need to educate mothers about the importance of good nutrition for their children, specifically in breastfeeding children from 0 to 2 years old. These topics could be included in workshops and institutions; thereby allowing greater access of information amongst mothers who attend schools. Community wide educational efforts could be undertaken to reach out of school young mothers.

Data from this study strongly suggest the need for greater outreach and educational programs ~~to~~ in rural areas and benefit these populations with information and food supplies. There are some limitations that must be considered when evaluating these results. ENDES does not collect information on the nutritional composition of the participants. Future studies should evaluate breastfeeding rates since this variable was not considered in the sample. This single variable could change the nutritional status of children in Peru.

Conflict of interest

The authors declare that they have no conflicts of interest.

Authors' contribution

Conceptualization and design: M.T.R., L.R.A.; Methods: L.R.A., J.E.T., M.A.P., L.M.A.P.; Data collection and software: M.T.R., L.E.C.L.; Data analysis: L.R.A., J.A.DLC.V.; Principal Investigator: M.T.R.; Research: J.E.T., M.A.P.; Manuscript preparation: J.E.T., M.A.P., L.E.C.L.; Manuscript revision and editing, M.T.R., L.R.A., J.E.T., M.A.P., L.E.C.L., J.A.DLC.V.; Visualization, J.E.T., M.A.P.; Supervision: M.T.R., L.R.A., J.A.DLC.V.; Financing: J.E.T., M.A.P., L.E.C.L.

Acknowledgements

The authors wish to express their appreciation to Mr. Kenneth Perez, Presidential Scholar, Cal State Dominguez Hills for his assistance in the editorial development of this manuscript.

References

1. Dietary Guidelines for Americans, 2020-2025. :164.

2. Venkatramanan S, Armata IE, Strupp BJ, Finkelstein JL. Vitamin B-12 and Cognition in Children123. Adv Nutr. 7 de septiembre de 2016;7(5):879–88. DOI: 10.3945/an.115.012021

3. Spencer AE, Baul TD, Sikov J, Adams WG, Tripodis Y, Buonocore O, et al. The Relationship Between Social Risks and the Mental Health of School-Age Children in Primary Care. Acad Pediatr. marzo de 2020;20(2):208–15. DOI: 10.1016/j.acap.2019.11.006

4. Fafard St-Germain A-A, Siddiqi A. The Relation Between Household Food Insecurity and Children's Height in Canada and the United States: A Scoping Review. Adv Nutr Bethesda Md. 1 de noviembre de 2019;10(6):1126–37. DOI: 10.1093/advances/nmz034

5. Denney JT, Brewer M, Kimbro RT. Food insecurity in households with young children: A test of contextual congruence. Soc Sci Med 1982. octubre de 2020;263:113275. DOI: 10.1016/j.socscimed.2020.113275

6. Oruamabo RS. Child malnutrition and the Millennium Development Goals: much haste but less speed? Arch Dis Child. febrero de 2015;100 Suppl 1:S19-22. DOI: 10.1136/archdischild-2013-305384

7. Malnutrición [Internet]. [citado 21 de noviembre de 2020]. Disponible en: https://www.who.int/es/news-room/fact-sheets/detail/malnutrition

8. Victora CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, et al. Maternal and child undernutrition: consequences for adult health and human capital. Lancet. 26 de enero de 2008;371(9609):340–57. DOI: 10.1016/S0140-6736(07)61692-4

9. Sudfeld CR, McCoy DC, Danaei G, Fink G, Ezzati M, Andrews KG, et al. Linear Growth and Child Development in Low- and Middle-Income Countries: A Meta-Analysis. Pediatrics. 1 de mayo de 2015;135(5):e1266–75. DOI: 10.1542/peds.2014-3111

10. Perkins JM, Kim R, Krishna A, McGovern M, Aguayo VM, Subramanian SV. Understanding the association between stunting and child development in low- and middle-income countries: Next steps for research and intervention. Soc Sci Med. 1 de noviembre de 2017;193:101–9. DOI: 10.1016/j.socscimed.2017.09.039

11. Khan L. Anemia in Childhood. Pediatr Ann. 1 de febrero de 2018;47(2):e42–7. DOI: 10.3928/19382359-20180129-01

12. Contreras-Pulache H, Mori-Quispe E, Urrutia-Aliano D, Huapaya-Huertas O, Diestra-Ponte J. Aproximación a los niveles de anemia en población pediátrica de una zona urbano-marginal del Callao, Perú. Rev Peru Med Exp Salud Publica. abril de 2013;30(2):350–1. Disponible en: https://www.scielosp.org/article/rpmesp/2013.v30n2/350-351/es/

13. Zavaleta N. Anemia infantil: retos y oportunidades al 2021. Rev Peru Med Exp Salud Pública. diciembre de 2017;34:588–9. DOI: 10.17843/rpmesp.2017.344.3281

14. Peterson K. Viewpoint: childhood undernutrition: a failing global priority. J Public Health Policy. diciembre de 2009;30(4):455–64. DOI: 10.1057/jphp.2009.37

15. Stiller CK, Golembiewski SKE, Golembiewski M, Mondal S, Biesalski H-K, Scherbaum V. Prevalence of Undernutrition and Anemia among Santal Adivasi Children, Birbhum District, West Bengal, India. Int J Environ Res Public Health. 3 de enero de 2020;17(1). DOI: 10.3390/ijerph17010342

16. Wells JCK, Briend A, Boyd EM, Berkely JA, Hall A, Isanaka S, et al. Beyond wasted and stunted-a major shift to fight child undernutrition. Lancet Child Adolesc Health. noviembre de 2019;3(11):831–4. DOI: 10.1016/S2352-4642(19)30244-5

17. Nagata JM, Gippetti J, Wager S, Chavez A, Wise PH. Prevalence and Predictors of Malnutrition among Guatemalan Children at 2 Years of Age. PLOS ONE. 2 de noviembre de 2016;11(11):e0164772. DOI: 10.1371/journal.pone.0164772

18. Lykens K, Singh KP, Ndukwe E, Bae S. Social, economic, and political factors in progress towards improving child survival in developing nations. J Health Care Poor Underserved. 2009;20(4 Suppl):137–48. DOI: 10.1353/hpu.0.0217

19. Adair LS, Fall CH, Osmond C, Stein AD, Martorell R, Ramirez-Zea M, et al. Associations of linear growth and relative weight gain during early life with adult health and human capital in countries of low and middle income: findings from five birth cohort studies. The Lancet. 10 de agosto de 2013;382(9891):525–34. DOI: 10.1016/S0140-6736(13)60103-8

20. Perú | Programa Mundial de Alimentos [Internet]. [citado 25 de noviembre de 2020]. Disponible en: https://www.wfp.org/countries/peru

21. PERÚ Instituto Nacional de Estadística e Informática [Internet]. [citado 25 de noviembre de 2020]. Disponible en: https://proyectos.inei.gob.pe/endes/

22. Perú: Línea de base de los principales indicadores disponibles de los Objetivos de Desarrollo Sostenible (ODS) 2016 [Internet]. SINIA | Sistema Nacional de Información Ambiental. [citado 25 de noviembre de 2020]. Disponible en: https://sinia.minam.gob.pe/documentos/peru-linea-base-principales-indicadores-disponibles-objetivos

23. OMS | Patrones de crecimiento infantil de la OMS [Internet]. WHO. [citado 5 de diciembre de 2020]. Disponible en: https://www.who.int/childgrowth/es/

24. DIGITAL SDG. Datos Abiertos [Internet]. [citado 25 de noviembre de 2020]. Disponible en: http://www.softwarepublico.gob.pe/index.php/es/software-publico-es-2/datos-abiertos

25. Hernández-Vásquez A, Tapia-López E. [Chronic Malnutrition among Children under Five in Peru: A Spatial Analysis of Nutritional Data, 2010-2016]. Rev Esp Salud Publica. 19 de 2017;91. Disponible en: https://pubmed.ncbi.nlm.nih.gov/28509895/

26. Urke HB, Bull T, Mittelmark MB. Socioeconomic status and chronic child malnutrition: Wealth and maternal education matter more in the Peruvian Andes than nationally. Nutr Res N Y N. octubre de 2011;31(10):741–7. DOI: 10.1016/j.nutres.2011.09.007

27. Sobrino M, Gutiérrez C, Cunha AJ, Dávila M, Alarcón J. Desnutrición infantil en menores de cinco años en Perú: tendencias y factores determinantes. Rev Panam Salud Publica352feb 2014 [Internet]. 2014 [citado 26 de noviembre de 2020]; Disponible en: https://iris.paho.org/handle/10665.2/8432

28. Humbwavali JB, Giugliani C, Nunes LN, Dalcastagnê SV, Duncan BB. Malnutrition and its associated factors: a cross-sectional study with children under 2 years in a suburban area in Angola. BMC Public Health. 21 de febrero de 2019;19(1):220. DOI: 10.1186/s12889-019-6543-5

29. Yirga AA, Mwambi HG, Ayele DG, Melesse SF. Factors affecting child malnutrition in Ethiopia. Afr Health Sci. junio de 2019;19(2):1897–909. DOI: 10.4314/ahs.v19i2.13

30. Ortiz J, Camp JV, Wijaya S, Donoso S, Huybregts L. Determinants of child malnutrition in rural and urban Ecuadorian highlands. Public Health Nutr. septiembre de 2014;17(9):2122–30. DOI: 10.1017/S1368980013002528

31. Osorio AM, Romero GA, Bonilla H, Aguado LF. Socioeconomic context of the community and chronic child malnutrition in Colombia. Rev Saúde Pública. 3 de agosto de 2018;52:73. DOI: 10.11606/S1518-8787.2018052000394

32. Sánchez-Pérez HJ, Hernán MA, Ríos-González A, Arana-Cedeño M, Navarro A, Ford D, et al. Malnutrition Among Children Younger Than 5 Years-Old in Conflict Zones of Chiapas, Mexico. Am J Public Health. febrero de 2007;97(2):229–32. DOI: 10.2105/AJPH.2005.070409

33. Espo M, Kulmala T, Maleta K, Cullinan T, Salin ML, Ashorn P. Determinants of linear growth and predictors of severe stunting during infancy in rural Malawi. Acta Paediatr Oslo Nor 1992. 2002;91(12):1364–70. DOI: 10.1111/j.1651-2227.2002.tb02835.x

34. Osorio AM, Romero GA, Bonilla H, Aguado LF. Contexto socioeconómico de la comunidad y desnutrición crónica infantil en Colombia. Rev Saúde Pública. 26 de julio de 2018;52:73. DOI: 10.11606/S1518-8787.2018052000394

35. Instituto Nacional de Estadistica e Informatica [Internet]. [citado 26 de noviembre de 2020]. Disponible en: http://m.inei.gob.pe/prensa/noticias/la-sierra-presenta-los-mayores-niveles-de-anemia-del-pais-en-el-ano-12223/

36. Olazabal EMV. DIRECCIÓN Y SUPERVISIÓN. :62.

37. Mariños-Anticona C, Chaña-Toledo R, Medina-Osis J, Vidal-Anzardo M, Valdez-Huarcaya W. Determinantes sociales de la desnutrición crónica infantil en el Perú. 2014;18:8. Disponible en: https://www.redalyc.org/pdf/2031/203132677004.pdf

38. Correia LL, Silva AC e, Campos JS, Andrade FM de O, Machado MMT, Lindsay AC, et al. Prevalence and determinants of child undernutrition and stunting in semiarid region of Brazil. Rev Saúde Pública. febrero de 2014;48(1):19–28. DOI: 10.1590/s0034-8910.2014048004828

39. Vallejo Solarte ME, Castro Castro LM, Cerezo Corre MDP. Estado nutricional y determinantes sociales en niños entre 0 y 5 años de la comunidad de Yunguillo y de Red Unidos, Mocoa - Colombia. Univ Salud. 29 de abril de 2016;18(1):113. Disponible en: http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0124-71072016000100012

40. Leroy JL, Habicht J-P, González de Cossío T, Ruel MT. Maternal Education Mitigates the Negative Effects of Higher Income on the Double Burden of Child Stunting and Maternal Overweight in Rural Mexico. J Nutr. 1 de mayo de 2014;144(5):765–70. DOI: 10.3945/jn.113.188474