Relationship between iron deficiency anemia and dental caries in schoolchildren of peruvian native communities

Relación entre anemia por deficiencia de hierro y caries dentales en la comunidad escolar peruana

Christian Renzo Aquino-Canchari[1*] https://orcid.org/0000-0002-7718-5598

Sarai Gloria Chávez-Bustamante[2] https://orcid.org/0000-0002-8268-9424

Valeria Isabel Parco-Rupay[2] https://orcid.org/0000-0002-1078-9581

[1]Universidad Peruana los Andes, Sociedad Científica de Estudiantes de Medicina los Andes, Facultad de Medicina Humana. Huancayo, Perú.

[2]Universidad Continental, Sociedad Científica de Estudiantes de Medicina Continental, Escuela de Medicina Humana. Huancayo, Perú.

[*]Autor para la correspondencia: christian.aquino.canchari@gmail.com

ABSTRACT

Introduction: children from native communities are exposed to inequities and inequalities in nutrition and oral health.

Objective: determine the relationship between iron-deficiency anemia and the prevalence of dental caries among schoolchildren from Peruvian native communities.

Methods: a cross-sectional study was conducted of children from the native communities in Satipo, Junín, Peru. The sample was 120 schoolchildren aged 6-12 years selected according to inclusion and exclusion criteria and in compliance with the ethical standards of scientific research. Hemoglobin concentration was measured with the system HemoCue®. Evaluation of the nutritional status was based on body mass index. Oral conditions were assessed with the following indicators: rate of tooth decay, loss and fillings, significant caries index, simplified oral health index and index of clinical consequences of untreated dental caries. Data were analyzed with the software STATA v. 14. Association between the variables was estimated with the chi-square test. A value of $p < 0.05$ was considered to be statistically significant.

Results: mean hemoglobin concentration was 11.9 mg/dl (1.49); prevalence of anemia was 44.16%: most schoolchildren were undernourished: 109 (90.83%). Prevalence, experience and significance of dental caries was 93.33%, 5.23 and 7.51, respectively. An association was observed between iron-deficiency anemia and the prevalence of dental caries *(p*=0.011).

Conclusions: a statistically significant association was found between the variables studied ($p> 0.05$).

Key words: anemia; native population; malnutrition; oral health; Peru.

RESUMEN

Introducción: los niños de comunidades nativas están expuestos a las inequidades y desigualdades en nutrición y salud oral.

Objetivo: determinar la relación entre la anemia por deficiencia de hierro y la prevalencia de caries dental en escolares de comunidades nativas peruanas.

Métodos: estudio transversal en niños de comunidades nativas de Satipo, Junín, Perú. La muestra estuvo conformada por 120 escolares de 6 a 12 años, cumpliendo con los criterios de inclusión y exclusión, según las normas éticas en investigación científica. La concentración de hemoglobina se evaluó a través del sistema HemoCue®. Se evaluó el estado nutricional mediante el indice de masa corporal. Las condiciones orales se evaluaron a través de los indicadores: Índice de dientes cariados, perdidos y obturados, índice de caries significativo, el índice de salud oral simplificado y el índice de consecuencias clínicas de la caries dental no tratada. Los datos se analizaron en el programa STATA v.14, la asociación entre las variables se calculó usando la prueba de chi-cuadrado: $p < 0,05$ se consideró estadísticamente significativo.

Resultados: la concentración promedio de hemoglobina fue de 11,9 mg/dL (1,49), se encontró una prevalencia de 44,16 % de anemia, la mayoría de los escolares presentó desnutrición 109 (90,83 %). La prevalencia, experiencia y significancia de caries dental fue del 93.33 %, 5,23 y 7,51, respectivamente. Se encontró asociación entre la anemia por deficiencia de hierro y la prevalencia de caries dental *(p=0,011).*

Conclusiones: Se encontró asociación estadísticamente significativa entre las variables estudiadas (*p> 0,05*).

Palabras clave: anemia; población indígena; malnutrición; salud oral; Perú.

Introduction

World Health Organization (WHO) estimates that there are more than 370 million indigenous people worldwide.[1] Native communities represent a diversity of cultures, religions, traditions, languages and stories, but remain among the most marginalized population groups due to their pluricultural differences.[2,3]

The health status of indigenous peoples is very different due to the sociodemographic characteristics of this type of vulnerable population. In Peru, child malnutrition has been reduced in recent years, however, it still affects 13.1% of children under 5 in 2016; in rural areas it reaches 26.5% and 7.9% in urban areas.[4] Anemia affects 1620 million people worldwide, which corresponds to 24.8% of the population, and its highest prevalence is in preschoolers (47.4%).[5]

In addition, in Peru, anemia affects 43.6% of children under three years, several studies show that anemia in infants affects permanent psychomotor development, the weight of anemia correction, observation, long-term, the lowest performance in cognitive, social and emotional areas.[6] Oral conditions are one of the most common and endemic problems in Peru, and a preventive and promotional approach is necessary.[7]

The objective of this study was to determine the relationship between iron deficiency anemia and oral health in schoolchildren from Peruvian native communities.

Methods

Desing and sample

Cross-sectional and relational observational study. The population was made up of the total number of schoolchildren from Coriteni Tarso and Osherato, from the district of Rio Tambo, province of Satipo, Junín, during the month of March 2019 in the framework of the Multidisciplinary University Research and Service Camp (CUMIS) of the Continental Society of Student Medical Sciences (SOCIMEC). The sample consisted of 120 schoolchildren, selected for the convenience of the selected educational institutions.

The level of iron deficiency anemia was determined by capillary puncture in a single contact that met the biosafety criteria, was classified as mild anemia (Hb 11-11.4 g / dL), moderate (Hb of 8-10.9 g / dL) and severe (Hb <8 g / dL), according to the technical standard on the preventive treatment of anemia in children, adolescents, pregnant women and postpartum women (up to 1,000 masl) of the Ministry of Health of Peru (MINSA) [8] The sample was processed using the Hemocue® Hb 201+ system. To quantify the oral conditions, this was evaluated by the most frequent pathologies of the oral cavity: the prevalence was established by the number of dental caries cases, [9] the dental caries experience was calculated according to the DMFT index, [10] for the degree of severity the significant caries index (SiC) was used,[11] the oral hygiene condition was estimated using the simplified oral health index (IHO-S)[12] the consequences evaluated the PUFA index of untreated caries clinics.[13]

The inclusion criteria were: schoolchildren with regular attendance belonging to the selected native communities, signature of the informed consent, the exclusion criteria were: parents who did not sign the informed consent, presence of any systemic disease. WHO indications were used for data collection.[14] Natural light and diagnostic equipment were used for the detection of oral disorders. The present study complies with the ethical principles of the Helsinki declaration. The project was approved by the heads and settlers of the selected native communities by signing the informed consent and informed settlement for minors.

Stadistical analysis

The data were analyzed in the Microsoft Excel 2013 program and the statistical quantification was subsequently carried out using the statistical package STATA v 14.0, expressed in percentages and frequency measurements, average scores and standard deviations of the variables. The association between the variables was calculated using the chi-square test $p < 0.05$ was considered statistically significant.

Results

120 schoolchildren were included, the average age was 8.87 ± 1.95 years. The distribution of the selected sample was 65 women (54.16%) and 55 men (45.84%) (Table 1).

Table 1 - Distribution of the sample by communities, according to sex and age.

Age	Sex				Total	
	Male		Female			
	n	%	n	%	n	%
6	7	5.83	13	10.83	20	16.6
7	11	9.16	4	3.33	15	12.5
8	5	4.16	12	10.0	17	14.1
9	10	8.33	10	8.33	20	16.6
10	5	4.16	12	10.0	17	14.1
11	7	5.83	12	10.0	19	15.8
12	10	8.33	2	1.66	12	10.0
Total	55	45.84	65	50.91	120	100

The average hemoglobin concentration was 11.9 mg/dl (1.49), a prevalence of 44.16% of anemia (53 children) was found, with moderate anemia being the most frequent 42 (34.99%), late due to the level of anemia 10 (8.33%) and severe anemia 1 (0.83%), presenting more cases the sex female sex (Table 2).

Table 2- Classification of anemia, according to sex.

Sex	Anemia Classification				
	Without anemia	Mild anemia	Moderate anemia	Severe anemia	Total
Male	31 (28,83%)	4 (3,33%)	20 (16,66%)	0 (0,00%)	24 (19,99%)
Female	36 (15,37%)	6 (5,00%)	22 (18,33%)	1 (0,83%)	29 (24,16%)
Total	67 (44,20%)	10 (8,33%)	42 (34,99%)	1 (0,83%)	53 (44,16%)

A prevalence of dental caries of 93.33% was found, the experience of population dental caries was moderate (5.23), according to the WHO criteria and a population SIC of 7, 51 (Table 3).

Table 3 - Prevalence, experience and importance of dental caries, according to school sex.

Sex	Prevalence	Tooth Decay $\bar{x}$ (DS)	Tooth lost due to tooth decay $\bar{x}$ (DS)	Filled teeth $\bar{x}$ (DS)	DMFT $\bar{x}$ (DS)	SiC
Male	53 (96,36)	5,27 (2,10)	0,15 (0,36)	0,33 (1,51)	5,75 (1,85)	7,94
Female	59 (90,77)	4,54 (2,30)	0,12 (0,33)	0,20 (0,73)	4,00 (2,13)	7,09
Total	112 (93,33)	4,88 (2,23)	0,23 (1,14)	0,23 (1,14)	5,23 (2,06)	7,51

As for the PUFA index, a prevalence of 31.66% was found, pulp involvement was the most prevalent clinical consequence 17 (14.16%) (Table 4).

Table 4 - PUFA index, according to sex in schoolchildren of Coriteni Tarso and Osherato, of the district of Río Tambo, province of Satipo

| Clinical consequences of untreated tooth decay |
|---|
| |

Sex	Pulp Commitment n ($\overline{x}$)	Ulceration n ($\overline{x}$)	Fistulan ($\overline{x}$)	Abscess n ($\overline{x}$)	PUFA n ($\overline{x}$)
Male	6 (0,15)	3 (0,05)	2 (0,02)	4 (0,07)	15 (0,29)
Female	11 (0,18)	4 (0,06)	1 (0,03)	7 (0,11)	23 (0,38)
Total	17 (93,33)	7 (2,23)	3 (1,14)	11 (1,14)	38 (2,06)

Regarding the nutritional status of schoolchildren, it was found that the majority presented malnutrition 109 (90.83%), this condition is higher in the female sex (Table 5).

Table 5 - Nutritional status in schoolchildren of Coriteni Tarso and Osherato, from the district of Río Tambo, province of Satipo

	Nutritional states			
Sex	Underweight n (%)	Normal weight n (%)	Overweight n (%)	Obesity n (%)
Male	48 (40,0)	7 (5,83)	0	0
Female	61 (50,83)	4 (3,33)	0	0
Total	109 (90,83)	11 (9,16)	0	0

Regarding the oral hygiene condition, the overall average of the IHO-S was 5.02 (SD = 0.51), the majority present in a good oral hygiene condition 72 (60%), followed by the poor oral condition 25 (21%) and the regular condition 23 (19%) (Fig. 1).
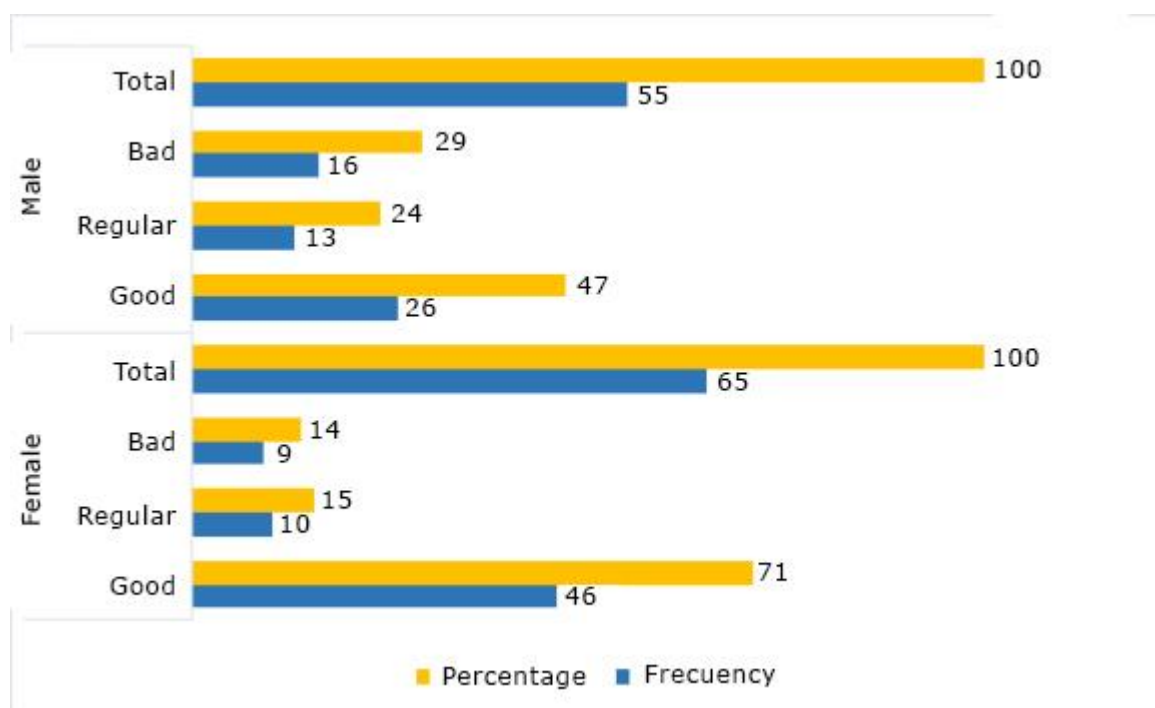
Fig. 1 - Condition of oral hygiene in school children of Coriteni Tarso and Osherato, from the district of Río Tambo, province of Satipo.

In relation to the association between the history of dental caries and the condition of iron deficiency anemia, a statistically significant association was found ($p = 0.011$) (Table 6).

Table 6 - Relationship between the level of anemia and oral conditions in school children in Coriteni Tarso and Osherato, in the district of Río Tambo, province of Satipo.

Anemia[a]	No caries history n	With a history of tooth decay n	Total n	Chi-square test
Yes	4	49	53	0,011*
No	7	60	67	

*$p < 0.05$ had a statistically significant difference.
[a]Based on the standards established by Ministry of health of Peru (MINSA)

Discussion

In relation to the prevalence of anemia, it was high, which is consistent with what was reported by *Ferreira et al.* (45%),[15] *Udovicich et al.* (52%),[16] which exemplifies health inequality, so it is necessary to promote nutritional health programs in native populations.[17] Anemia generates a high cost in the Peruvian state, which mainly affects the education sector,[4] to solve this problem it is necessary to involve the different social actors.

As for the most affected gender, it was higher "the female sex", which differs from that reported by *Ferreira et al.*,[15] and *Morais et al.*,[18] where male sex was the most affected, it should be noted that anemia is more frequent in rural areas than in urban areas.[19] With respect to the assessment of nutritional status, it is consistent with that reported by *Moshena et al.*[20]

Malnutrition in native communities arises from a set of factors, among which are the ethnography of their diet, the lack of economic resources, the lack of health workers that promote healthy eating,[21] it is necessary to promote actions in favor of nutritional status. of vulnerable populations.

In relation to oral health, a prevalence and experience of dental caries was found similar to that reported by *Pérez et al.*,[22] also, in relation to the prevalence of the clinical consequences of untreated tooth decay was lower than reported by *Aquino et al.*[23] what evidences that the inhabitants of the native communities are more prone to present affections in the oral cavity, reason why it is necessary to reorient the capacities of the oral health professionals with respect to the recognition of the cultural differences that promote social inclusion.

The study found an association between history of dental caries and anemia due to iron deficiency in schoolchildren studied, which coincides with reported by *Tang et al.* ($p <$ 0.05),[24] *Bansal K et al.* (p = 0.01),[25] however the evidence is controversial, this may be due to the multifactorial etiology of dental caries.

The native communities of Peru, are in a disadvantage in relation to other populations, oral health is a human right, therefore, working the issue of intercultural health is not only a necessity of these communities, but also a duty of the Peruvian state, communities should be considered as part of the solution and development and not as part of the problem.[26,27]

However, this study has limitations. The study design was cross-sectional, which does not allow for the determination of true cause and effect. It was extremely challenging to find caries free age matched controls to participate in the study, also the sample was not randomly selected.

Conclusion

A statistically significant association was found between the level of iron deficiency anemia and the prevalence of dental caries ($p = 0.011$).

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Conflicts of interest

There authors declare no conflicts of interest.

Authors contributions

Christian Renzo Aquino-Canchari: Participated in conception and desing of study, data collection, analysis and interpretation of data, critical revision, drifting and reviewed to the final manuscript.

Sarai Gloria Chavez-Bustamante: Participated in desing of study, data collection, drifting and reviewed to the final manuscript.

Valeria Isabel Parco-Rupay: Participated in desing of study, data collection, drifting and reviewed to the final manuscript.

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