



Factors associated with the use of medicines and self-medication during the COVID-19 pandemic in 12 Latin American countries

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ABSTRACT

Introduction: The coronavirus disease 2019 (COVID-19) pandemic has triggered a rise in the global phenomenon of self-medication. The use of medicines with unsubstantiated claims of benefit for the prevention and/or treatment of infected people has been widely adopted.

Objective: To determine the factors associated with the use of medicines and self-medication by Latin American populations during the COVID-19 pandemic.

Methods: This analytical cross-sectional study was conducted via an analysis of secondary data collected from 8777 responses from 12 Latin American countries obtained from a survey on the use of medicines and self-medication during the pandemic.

Results: Respondents who reported using Paracetamol, Ibuprofen, or antibiotics (ABx) disclosed this as self-medication in 26.9%, 16.6%, and 9.7% of cases respectively. In our multivariate analysis, significant associations were found between: self-medication by individual choice and the use of Hydroxychloroquine, ABx, or non-steroidal anti-inflammatory drugs (NSAIDs) ($p = 0.026$, $= 0.003$, and <0.001 respectively); self-medication on the recommendation of a family member, with ABx, Paracetamol, Ibuprofen, or other NSAIDs ($p < 0.001$, <0.001 , <0.001 , and <0.001 respectively); and self-medication on the recommendation of another person, with Chloroquine, Hydroxychloroquine, Azithromycin, Penicillin, other ABx, Warfarin, Ivermectin, Paracetamol, Ibuprofen, or other NSAIDs ($p < 0.001$, <0.001 , <0.001 , $= 0.001$, <0.001 , <0.001 , $= 0.004$, <0.001 , <0.001 , and <0.001 respectively).

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Conclusion: There was a significantly high prevalence of self-medication in our Latin American study population, including the use of medicines not recommended for COVID-19 treatment and/or prevention. The implementation of public health measures aimed at combating the worrying COVID-19 infodemic is essential to prevent this ongoing issue and its associated negative impacts on both current public health and future medication efficacy. This is especially important in the case of ABx due to the threat of a future antimicrobial resistance pandemic.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic has represented the most significant public health challenge of the 21st century [1], with more than 676,600,000 confirmed cases of the disease worldwide and approximately 6,881,000 deaths (as of 14/03/2023). Of the Latin American countries, Brazil, Mexico, and Peru, occupy the second, fifth and, sixth positions respectively, in terms of the global number of deaths from COVID-19 (as of 14/03/2023) [2]. Within this context the pandemic has had serious negative impacts on the usual functioning of local economy, politics, and daily social life [3].

In addition to the rapid spread of COVID-19, coupled with the fact that it was a new disease to be identified in humans, the evidence to support and approve effective medicines for its treatment is both recent and ongoing [4]. As a result, medicines for the disease are not yet widely available through national healthcare services in many countries around the world, especially in developing countries [5]. By contrast, during most of the pandemic, the use of medicines with unsubstantiated claims of benefit for the prevention and/or treatment of infected people has been widely adopted by the public, largely due to fear of the disease [6]. Three examples of such medications are Hydroxychloroquine, Azithromycin, and Ivermectin, which were subject to much debate and controversy on the part of governments and scientists [7,8], and particularly on social media, as there remained a lack of robust scientific evidence for their use against COVID-19 [6,8].

Faced with the knowledge that people are taking the use of medications into their own hands, it is of imminent importance to know which unproven medicines have been used for COVID-19 prevention and/or treatment in Latin American countries during the pandemic. Further, it may be beneficial to identify factors associated with their use, since there are many cultures and beliefs across the region which could predispose to self-medication [6], in addition to the influence of the media [9,10]. With this knowledge in hand, effective and population-targeted public health measures could then be implemented in order to better inform and help people, thereby minimizing health risks. However, to date, only a few studies on this subject involving Latin American countries have been published. Thus, in this novel study we determine the factors associated with the use of medicines and self-medication by the Latin American population during the COVID-19 pandemic.

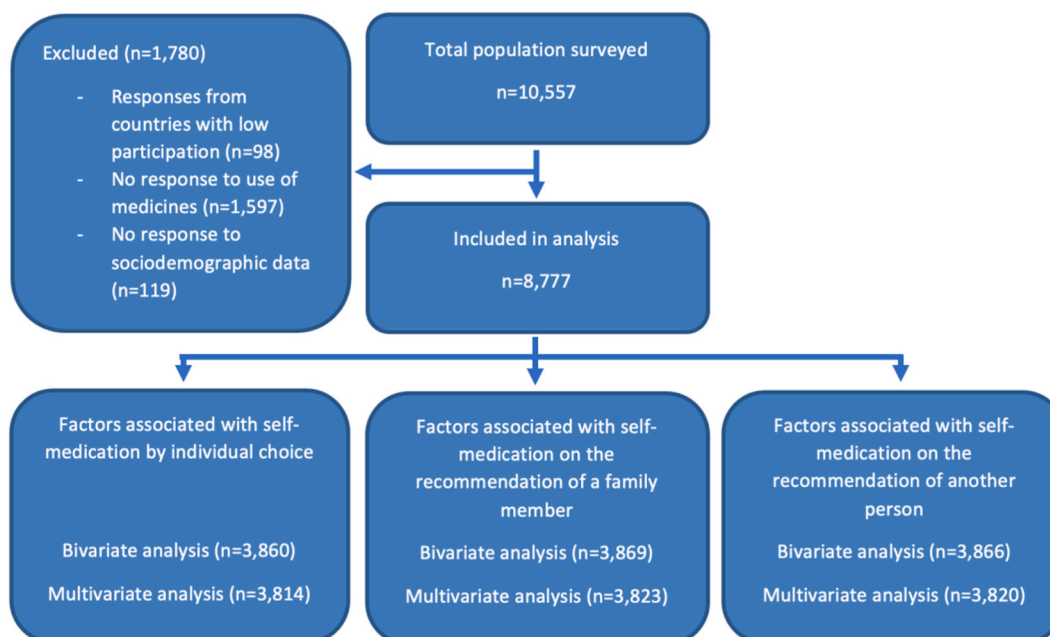


Fig. 1. Flowchart of study sample size selection.

2. Methods

2.1. Design and participants

This is an analytical cross-sectional study of secondary data obtained from a survey conducted by members of the Latin American Federation of Scientific Societies of Medical Students (FELSOCEM). People over the age of 18 years old, from Bolivia, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Panama, Paraguay, and Peru were included in the study. Participants who did not fully complete the survey were excluded. A total of 10557 respondents answered the survey, of which 1780 did not meet the inclusion criteria. Thus, a total of 8777 respondents were included in the analysis, with a response rate of 82.98%.

A power calculation was performed [11], of which 8 cases did not achieve a power of 80% and were therefore not considered; since they had a reduced confidence in the associations found. These are the following: individual self-medication with Azithromycin (0.0799), Penicillin (0.7758), other antibiotics (ABx) (0.7205), Warfarin (0.0987), Paracetamol (0.7025), Ibuprofen (0.4818), Hydroxychloroquine (0.0404), and self-medication with Ivermectin on the recommendation of a family member (0.4301).

The sample size selection process is detailed below (Fig. 1). The survey was distributed through social networks, in this case, via the social networking groups of members of FELSOCEM.

2.2. Ethics and procedures

The present study was approved by the Research Ethics Committee of the Universidad Peruana de Ciencias Aplicadas (FCS-CEI/777-12-20). The retrospective data of this study were obtained from a previous virtual survey [supplementary material]. The survey was conducted between June and August 2020, to learn about the reality of part of the Latin American population during the COVID-19 pandemic, given that the first peak in the spread of the disease occurred during this period. Participants were informed that the survey would be anonymous and consent was requested as a pre-requisite for participation. The mentioned survey was distributed with detailed instructions. Participants were also informed that they could decline to answer any or all of the questions if they wished. Responses were recorded in a Google Form, which was the platform used to distribute the survey.

2.3. Variables

For this study three types of self-medication were considered and analyzed: self-medication by individual choice, on the recommendation of a family member or on the recommendation of another person. The survey asked about the use of 10 types of medications: Paracetamol, Ibuprofen, other non-steroidal anti-inflammatory drugs (NSAIDs), Hydroxychloroquine, Chloroquine, Azithromycin, Penicillin, other ABx, Warfarin, and Ivermectin. It was asked about the frequency of use of each type of medication, as well as if their use was by medical prescription or self-medication. Each respondent was also asked whether or not they consumed any of these medicines during the pandemic. In addition, demographic data, including age (quantitative variable), gender (male or female), country of residence (Peru, Chile, Paraguay, Mexico, Colombia, Bolivia, Panama, Ecuador, Costa Rica, El Salvador, Honduras, and Guatemala), and educational level (secondary school or high school, technical school, university, postgraduate) were collected.

Table 1
Demographic details of participants.

Variable	n = 8777	%
Gender		
Women	5235	59.6
Man	3542	40.4
Age*	M = 22	IQR = 20-28
Country		
Peru	4293	48.9
Chile	777	8.9
Mexico	677	7.7
Paraguay	644	7.3
Colombia	481	5.5
Bolivia	429	4.9
Panama	418	4.8
Ecuador	291	3.3
Costa Rica	257	2.9
El Salvador	209	2.4
Honduras	185	2.1
Guatemala	116	1.3
Education level		
Secondary school or high school	1895	21.6
Technical school	679	7.7
University	5560	63.4
Postgraduate	643	7.3

* Age reported in years, median (M) and interquartile range (IQR) are given.

The survey was conducted in Spanish, since this is the language spoken in the countries participating in the study. All responses were later translated into English by the authors of the study.

2.4. Statistics

The data collection strategy was carried out as described above. The collected data was assessed by experts from the countries that participated in the research. For the univariate statistics, the categorical variables were described by absolute and relative frequencies, aside from the quantitative variable ‘age’, which was described by median interquartile range. For the bivariate and multivariate analysis, a p-value <0.05 was considered statistically significant. The dependent variables were medicines use and self-medication. Models with robust variances were used. For the bivariate and multivariate analysis of the factors associated with self-medication, the Poisson regression model was used, where each analysis was adjusted for age, gender, country of residence, and education level.

3. Results

Of the total respondents, 59.6% (6314) were female, and the average age was 22 years old (interquartile range: 20–28). Peru was found to be the country with the highest number of respondents, with 4293 participants (48.9% of the study population) (Table 1).

Paracetamol was the most widely used medication, reported by 2361 participants (26.9% of the study population) (Table 2).

The countries reporting the highest cumulative percentages of self-medication (individual choice, on the recommendation of a family member, and on the recommendation of another person) were El Salvador with 79%, followed by Peru, Chile, and Ecuador with 66% each. Those with the lowest percentages were Panama and Honduras with 35% and 32%, respectively (Fig. 2).

When bivariate and multivariate analysis were performed for the self-medication by individual choice group, we found a higher use of Hydroxychloroquine ($p = 0.026$), other ABx ($p = 0.003$), and other NSAIDs ($p < 0.001$), while there was lower use of Ivermectin ($p = 0.005$). Furthermore, for all medicines aside from Hydroxychloroquine, there was a higher prevalence of use amongst men (all p-values <0.05). A positive association with increasing age of the respondents (all p-values <0.001) was also observed. All associations were adjusted for participants having COVID-19, their gender, age, educational level, and country of residence (Table 3).

When considering factors associated with self-medication on the recommendation of a family, an increased use of other ABx ($p = 0.003$), Paracetamol ($p < 0.001$), Ibuprofen ($p < 0.001$), and other NSAIDs ($p < 0.001$) was elicited by the multivariate analysis. In addition, there was an increased use of these medications in participants who had COVID-19 (all p-values <0.001). All associations were adjusted for participants having COVID-19, their gender, age, educational level, and country of residence (Table 4).

Finally, in the multivariate analysis of factors associated with self-medication on the recommendation of another person, there was

Table 2
Medications used by participants.

Variable	n = 8777	%
Chloroquine		
Consumption	105	1.2
No consumption	8672	98.8
Hydroxychloroquine		
Consumption	124	1.4
No consumption	8653	98.6
Azithromycin		
Consumption	387	4.4
No consumption	8390	95.6
Penicillin		
Consumption	211	2.4
No consumption	8566	97.6
Other ABx		
Consumption	849	9.7
No consumption	7928	90.3
Warfarin		
Consumption	108	1.2
No consumption	8669	98.8
Ivermectin		
Consumption	209	2.4
No consumption	8568	97.6
Paracetamol		
Consumption	2361	26.9
No consumption	6416	73.1
Ibuprofen		
Consumption	1456	16.6
No consumption	7321	83.4
Other NSAIDs		
Consumption	951	10.8
No consumption	7826	89.2

ABx: antibiotics. NSAIDs: non-steroidal anti-inflammatory drugs.

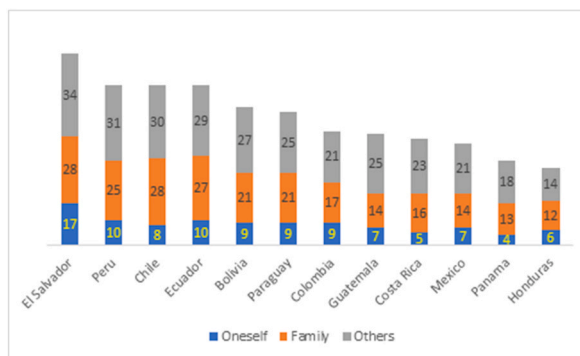


Fig. 2. Percentages of individual self-medication, on the recommendation of a family member, and on the recommendation of another person in 12 Latin American countries during the pandemic, based on the survey.

Table 3

Bivariate (n = 3860) and multivariate (n = 3814) analysis of factors associated with self-medication by individual choice.

Medicine	Bivariate analysis	Multivariate analysis according to			
		Self-medication	Positive COVID-19	Gender ♂	Age
Chloroquine	0.446	0.107	0.182	0.049 +	<0.001 +
Hydroxychloroquine	0.327	0.026 +	0.308	0.052	<0.001 +
Azithromycin	0.837	0.517	0.161	0.045 +	<0.001 +
Penicillin	0.505	0.650	0.269	0.046 +	<0.001 +
Other ABx	0.201	0.003 +	0.181	0.040 +	<0.001 +
Warfarin	0.916	0.798	0.090	0.040 +	<0.001 +
Ivermectin	0.259	0.005 -	0.115	0.038 +	<0.001 +
Paracetamol	0.080	0.137	0.206	0.028 +	<0.001 +
Ibuprofen	0.254	0.066	0.121	0.029 +	<0.001 +
Other NSAIDs	0.031 +	<0.001 +	0.176	0.037 +	<0.001 +

COVID-19: coronavirus disease 2019. ABx: antibiotics. NSAIDs: non-steroidal anti-inflammatory drugs. P-values were obtained using generalized linear models, with the Poisson distribution and a logarithmic link function, and models for robust variance adjusted. In the multivariate model, we adjusted for educational level and country of residence. The sign indicates whether the prevalence of drug use was found to be higher (+) or lower (-).

Table 4

Bivariate (n = 3869) and multivariate (n = 3823) analysis of factors associated with self-medication on the recommendation of a family member.

Medicine	Bivariate analysis	Multivariate analysis according to			
		Self-medication	Positive COVID-19	Gender ♂	Age
Chloroquine	0.234	0.251	0.976	0.377	0.316
Hydroxychloroquine	0.968	0.899	0.887	0.414	0.265
Azithromycin	0.037 +	0.051	0.956	0.338	0.325
Penicillin	0.365	0.323	0.974	0.385	0.261
Other ABx	<0.001 +	<0.001 +	0.942	0.513	0.806
Warfarin	0.472	0.321	0.789	0.460	0.249
Ivermectin	0.664	0.348	0.934	0.381	0.270
Paracetamol	<0.001 +	<0.001 +	0.880	0.609	0.381
Ibuprofen	<0.001 +	<0.001 +	0.738	0.961	0.878
Other NSAIDs	<0.001 +	<0.001 +	0.990	0.559	0.248

COVID-19: coronavirus disease 2019. ABx: antibiotics. NSAIDs: non-steroidal anti-inflammatory drugs. P-values were obtained using generalized linear models, with the Poisson distribution and a logarithmic link function, and models for robust variance adjusted. In the multivariate model, we adjusted for educational level and country of residence. The sign indicates whether the prevalence of drug use was found to be higher (+) or lower (-).

an increased use of all the study-assessed medications (Penicillin (p = 0.001), Ivermectin (p = 0.004), and the other medicines (all p-values <0.001)). This positive statistical relationship was further observed in all cases of participants with COVID-19 (all p-values <0.001). All associations were adjusted for participants having COVID-19, their gender, age, educational level, and country of residence (Table 5).

Table 5

Bivariate (n = 3866) and multivariate (n = 3820) analysis of factors associated with self-medication on the recommendation of another person.

Medicine	Bivariate analysis	Multivariate analysis according to			
		Self-medication	Positive COVID-19	Gender δ	Age
Chloroquine	<0.001 +	<0.001 +	<0.001 +	0.207	0.547
Hydroxychloroquine	0.005 +	<0.001 +	<0.001 +	0.227	0.505
Azithromycin	<0.001 +	<0.001 +	<0.001 +	0.183	0.661
Penicillin	0.006 +	0.001 +	<0.001 +	0.266	0.471
Other ABx	<0.001 +	<0.001 +	<0.001 +	0.370	0.641
Warfarin	0.016 +	<0.001 +	<0.001 +	0.218	0.482
Ivermectin	0.029 +	0.004 +	<0.001 +	0.235	0.487
Paracetamol	<0.001 +	<0.001 +	<0.001 +	0.899	0.333
Ibuprofen	<0.001 +	<0.001 +	<0.001 +	0.766	0.794
Other NSAIDs	<0.001 +	<0.001 +	<0.001 +	0.413	0.419

COVID-19: coronavirus disease 2019. ABx: antibiotics. NSAIDs: non-steroidal anti-inflammatory drugs. P-values were obtained using generalized linear models, with the Poisson distribution and a logarithmic link function, and models for robust variance adjusted. In the multivariate model, we adjusted for educational level and country of residence. The sign indicates whether the prevalence of drug use was found to be higher (+) or lower (-).

4. Discussion

We demonstrated evidence of a high prevalence of self-medication tendencies in the Latin American populations in the 12 included countries. The majority of respondents were young, with a median age of 22 years, and female (59.6%). We observed that the most frequently used medicine in the study population was Paracetamol (26.9%), followed by Ibuprofen (16.6%). We also noted an increased use of these medicines in patients who had been infected with COVID-19. Corroborating our findings, a previous study reported that Acetaminophen (an alternative name for Paracetamol) was the most frequent choice of self-medication used by undergraduate nursing students for symptoms including fever, headache, cough, and sore throat, with a prevalence of 87% [12].

For this study, three classes of self-medication were considered and analyzed: self-medication by individual choice, on the recommendation of a family member, or on the recommendation of another person. When combining these three classes of self-medication, we found that El Salvador was the country with the highest degree of self-medication among the 12 Latin American countries evaluated (79%), followed closely by Peru, Chile, and Ecuador, while Honduras was the country with the lowest level of self-medication (32%). By individual class, self-medication on the recommendation of another person was predominant in El Salvador. Although to date there is little robust published evidence on self-medication and medicines used in Latin America during the pandemic, data describing the rates of self-medication in other countries, such as Togo, show an overall prevalence of 34.2% for self-medication during this period [13]. Moreover, another study conducted in Uganda found a decrease in self-medication practices during the confinement period [14], which means that some Latin American countries may have actually had a higher prevalence of self-medication during the pandemic on a global scale.

We also found that Hydroxychloroquine, other ABx, and other NSAIDs were frequently consumed, while Ivermectin was consumed in a lower proportion. According to the Peruvian study by Zavala-Flores and Salcedo-Matienco, uncertainties surrounding the prevention and/or treatment of COVID-19 have led to the widespread use of medications based on “pathophysiological plausibility” or findings from in-vitro studies. In addition, difficulties faced by the public in accessing healthcare services may well have contributed to the adoption of self-medication. The above authors observed that around 80% of patients hospitalized by COVID-19 in their sample, had received or taken some form of ‘treatment’ prior to admission, of which 33.9% were without a medical prescription [15]. Another recent Colombian study also shows high levels of self-medication among adults during the lockdown period [16], which supports our findings on self-medication in Latin American countries during the pandemic.

A further important point in the present study was the greater rate of self-medication amongst the male participants. The most commonly used medicines in this group were Chloroquine, Azithromycin, Penicillin, other ABx, Warfarin, Ivermectin, Paracetamol, Ibuprofen, and other NSAIDs, whilst the least consumed drug was Hydroxychloroquine. The increasing age of male participants was found to be directly proportional to the chance of self-medication. This result contradicts the results of a previous study on factors associated with self-medication for COVID-19 by Peruvian healthcare students, which reported that female gender was associated with higher rates of self-medication [17]. This could be due to different factors. First, the survey used in our study was conducted during the first few months of the pandemic. Second, women tend to have a greater degree of anxiety, thus leading to a greater potential tendency to self-medication [18].

It is also worth highlighting that our findings surrounding self-medication on the recommendation of a family member revealed that the most used medicines were other ABx, Paracetamol, Ibuprofen, and other NSAIDs. Although the recommendation to self-medication can come from friends, family, neighbors, pharmacists, clinicians, or even previous prescriptions, the current trend of seeking advice online has been intensified by the role of the media [19,20].

Despite the above, self-medication on the recommendation of another person still occurred with significant rates across all 10 medication groups in this study. Our results can be viewed in conjunction with those of a study entitled “Self-medication in adults in 11 Latin American cities”, which inquired about who recommended which medicines to the participants. Whilst 56.1% of participants reported that the recommendation came from family and friends, only 26.8% reported that the recommendation came from a

pharmacist [21]. This fact is of critical importance, as it indicates the weight which the opinions of trusted third parties can hold in the decisions taken by this Latin American population. Therefore, this should present a prime opportunity for interventions to build trust and influence amongst healthcare professionals, in order to avoid the potential harmful effects on health which may present with unadvised self-medication.

In addition to this finding, we also observed a higher rate of self-medication on the recommendation of another person of all the studied medications by participants with COVID-19. Although the inherent risks of the disease are known to many people, this may not necessarily have a significant impact on decisions about self-medication. Also, in the absence of widely available robust scientific evidence about COVID-19 prevention and/or treatment during the early stages of the pandemic, the proliferation of false information, misinformation, and medical mistrust may in fact have occurred and spread amongst vulnerable populations [19,20]. Indeed, the influence of social media has been critically devastating with regards to causing confusion and fear, and propagating false information, which has certainly contributed to an increase in self-medication, including the use of home remedies, with unsubstantiated claims of reliability and efficacy [20,22].

This study is not without its limitations. It suffers potential selection bias, due to the type of sampling used, and it is therefore not possible to extrapolate the results directly to all the surveyed countries, since the study intention was only to analyze associations. This is due to the non-probabilistic convenience sampling used, which is not significant for the entire populations of each included country. Furthermore, in our survey there were no specific questions that could determine which type of person/professional recommended self-medication in cases of self-medication on the recommendation of another person, which should be evaluated in future research. Nevertheless, our results are meaningful and robust, given the large sample of people who completed the survey between June and August 2020, which is the period in which the pandemic had the first severe impact on Latin America. Further, our results build upon previous published material based on only one Latin American country [23], thereby extending their applicability and impact.

5. Conclusion

This study shows a significantly high prevalence of self-medication among the population of different countries in Latin America, including the use of medicines not recommended for COVID-19 prevention and/or treatment. Although the public is advised against consuming medications without proper medical advice or prescription, due to health-related risks, more action is needed so that the general public is indeed properly educated and informed before taking any medication when seeking medical assistance, either by teleconsultation or via face-to-face medical consultation, as well as when buying over-the-counter medications. To achieve this, public health measures aimed at combating the worrying COVID-19 infodemic should be implemented in order to prevent this ongoing issue and its associated negative impacts on both current public health and future medication efficacy.

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Data availability statement

Data included in article/supp. material/referenced in article.

CRedit authorship contribution statement

Christian R. Mejia: Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Mely Ruiz-Aquino:** Writing – original draft, Resources, Investigation, Conceptualization. **Gianela Garcia-Arteta:** Writing – original draft, Resources, Investigation, Conceptualization. **Gin Ramos:** Writing – original draft, Resources, Investigation, Conceptualization. **Isabel Astete-Pérez:** Writing – original draft, Resources, Investigation, Conceptualization. **Mariana Pineda-Cáceres:** Writing – original draft, Resources, Investigation, Conceptualization. **Marilyn Collahua-Briceno:** Writing – original draft, Resources, Investigation, Conceptualization. **Katherine Vargas-Patiño:** Writing – original draft, Resources, Investigation, Conceptualization. **Dennis Arias-Chávez:** Writing – original draft, Resources, Investigation, Formal analysis, Data curation, Conceptualization. **Thomas Franchi:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis. **Paolo Pedersini:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis. **Marcos Roberto Tovani-Palone:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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