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ARTICLE

GEOGRAPHICAL BARRIERS TO THE USE OF TOOTHPASTE CONTAINING ≥1000 PPM FLUORIDE IN PERUVIAN CHILDREN.

Barreras geográficas para el uso de pasta dental con fluoruro ≥1000 ppm en niños peruanos.

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ABSTRACT:

Objective: The aim of this was to determine the geographical barriers for the use of equal or more than 1000 (≥1000) parts per million (ppm) of toothpaste with fluorine (F) in children aged 1 to 11 years in Peru in 2018.

Material and Methods: This is a cross-sectional study, the database of Demographic and Family Health Survey (ENDES, for its Spanish acronym) of Peru in 2018 was used; the final sample was 25660 records of children between 1 and 11 years old. The variables evaluated were the use of ≥1000 ppm fluoride toothpaste, place of residence, natural region, area of residence, region, wealth index, access to dental service, whether information was received about oral hygiene, daily tooth brushing, age and sex. A descriptive, bivariate (Chi square) and multivariate (log-linear Poisson regression) analysis was performed.

Results: An association was found between the use of toothpaste ≥1000 ppm F with place of residence: small city vs capital-large city with an adjusted prevalence ratio (RPa): 0.94; 95% confidence interval (95% IC): 0.90-0.98, town and country vs. capital-large city both with an RPa: 0.95; 95% CI: 0.91-0.99. With natural region: rest of the Coast vs Lima with RPa: 0.94; 95% CI: 0.91-0.98, Sierra vs Lima with RPa: 0.95; 95% CI: 0.92-0.99 and Jungle vs Lima with RPa: 0.94; 95% CI: 0.90-0.98).

Conclusion: The place of residence and the natural region are geographic barriers to the use ≥1000 ppm fluoride toothpaste in children aged between 1 and 11 years in Peru in 2018.

KEYWORDS:

Health Services Accessibility; Child; Oral health; Toothpaste; fluorine; Association

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RESUMEN:

Objetivo: El objetivo de este fue determinar las barreras geográficas para el uso de igual o más de 1000 (≥1000) partes por millón (ppm) de pasta dental con flúor (F) en niños de 1 a 11 años en Perú en 2018.

Material y Métodos: Se trata de un estudio transversal, la base de datos de la Encuesta Demográfica y de Salud Familiar (ENDES) del Perú en 2018 fue usada con una muestra de 25 660 registros de niños entre 1 y 11 años. Las variables evaluadas fueron el uso de pasta dental ≥1000 ppm F, lugar de residencia, región natural, área de residencia, región, índice de riqueza, acceso al servicio odontológico, si se recibió información sobre higiene bucal, cepillado diario de dientes, edad y sexo. Se realizó un análisis descriptivo, bivariado (Chi cuadrado) y multivariado (regresión loglineal de Poisson).

Resultados: Se encontró una asociación entre el uso de pasta dental ≥1000 ppm F con el lugar de residencia: ciudad pequeña vs ciudad capital-grande con una razón de prevalencia ajustada (RPa): 0,94; intervalo de confianza de 95% (IC 95%): 0,90-0,98, ciudad y campo vs. capital-grande ciudad ambos con un RPa: 0,95; IC 95%: 0,91-0,99. Con región natural: resto de la Costa vs Lima con RPa: 0,94; IC 95%: 0,91-0,98, Sierra vs Lima con RPa: 0,95; IC 95%: 0,92-0,99 y Selva vs Lima con RPa: 0,94; 95% % CI: 0,90-0,98.

Conclusión: El lugar de residencia y la región natural son barreras geográficas para el uso de pasta dental fluorada ≥1000 ppm en niños de 1 a 11 años en Perú en 2018.

PALABRAS CLAVE:

Accesibilidad a los Servicios de Salud; niño; Salud bucal; pastas de dientes; flúor; Asociación.

INTRODUCTION.

Today the use of toothpaste with an appropriate fluoride concentration in oral hygiene habits has reduced dental caries globally.[1] Since the review performed by Marinho *et al.*,[2] a lot of research have been carried out.[3-5] They have confirmed the effectiveness of toothpaste with concentrations of ≥ 1000 ppm F for prevention of dental caries mostly in children if tooth brushing is supervised,[2,3] and if performed at least twice a day.[6]

In Peru, the Health Technical Standard for the addition of fluoride in toothpastes, mouthwashes and other products used in oral hygiene, which is in force since 2001, indicates that toothpastes for children under 6 years must contain concentrations below 600 ppm F.7 In 2017, the Technical Guidelines: Clinical practice guidelines for the prevention, diagnosis and treatment of dental caries in children was issued by the Ministry of Health (MINSA, for its Spanish acronym). This document recommended the use of toothpastes ≥1000 ppm F since the appearance of the first deciduous tooth.[8]

However, around fifty percent of toothpastes marketed in Peru contain amounts of fluoride below 1000 ppm F.[9,10] In general, there are barriers of accessibility to health, including preventive measures, such as the use of fluoridated toothpastes with adequate concentrations. Two models can be approached to understand accessibility: the Word Health Organization (WHO) traditional model and the Tanahashi T model.[11,12]

The first model identifies four barriers: geographical, economic, cultural and administrative;[12] the second addresses the concept of accessibility to health care, resulting in an adjustment between demand (health need) and supply (health system).[13] Furthermore, this last model groups facilitating factors in access to health services into five categories:

availability, accessibility, acceptability, contact, and effective coverage.[11,12]

In the case of a preventive measure, both models are valid since accessibility is the way people can use health goods and services. Thus, it is important to highlight these possible barriers to identify solutions through efficient public policies at the national level.[14] Therefore, the purpose of this research was to determine the geographical barriers for the use of toothpastes ≥1000 ppm F in children aged 1 to 11 years old in Peru in 2018.

MATERIALS AND METHODS.

This present study was cross-sectional. The initial sample were 25,660 records of children between the ages of 1 to 11 years from the database of the Demographic and Family Health Survey of 2018 (ENDES, for its Spanish acronym) in Peru. However, records with inconsistent and incomplete information about the use of fluoride toothpastes were excluded, resulting in a final sample of 16,227 records, reporting a loss rate of 36.76%. This survey is conducted by the National Institute of Statistics and Informatics (INEI, for its Spanish acronym) and is freely accessible to any person and public or private entity.[15]

The dependent variable was the use of toothpaste ≥1000 ppm F, and the independent variable was geographic barriers measured according to the place of residence, the natural region and the area of residence. Regarding the place of residence, it is grouped into 4 categories:

capital-large city; capital of province or department;

small town: district capital; town; rural village with a population from 500 to less than 2000 inhabitants; and country: rural village with less than 500 inhabitants. It is important to mention that for the natural region Lima is excluded from the rest of the Coast because it is the capital of the country. Moreover, the following covariates were included: region; wealth index; access to dental care; whether people received information about oral hygiene, daily tooth brushing; age and gender.

After identifying the study variables, we went to the INEI website (*www.inei.gob.pe*) and entered the option "Database". Then, we selected the option "Microdata" to access each module of the 2018 ENDES survey. The following variables were obtained from the CSSALUD08 database of the "Health Survey" module: use of toothpastes ≥1000 ppm F (original question in Spanish:

¿Podría mostrar la crema dental de la niña(o) y verifique la concentración de flúor?, which is categorized in use according to 1000 ppm F); access to dental care (original question in Spanish: *¿Alguna vez ha sido atendido(a) en un servicio dental por un odontólogo?*); receive information about oral hygiene (original question in Spanish: *¿En los últimos 12 meses, recibió información sobre cuidado e higiene bucal de las niñas y niños de una persona o medio de comunicación?*), daily tooth brushing (original question in Spanish: *¿Se cepilla los dientes todos los días?*); and age. From the module "Household characteristics" the variables taken included: region, area of residence, place of residence (RECH0 database) and gender (RECH1 database). From the REC0111 database of the "Basic data on women of childbearing age (MEF, for its Spanish acronym)" module, the wealth index was calculated and, finally, from the RECH23 database of the "Housing characteristics" module, the natural region was determined.

The downloaded databases were consolidated to obtain a single database for the respective analysis. We performed a Chi-Square test to obtain a descriptive and bivariate analysis. Then, we applied the Poisson regression method to determine the prevalence ratio (PR) and adjusted prevalence ratio (RPa) with those variables that presented bivariate association. The svy command was used to determine representative estimates because the survey design was included for data analysis, where the sampling patterns were differentiated by stratum, primary sampling unit, and weights. The study had a confidence level of 95%, a $p<0.05$ and the statistical Software STATA 15.0 was used.

This study was approved by the Institutional Ethics Committee of the Universidad Peruana Cayetano Heredia (CIE-UPCH) on April 16, 2020, with SIDISI Code No. 201304.

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RESULTS.

A total of 63.24% (n = 16227) use toothpaste ≥1000 ppm F. Piura is the region that shows the greatest use with 75.41% (n = 549). 34.12% (n = 8756) use toothpaste with concentrations below 1000 ppm F. And, finally, only 2.64% (n = 677) do not use toothpaste (Table 1).

According to the geographical characteristics, among those who use toothpaste ≥1000 ppm F, 64.65% (n = 1730) reside in Lima, and 61.22% of this group (n = 4301) live in rural areas. A relationship was found between access to fluoridated toothpastes with the place of residence and the natural region (p <0.01). According to the covariates, among those who use toothpaste ≥1000 ppm F, 62.80% (n = 3388) are poor (according to the wealth index); 65.08% (n = 6251) did not have access to dental services; 67.29% (n = 4100) did not receive information about oral hygiene; 64.67% (n = 14133) carried out daily tooth brushing; 78.51% (n = 9938)

Table 1. Use of fluoride toothpaste among children aged 1 to 11 years in Peru, 2018.

REGIONS	1000 ppm F and above		Below 1000 ppm F		Do not use toothpaste	
	n	%	n	%	n	%
Amazonas	468	63.16	248	33.47	25	3.37
Ancash	523	65.21	260	32.42	19	2.37
Apurimac	494	65.00	246	32.37	20	2.63
Arequipa	421	52.04	362	44.75	26	3.21
Ayacucho	530	57.86	355	38.76	31	3.38
Cajamarca	480	53.81	399	44.73	13	1.46
Callao	497	65.65	245	32.36	15	1.98
Cusco	422	67.74	190	30.50	11	1.77
Huancavelica	555	66.47	255	30.54	25	2.99
Huanuco	470	61.60	273	35.78	20	2.62
Ica	360	48.98	332	45.17	43	5.85
Junin	357	51.59	314	45.38	21	3.03
La Libertad	427	57.09	309	41.31	12	1.60
Lambayeque	438	63.39	229	33.14	24	3.47
Lima	1623	62.45	911	35.05	65	2.50
Loreto	414	57.58	294	40.89	11	1.53
Madre de Dios	352	52.30	297	44.13	24	3.57
Moquegua	408	55.14	315	42.57	17	2.30
Pasco	365	57.57	258	40.69	11	1.74
Piura	549	75.41	162	22.25	17	2.34
Puno	524	68.41	232	30.29	10	1.31
San Martín	444	59.52	282	37.80	20	2.68
Tacna	412	57.87	279	39.19	21	2.95
Tumbes	380	57.84	247	37.60	30	4.57
Ucayali	534	62.82	285	33.53	31	3.65
Total	**16227**	**63.24**	**8756**	**34.12**	**677**	**2.64**

n: Absolute frequency. %: Relative frequency. °: Totals differ due to missing data on analyzed variables.

were between 6 and 11 years old; and 63.28% (n = 7755) were men. A relationship was found between the use of toothpaste ≥1000 ppm F with access to dental services, whether information was received about oral hygiene, daily tooth brushing, and age (p <0.01) (Table 2).

With respect to the geographical barriers for the use of toothpastes ≥1000 ppm F, a relationship was found between small city *versus* capital-large city (RPa: 0.94; IC95 %: 0.90-0.98); town *versus* capital-large city (RPa: 0.95; IC95 %: 0.91-0.99), country *versus* capital-large city (RPa: 0.95; IC95 %: 0.91-0.99), and, in relation to the natural region, a relationship was found between Coast *versus* Lima (RPa: 0.94; IC95%: 0.91-0.98), Sierra *versus* Lima (RPa: 0.95; IC95%: 0.92-0.99) and Jungle *versus* Lima (RPa: 0.94; IC95 %: 0.90-0.98) (Table 3).

Table 2. Use of fluoride toothpastes by place of residence, natural region, and area of residence among children aged 1 to 11 years in Peru, 2018.

VARIABLE		1000 ppm F and above		Below 1000 ppm F or do not use		p-value*
		n	%	n	%	
Place of residence	Capital-Large city	1730	64.65	946	35.35	<0.01
	Small city	3311	57.88	2409	42.12	
	Town	3105	60.10	2061	39.90	
	Country	4301	61.22	2725	38.78	
Natural region	Lima	1730	64.65	946	35.35	<0.01
	Rest of Coast	3264	58.97	2271	41.03	
	Sierra	4687	60.76	3027	39.24	
	Jungle	2766	59.32	1897	40.68	
Area of residence	Urban	8146	60.06	5416	39.94	0.11
	Rural	4301	61.22	2725	38.78	
Wealth index	Very poor	3511	60.09	2332	39.91	0.06
	Poor	3388	62.80	2007	37.20	
	Middle	2755	61.97	1691	38.03	
	Wealthy	2100	61.69	1304	38.31	
	Very wealthy	1631	61.52	1020	38.48	
Access to dental careYes	9976	62.14	6079	37.86	<0.01	
	No	6251	65.08	3354	34.92	
Receive information about oral hygiene	Yes	6570	60.01	4379	39.99	<0.01
	No	4100	67.29	1993	32.71	
Daily tooth brushing	Yes	14133	64.67	7720	35.33	<0.01
	No	2083	54.96	1707	45.04	
Age	1 to 5 years	6289	48.37	6712	51.63	<0.01
	6 to 11 years	9938	78.51	2721	21.49	
Gender	Male	7755	63.28	4501	36.72	0.91
	Female	8472	63.21	4932	36.79	

n: Absolute frequency. %: Relative frequency. °: Totals differ due to missing data on analyzed variables. p: Statistical significance
*Chi-Square Test

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Table 3. Relationship between the use of toothpaste ≥1000 ppm F by place of residence and natural region among children aged 1 to 11 years in Peru, 2018.

ACCESS		Model 1 raw PR	95% CI	*p*-value	Model 2 adjusted aPR	95% CI	*p*-value
Place of residence							
	Capital-Large city	**Ref.**			**Ref.**		
	Small city	0.90	0.86-0.93	<0.001	0.94	0.90-0.98	0.004
	Town	0.93	0.90-0.96	<0.001	0.95	0.91-0.99	0.008
	Country	0.95	0.92-0.98	0.001	0.95	0.91-0.99	0.009
	Small city	**Ref.**			Ref.		
	Town	1.04	1.01-1.07	0.019	1.00	0.97-1.04	0.948
	Country	1.06	1.03-1.09	<0.001	1.01	0.98-1.04	0.667
	Town	**Ref.**			Ref.		
	Country	1.02	0.99-0.1.05	0.001	1.01	0.97-1.04	0.751
Natural region							
	Lima	**Ref.**			Ref.		
	Rest of Coast	0.91	0.88-0.95	<0.001	0.94	0.91-0.98	0.049
	Sierra	0.94	0.91-0.97	<0.001	0.95	0.92-0.99	0.012
	Jungle	0.92	0.88-0.95	<0.001	0.94	0.90-0.98	0,004
	Rest of Coast	**Ref.**			Ref.		
	Sierra	1.03	1.00-1.06	0.039	1.01	0.98-1.04	0.585
	Jungle	1.01	0.97-1.04	0.722	1.00	0.96-1.03	0.847
	Sierra	**Ref.**			Ref.		
	Jungle	0.98	0.95-1.01	0.114	0.99	0.96-1.02	0.501
Area of residence							
	Urban	**Ref.**			**Ref.**		
	Rural	1.02	1.00-1.04	0.108	0.99	0.97-1.02	0.674

PR: Prevalence ratio. aPR: Adjusted prevalence ratios. a: Adjusted according access to dental care; Receive information about oral hygiene; daily tooth brushing; and age

DISCUSSION.

Access to fluoride toothpastes in Peru is associated with factors such as economic, educational, social, cultural situation, among others, even though it has been demonstrated that their daily use in adequate quantity and quality is essential for the prevention of dental caries.[16] Accessibility is both a problem of supply and coverage. When access to a service does not concern the practices and care needs of the population, it indirectly generates a lack of interaction between the service provided and the beneficiaries. The study design has been based on the geographical barriers previously described by the WHO itself or Tanahashi, the latter proposes an effective coverage access model in which the population receives a good or service efficiently, and it is important to identify vulnerable groups with specific needs and barriers that must be promptly addressed.[11,12] Similarly, Donabedian identifies a relationship between socio-organizational accessibility, which includes service supply, and geographical accessibility with distance, time, and travel cost, among others.[17]

MINSA recommends the use of toothpastes

≥1000 ppm F to prevent dental caries.[2] However, this study shows that children who live in smaller cities use less toothpastes with adequate concentrations of fluoride. Hernández et al. indicate that people have greater access to dental services in capital cities,[18] which could be associated with a higher frequency of recommendations for the use of appropriate toothpastes, compared to less developed and remote cities. Although in the capital children use more toothpastes ≥1000 ppm F, it is evident that the supply is truly diverse with variations in composition and concentration of fluoride. This is due to the 2001 Technical Standard that allows commercialization of other concentrations lower than those recommended.[16,19,20]

According to data from the Peruvian Cosmetic and Hygiene Association (COPECOH, for its Spanish acronym), developed cities generate a greater demand for oral hygiene products.[21,22] In contrast, in the most vulnerable populations, programs like "Plan de Salud Escolar" and "Juntos" have promoted practices and habits aimed at oral health care mainly among public schools through the delivery of toothpastes and toothbrushes.[18,23] However, these efforts have not been sufficient. In the present study, children from less developed areas were those who least accessed this type of preventive measure. This makes us think that, although they receive State support through dental care or information about oral hygiene, they are still excluded from accessing toothpastes ≥1000 ppm F, which ultimately explains the high levels of dental caries.

There are certain family customs associated with low income that are likely to contribute to an adequate preventive practice. Arana *et al.*,[21] argue that in many families, children share the adult's toothpaste.Ramírez reported a similar situation in Colombia, in community homes.[24] In some low-income families, children may not be able to have their own toothpaste. Therefore, family toothpaste, which is used by adults and shared with children, usually has concentrations greater than 1000 ppm F. However, this would not occur in more geographically excluded areas where there is probably not access or enough income to purchase adequate toothpaste.[21,24] In 2018, Quiroz found that in Lima there is a wide variety of toothpaste presentations for children;[19] and in 2019, Hinostroza et al. found that only 43.75% of fluoridated toothpastes that are offered in the country's capital contain adequate concentrations of fluoride.[10] Therefore, it is evident that in the more developed cities there is a greater supply of toothpaste of multiple brands, origins, and varieties. Despite this situation, parents buy the appropriate toothpastes, possibly due to professional recommendation. The main limitation of the study is the loss of records during the data cleaning process; however, the type of sampling and analysis include this possible loss to continue having representative results.

Moreover, children younger than 1 year were not considered in this study because the ENDES survey did not record access to fluoridated toothpastes at that age, even though it is recommended that children use toothpaste since the appearance of the first tooth, which occurs approximately when they are six months. In addition, other socioeconomic, cultural, and educational variables associated with barriers to health access could not be included because the survey does not record them. Despite these limitations, the results are of the utmost importance since they show the Peruvian reality regarding the main preventive measure in oral health, helping to redesign strategies for having access to toothpastes with adequate fluoride concentrations. However, the inconsistency between the Technical Guidelines: clinical practice guidelines for the prevention, diagnosis and treatment of dental caries in children, which recommends the use of ≥1000 ppm fluoride toothpaste,8 and the Health Technical Standard for the addition of fluorides in toothpastes, mouthwashes and other products used in oral hygiene, which allows the commercialization of toothpastes of lower concentrations,[7] evidence that it is unlikely to implement an effective policy for the prevention of dental caries. This is a challenge that

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the Ministry of Health itself, which is responsible for both regulations, must assume. By correcting the technical standard, adequate access to toothpastes with adequate fluoride concentrations would be guaranteed throughout the country, and this would benefit the entire population.

Finally, the results presented are before the coronavirus disease pandemic (COVID-19), which may have varied due to the impact that the pandemic has had on oral health indicators such as access to dental care, which increased by more one year according to previous study.[25] However, these results should be considered by those who make public health policies, specifically by those responsible for oral health at the national level in Peru and countries in the region, so that they can evaluate how geographical barriers may limit the establishment of oral health practices such as the use of fluoridated toothpastes; these policies to close inequality gaps will allow for better oral health in the population.

CONCLUSION.

In general, it is concluded that the place of residence and the natural region are geographical barriers for the use of ≥1000 ppm fluoride toothpaste in children aged 1 to 11 years in Peru in 2018, and, specifically, that the majority of children from 1 to 11 years old use ≥1000 ppm fluoride toothpaste. In addition, in the country, town and small city, children use less ≥1000 ppm fluoride toothpaste than in the capital or large city. The same result is observed in the Jungle, Sierra and the rest of the Coast when compared to Lima.

Conflict of interests:

All The Authors Declare No Conflict Of Interest In The Execution Of This Project.

Ethics approval:

This study was approved by the Institutional Ethics Committee of the Universidad Peruana Cayetano Heredia (CIE-UPCH) on April 16, 2020, with SIDISI Code No. 201304.

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REFERENCES.

1. Petersson GH, Bratthall D. The caries decline: a review of reviews. Eur J Oral Sci. 1996;104(4):436-43.
2. Marinho VC, Higgins JP, Sheiham A, Logan S. Fluoride toothpastes for preventing dental caries in children and adolescents. Cochrane Database Syst Rev. 2003.
3. Walsh T, Worthington HV, Glenny AM, Appelbe P, Marinho VC, Shi X. Fluoride toothpastes of different concentrations for preventing dental caries in children and adolescents. Cochrane Database Syst Rev. 2010.
4. Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, Lingström P, Mejàre I, Nordenram G, Norlund A, Petersson LG, Söder B. Caries-preventive effect of fluoride toothpaste: a systematic review. Acta Odontol Scand. 2003;61(6):347-55. doi: 10.1080/00016350310007590. PMID: 14960006.
5. Dos Santos AP, Nadanovsky P, de Oliveira BH. A systematic review and meta-analysis of the effects of fluoride toothpastes on the prevention of dental caries in the primary dentition of preschool children. Community Dent Oral Epidemiol.2013;41(1):1-12.
6. Kumar S, Tadakamadla J, Johnson NW. Effect of Toothbrushing Frequency on Incidence and Increment of Dental Caries: A Systematic Review and Meta-Analysis. J Dent Res. 2016;95(11):1230-6.
7. Ministry of Health. Sanitary technical standard for the addition of fluorides in toothpastes, mouthwashes and other products used in oral hygiene. Lima: Ministry of Health; 2001. Available from: http://www.digemid.minsa.gob.pe/UpLoad/UpLoaded/PDF/RESOLUCIONMINISTERIALN454-2001-SA_DM.pdf
8. Ministry of Health. Technical Guidelines: Clinical practice guide for the prevention, diagnosis and treatment of dental caries in children. Lima: Ministry of Health; 2017. Available from: https://cdn.www.gob.pe/uploads/document/file/322902/Gu%C3%ADa_de_pr%C3%A1ctica_cl%C3%ADnica_para_la_prevenci%C3%B3n__diagn%C3%B3stico_y_tratamiento_de_la_caries_dental_en_ni%C3%B1as_y_ni%C3%B1os__Gu%C3%ADa_t%C3%A9cnica20190621-17253-1sj2h61.pdf
9. Chávez BA, Vergel GB, Cáceres CP, Perazzo MF, Vieira-Andrade RG, Cury JA. Fluoride content in children's dentifrices marketed in Lima, Peru. Braz Oral Res. 2019;33:E51
10. Hinostroza-Ninahuanca JL, Serrano Cabana LC, Serrano Cabana RA. Characteristics of children's toothpastes marketed in Lima, 2019. [Thesis for professional degree]. Lima: Universidad Peruana Cayetano Heredia; 2019.
11. Tanahashi T. Health service coverage and its evaluation. Bulletin of the World Health Organization.1978;56(2):295-303.
12. Hirmas Adauy M, Poffald Angulo L, Jasmen Sepúlveda AM, Aguilera Sanhueza X, Delgado Becerra I, Vega Morales J. Barriers and facilitators of access to healthcare: a qualitative systematic review. Rev Panam Salud Publica. 2013;33(3):223–9.
13. Frenz P, Vega J. Universal health coverage with equity: what we know, don't know and need to know. Switzerland: Health Systems Global; 2010. Available from: http://healthsystemsresearch.org/hsr2010/images/stories/9coverage_with_equity.pdf
14. Sánchez-Torres DA. Accessibility to health services: theoretical debate on determinants and implications in public health policy. Rev Med Inst Mex Seguro Soc. 2017;55(1):82-9.
15. National Institute of Statistics and Informatics. Peru: Demographic and Family Health Survey 2018. [In Spanish]. Lima: National Institute of Statistics and Informatics; 2020.
16. Singh A, Purohit BM. Caries Preventive Effects of High-fluoride vs Standard-fluoride Toothpastes-A Systematic Review and Meta-analysis. Oral Health Prev Dent. 2018;16(4):307-14.
17. Travassos C, Martins M. A review of the concepts of access and use of health services. Cad. Saúde Pública, Rio de Janeiro. 2004;20(2):190-8.
18. Hernández-Vasquez A, Azañedo D, Díaz D, Bendezú G, Arroyo H; Vilcarromero S, Agudelo A. Access to oral health services in children under twelve years of age in Peru, 2014. Salud Colectiva. 2016;12(3):429-41.
19. Quiroz JM. In vitro evaluation of fluoride concentration in children's toothpastes marketed in Peru. [Thesis for master degree in pediatric dentistry]. Lima: Universidad Peruana Cayetano Heredia; 2018.
20. Hernández-Vásquez A, Azañedo D. Toothbrushing and fluoride levels in toothpaste used by Peruvian children under 12 years old. Rev Peru Med Exp Salud Publica. 2019;36(4):646-52.
21. Arana AS, Villa AE. Use of fluoridated toothpaste by children between 3 and 5 years of age in Trujillo. [In Spanish]. Rev Estomatol Herediana. 2006;16(2):89 - 92.
22. Encinas I. The cosmetic and personal hygiene market in Peru. Spain: Economic and commercial office of the embassy of Spain in Lima; 2018. Available from: https://www.ivace.es/Internacional_Informes-Publicaciones/Pa%C3%ADses/Per%C3%BA/Perucosmeticahigienepersonalicex2017.pdf
23. Villavicencio-Montenegro AL, León-Manco RA. The impact of mass media on the access to oral care and hygiene information in Peru, 2013-2016. Rev Fac Odontol Univ Antioq. 2019;30(2):143-53.
24. Ramírez-Puerta BS, Franco-Cortés AM, Ochoa-Acosta EM. Consumption habits and toothpaste use in the family group and children attending the community homes and childcare centres in Medellin, Colombia. Rev Salud Pública de Medellín. 2012;5(2):7-20.
25. Garcés-Elías MC, Castillo-López CED, León-Manco RA, Agudelo-Suárez AA. Impact of the COVID-19 pandemic on the timing of dental care in Peruvian children. Dent Med Probl. 2022;59(1):37-44.