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Development and Initial Psychometric Evaluation of the Infant Oral Care Knowledge, Attitudes and Intended Practices (Iockap) Tool Among Pregnant Women: A Cross-Sectional Study

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DEVELOPMENT AND INITIAL PSYCHOMETRIC EVALUATION OF THE INFANT ORAL CARE KNOWLEDGE, ATTITUDES AND INTENDED PRACTICES (IOCKAP) TOOL AMONG PREGNANT WOMEN: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background. Valid and concise instruments are needed to identify pregnant women's educational needs regarding infant oral care. This study aimed to develop and conduct an initial psychometric evaluation of the Infant Oral Care Knowledge, Attitudes, and Intended Practices (IOCKAP) tool among pregnant women attending primary care in Mexico.

Methods. A pool of 26 items was generated from previously published instruments, clinical recommendations, oral health policies, and conceptual models. Following expert assessment of face and content validity, a cross-sectional psychometric evaluation was conducted among 204 pregnant women aged 18-45 years attending a primary care facility in León, Guanajuato, Mexico. Item response characteristics and discriminatory ability were analyzed. The internal structure was examined using principal component analysis with Varimax rotation and Kaiser normalization, specifying a three-component solution corresponding to the theoretically defined Knowledge, Attitudes, and Intended Practices domains. Internal consistency was assessed using Cronbach's alpha.

Results. The final IOCKAP tool comprised 15 items: six Knowledge, five Attitudes, and four Intended Practices items. The content validity index was 0.89. The data were suitable for principal component analysis (KMO=0.760; Bartlett's test: $\chi^2(105)=811.66$, $p<0.001$). The three-component solution explained 50.64% of the total variance, with rotated component loadings ranging from 0.46 to 0.81. Cronbach's alpha was 0.82 for the overall tool and 0.70, 0.73, and 0.82 for Knowledge, Attitudes, and Intended Practices, respectively.

Conclusions. The IOCKAP showed evidence of content validity, an interpretable three-component internal structure, and acceptable internal consistency in this sample of pregnant women. The tool may be useful for identifying educational needs regarding infant oral care; however, external validation and assessment of temporal stability and predictive validity are warranted before broader application.

KEY WORDS:

Health Knowledge, Attitudes, Practice, Infant, Dental Care for Children, Oral Hygiene, Pregnant Women, Psychometrics.

BACKGROUND

The first 2,000 days of human life span the period from conception to five years of age and represent a critical window for establishing healthy behaviors.[1,2]

Oral health is no exception; during this period, consuming sugar increases the risk of dental caries due to ecological dysbiosis, in a positive dose-dependent manner.[3,4] Previous reports have demonstrated that the effect of sugar can be modulated by

63 factors such as oral hygiene, fluoride use, access to dental services, and the food
64 environment.[5]

65 Key measures for preventing early childhood caries (ECC) and limiting its progression
66 include reducing sugar intake and toothbrushing with fluoridated toothpaste.[6] There
67 are also specific guidelines on when to start brushing, how much toothpaste to use,
68 how to apply fluoride, and which oral hygiene accessories are required for children
69 under 3 years old.[7]

70 International recommendations for the use of dental services state that the first
71 examination of an infant or child between 1 and 23 months of age, should be performed
72 at the eruption of the first tooth and no later than 12 months. In our country, Mexico,
73 the official Mexican Standard NOM-013-SSA2-2015 for the prevention and control of
74 oral diseases states that it should begin in the first month of life.[8]

75 Additionally, maternal oral health and parental education play important roles in the
76 development of infants' oral health habits. In this context, the first 2,000 days of life
77 constitute a critical period for establishing oral health behaviors within the family
78 environment, and the knowledge, attitudes, and practices (KAP) of parents or
79 caregivers are fundamental.[9–11]

80 Effective planning of preventive oral health strategies from early life requires valid and
81 relevant assessment tools. Although instruments assessing parents’ and caregivers’
82 knowledge, attitudes, and practices related to children’s oral health are available, tools
83 specifically developed for use during pregnancy remain limited. Moreover, intentions
84 regarding infant oral care may begin to develop during pregnancy, making this period
85 particularly relevant for identifying educational needs and planning preventive

interventions. To our knowledge, no validated Spanish-language instrument has been specifically developed to assess pregnant women's knowledge, attitudes, and intended practices regarding infant oral care. Therefore, this study aimed to develop and conduct an initial psychometric evaluation of the Infant Oral Care Knowledge, Attitudes, and Intended Practices (IOCKAP; CAPCOB in Spanish) questionnaire among pregnant women attending a primary care facility in Mexico.

METHODS

Study design and setting

A cross-sectional validation study was conducted from 2019 to 2021. For this purpose, pregnant women aged 18 to 45 years who attended the CAISES León pregnancy club in Leon, Guanajuato, Mexico, and who were able to complete the tool independently were included in the present study. Participants who did not complete the questionnaire were excluded.

Sample size

The sample size was calculated assuming 20 items, with a minimum of 10 pregnant women per item, to perform a principal components analysis of the tool.[12] As a result, a minimum sample of 200 participants was established. The sampling was non-probabilistic.

Instrument administration and scoring

Sociodemographic data were collected, including age; educational level (no studies, primary, secondary, high school, or higher); occupation (housewife, employee,

professional, student, or other); and marital status (single, cohabiting, married, divorced, widowed). The variables of interest were measured as follows: Knowledge on a dichotomous scale; Attitudes and Intended Practices.

The study was carried out in two phases: (1) Tool development and face and content validity by experts; and 2) Item analysis, internal structure, and consistency evaluation (Figure 1).

Phase 1: development and experts' evaluation

Tool development

To develop the IOCKAP tool, two experts in oral public health (RT, VV) collected and developed a pool of 26 items, using the following validated instruments: Early Childhood Caries Basic Research Factors Questionnaire (BRFQ),[13] KAP questionnaires on children's oral health,[14] clinical recommendations in pediatric dentistry,[10,11,15,16,17] oral care policies,[8,18,19] and conceptual models related to infant oral care from the prenatal stage.[20-22]

Face and content validity by experts

Face and content validity were assessed using expert judgment, following the methodology previously reported by our research group.[23] In this way, 20 items related to practices, attitudes, and knowledge regarding dental visits, oral hygiene, fluoride use, sugar consumption, and the use of shared cutlery were selected.

Phase 2: psychometric evaluation in pregnant women

Item analysis

For each item, an item response index was calculated as the proportion of participants providing the response a priori defined as correct or favorable, divided by the total number of participants who answered that item. For dichotomous Knowledge items, the index represented the proportion of correct responses and was interpreted as an item difficulty index. For Likert-type Attitudes and Practices items, Agree/Strongly agree responses were classified as favorable for positively worded items, whereas Disagree/Strongly disagree/Don't know responses were classified as favorable for negatively worded items. Values between 0.20 and 0.80 were considered acceptable, as they indicated sufficient response variability and reduced the likelihood of extreme floor or ceiling effects.

Item discrimination was assessed by comparing participants with high and low total IOCKAP scores. The median of the total score distribution was used as the cutoff point to classify participants into the low and high-score groups. For each item, response distributions between the two groups were compared using the Kruskal–Wallis test. Items showing statistically significant differences between the high- and low-score groups ($p<0.05$) were considered to have adequate discriminatory ability.

Internal consistency

Cronbach's alpha was calculated for the overall instrument and for each dimension. Item-deleted alpha coefficients were also examined to determine whether removal of any individual item improved internal consistency.

Internal structure

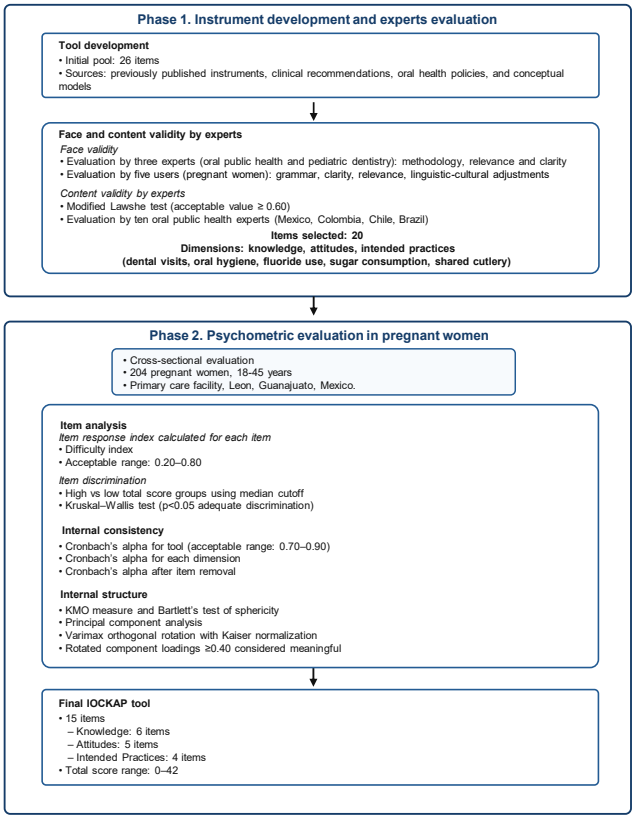
The suitability of the data for principal component analysis was assessed using the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. Because the IOCKAP tool was developed a priori to assess three theoretically defined domains (Knowledge, Attitudes, and Practices) a three-component solution was specified. Principal component analysis with Varimax orthogonal rotation and Kaiser normalization was performed to examine the internal structure of the tool. Rotated component loadings ≥0.40 were considered meaningful for item interpretation. Because Varimax is an orthogonal rotation method, correlations among components were constrained to zero and therefore were not reported. Statistical analyses were performed using IBM SPSS Statistics for Windows, v 27.

Ethical considerations

The Research Ethics Committee of the National School of Higher Studies, León Unit, UNAM, approved the research protocol under CEI.18_013_S1. All participants signed an informed consent.

Figure 1 Development and psychometric evaluation of the IOCKAP tool

Figure 1. Development and psychometric evaluation of the IOCKAP tool



RESULTS

Participant characteristics

The sample comprised 204 pregnant women aged 18-45 (mean age 25 years, SD 6) who participated in the study. All were attendees of the CAISES Leon pregnancy club in León, Guanajuato, Mexico. The pregnant women reported having primarily completed secondary and high school education. Regarding occupation, a high percentage reported being homemakers or employed. Most participants were in a common-law relationship or married, while 42 reported being single, and the smallest percentage reported being widowed or divorced. Regarding pregnancy-related

aspects, 45.6% of the pregnant women were in the first trimester of pregnancy, and more than half were multiparous women (Table 1).

Table 1. Description of the population by sociodemographic characteristics. (n=204)

Sociodemographic characteristic	Mean (SD)[a]	n	%
Maternal age, years	25 (6)		
Educational level			
Without studies		7	3.5
Primary		33	16.2
Secondary		80	39.2
High school		48	23.5
University		36	17.6
Occupation			
Housewife		129	63.3
Employee		40	19.6
Professional		16	7.8
Student		8	3.9
Other		11	5.4
Marital status			
Single woman		42	20.7
common-law union		83	40.6
Married		76	37.2
Divorced/ Widowed		3	1.5
First pregnancy			
No		114	55.9
Yes		90	44.1
Pregnancy trimester			
First trimester		93	45.6
Second trimester		64	31.4
Third trimester		47	23.0
Dental insurance			
No		189	92.6
Yes		15	7.4

[a]SD: Standard Deviation

Content Validity

The reference value for item validity was ≥0.60.[24] Seventeen items had acceptable content validity values. The items "*It is necessary to supplement breast milk with powdered milk during the baby's first six months"*; "*Germs that cause dental caries can*

be transmitted to the baby if they are kissed on the mouth"; and "I*t is important to apply fluoride to strengthen the baby's teeth*" were discarded due to their values ranging from 0.30 to 0.50. At the end of the evaluation process, the final 10-item instrument achieved a content validity index (CVI′) of 0.89.

Item difficulty and discrimination

The difficulty of each, item ranged from 0.25 to 0.83. One retained item showed an item response index of 0.83, slightly above the predefined upper threshold of 0.80. We retained this item because of its conceptual relevance to infant oral care and because the deviation from the predefined criterion was marginal. Expert judgment supported its inclusion to preserve the content coverage of the Knowledge domain. Only two items, "*Decay in baby teeth can cause decay in adult teeth*" and "*It is important to take your baby to the dentist, even if they don't have teeth*," yielded values of 0.16 and 0.07, respectively, and were therefore excluded from further analysis. The optimal difficulty was observed in the average item difficulty across the final set of 15 items (0.50).

Using the median total IOCKAP score as the cutoff point, participants were classified into low-score and high-score groups. The Kruskal–Wallis test showed statistically significant differences in item responses between the two groups ($p<0.001$), supporting the retained items' discriminatory ability (Table 2).

Table 2. Item validity, response indices, and internal consistency of the IOCKAP tool.

Dimension	Item	CVR'[a]	d[b]	α[c] if item deleted	Decision
Knowledge	1. Dental visits should begin at one month of age	0.9	0.68	0.65	Accepted
	2. The baby's mouth should be cleaned with gauze and water, even if the milk teeth have not yet come in.	0.8	0.72	0.65	Accepted
	3. Brushing with a toothbrush should begin as soon as the baby teeth appear.	1.0	0.67	0.68	Accepted
	4. The baby's mouth should be cleaned at least twice a day	1.0	0.83	0.67	Accepted
	5. The amount of toothpaste used on a baby's toothbrush between 6 months and 3 years old should be equivalent to the size of a grain of rice (if they can already spit).	0.8	0.74	0.66	Accepted
	6. The use of fluoride strengthens baby's teeth	0.7	0.68	0.63	Accepted
	-- It is necessary to supplement breast milk with powdered milk during the baby's first six months.	0.5	-	-	Rejected
	-- Germs that cause tooth decay can be transmitted to a baby if they are kissed on the mouth	0.3	-	-	Rejected
	-- Tooth decay in baby teeth can lead to tooth decay in adult (hard) teeth.	0.7	0.16	-	Rejected
Attitudes	7. It is important to take the baby to the dentist, even if there is no pain or apparent problem.	0.9	0.51	0.73	Accepted
	8. It is important to clean the baby's mouth, even if they don't have teeth yet.	0.9	0.29	0.70	Accepted
	9. It is important to control the amount of sugar given to the baby.	0.9	0.50	0.63	Accepted
	10. Using a baby bottle with sugary drinks to help the baby sleep is harmful to the baby.	1.0	0.46	0.66	Accepted
	11. It is important that babies have their own feeding and hygiene utensils	0.6	0.42	0.68	Accepted
	-- Applying fluoride is important to strengthen a baby's teeth	0.5	-	-	Rejected
	-- It's important to take your baby to the dentist, even if they don't have teeth.	0.8	0.07	-	Rejected
Intended Practices	12. I will take him to the dentist as soon as he turns one month old or his baby teeth come in.	0.9	0.28	0.81	Accepted
	13. I will clean his mouth at least twice a day	1.0	0.25	0.72	Accepted
	14. I will clean his mouth before he goes to sleep	1.0	0.27	0.75	Accepted
	15. I will clean his mouth after eating	1.0	0.25	0.77	Accepted
		CVI'[d] 0.89	D[e] 0.50	α[c] total 0.82	

[a]CVR': Content Validity Ratio per item (acceptable value ≥0.60)
[b]d: Item difficulty index (acceptable value 0.20 to 0.80)
[c]α: Cronbach's alpha
[d]CVI': Content Validity Index of the tool (acceptable value ≥0.60)
[e]D: Average difficulty index of the tool (acceptable values close of 0.50)

Internal structure

The data were suitable for principal component analysis, as indicated by a KMO value of 0.760 and a statistically significant Bartlett's test of sphericity (χ^2=811.66, p<0.001). The three-component solution explained 50.64% of the total variance. After Varimax rotation, the first component (knowledge) accounted for 22.15% of the variance, the second (attitudes) for 13.90%, and the third (intended practices) for 14.59%. All 15 retained items showed rotated component loadings ≥0.40 on their corresponding component, ranging from 0.466 to 0.813. The rotated solution showed an interpretable

structure that corresponds to the theoretically proposed Knowledge, Attitudes, and Intended Practices domains (Table 3).

Internal Consistency

The internal consistency analysis yielded a Cronbach's alpha of 0.82 for the 15-item IOCKAP tool. Cronbach's alpha values for removing each item ranged from 0.63 to 0.82, so all items were retained in the final tool. The α values obtained for the Knowledge dimension were 0.70, for Attitudes 0.73, and for Practices 0.82.

Table 3. Component loading matrix and Cronbach's alpha values for the dimensions identified in the IOCKAP tool.

Item	**Dimension 1** Knowledge	**Dimension 2** Attitudes	**Dimension 3** Intended Practices
1	0.73	-	-
2	0.75	-	-
3	0.62	-	-
4	0.70	-	-
5	0.79	-	-
6	0.81	-	-
7	-	0.46	-
8	-	0.57	-
9	-	0.75	-
10	-	0.68	-
11	-	0.58	-
12	-	-	0.62
13	-	-	0.78
14	-	-	0.74
15	-	-	0.70
	α= 0.70	α=0.73	α=0.82

[c]α: Cronbach's alpha
Extraction method: principal component analysis. Rotation method: Varimax with Kaiser normalization. Loadings <0.40 suppressed. KMO= 0.760; Bartlett's test of sphericity: $\chi^2(105)=811.66$, $p<0.001$. Total variance explained= 50.64%.

Based on the reliability and validity assessment criteria, the final version of the IOCKAP consisted of 15 items. The Knowledge component comprises six items with response

options: 0) False and 1) True. The Attitudes (five items) and Practices dimensions (four items) use a Likert-type scale with five response options: 0) Strongly disagree to 4) Strongly agree. The tool's minimum score is 0, and the maximum is 42, with higher scores indicating better knowledge, attitudes, and practices regarding infant oral care. The recorded response time was 9 minutes.

DISCUSSION

This study developed and conducted a psychometric evaluation of the IOCKAP, a brief tool designed to assess pregnant women's knowledge, attitudes, and intended practices regarding infant oral care. The final 15-item tool demonstrated satisfactory content validity, an interpretable three-component internal structure consistent with the theoretically proposed domains, and acceptable internal consistency. These findings provide preliminary support for using it to identify prenatal oral health educational needs.

For this evaluation, an initial objective content validity test was used, with the degree of agreement among experts serving as the criterion for including only items representative of the construct. Accordingly, the critical values of CVR' and CVI' from Tristan (2008)[24] are used to modify the Lawshe test and to verify the modification with other theoretical and dimensionality-reduction components.[25]

Although the results meet the statistical criteria for eliminating the items, opinion informed by theoretical knowledge and scientific evidence is still necessary. Therefore, it should be noted that the item "Germs that cause cavities can be transmitted to the

baby if they are kissed on the mouth" lacks conclusive supporting evidence. While saliva exchange can plausibly transmit cariogenic bacteria,[26] their presence does not determine the development of a multifactorial, behavioral disease such as dental caries.[3] For this reason, these items were eliminated rather than reformulated. Furthermore, the item "It is necessary to supplement breast milk with powdered milk during the baby's first six months" was identified as a confounding element that hindered the distinction between correct and incorrect information.

Two additional items showed very low proportions of expected responses and fell below the predefined threshold. These items were therefore removed before the internal structure analysis. The items "Can decay in baby teeth cause cavities in adult teeth?" and "It is important to take your baby to the dentist, even if they don't have teeth" were eliminated to avoid biased responses due to lack of understanding or confusing wording.

The prespecified three-component solution was consistent with the conceptual organization of the IOCKAP into Knowledge, Attitudes, and intended Practices and explained 50.64% of the total variance. All retained items had rotated component loadings ≥0.40. Nevertheless, because the three-component solution was specified a priori and evaluated in the same sample used for the initial psychometric assessment, its stability should be examined in an independent population using confirmatory approaches.[27] The structure of the proposed tool, identified through factor analysis, aligns with that of the initially proposed items, as confirmed by their critical CVR' values. This reinforces the KAP model's structure and its coherent grouping. The KAP model remains an epidemiological tool for rapid assessment and diagnosis of

population needs across various health areas, and it also helps identify gaps between knowledge and practice.[28] Finally, this tool has acceptable internal consistency values for each independent dimension and for the complete questionnaire. Additionally, individual item verification indicates that the overall alpha value does not improve when any item is removed.[29]

The proposed tool enables prenatal assessment of pregnant women's knowledge, attitudes, and intended practices regarding infant oral care. Several instruments focus on children, to our knowledge, the IOCKAP tool is among the first specifically designed for pregnant women. The BRFQ[13] was developed in Spanish and English in the United States, and its design process is documented; however, its psychometric properties have not yet been published. Another battery of instruments developed in Spanish for the Colombian population reported Cronbach's alphas of 0.82 for knowledge, 0.85 for attitudes, and 0.62 for practices.[14] Both instruments were designed for parents/caregivers of children aged 0 to 5 years. Another study reports the development of an instrument for caregivers of children aged 0-36 months, with evaluations of clarity (0.91) and relevance (0.95).[30] However, none of these studies targeted pregnant women.

Although breastfeeding, complementary feeding, and the transition to the family diet are essential components of infant oral health, the IOCKAP does not include specific items on these topics because validated instruments already assess these domains.[31–34] Use in combination with the CAPSOM tool,[23] which evaluates maternal oral health knowledge, attitudes, and practices, it may provide a more comprehensive perspective by addressing both maternal oral health and intended infant oral care. This

complementary approach may be particularly valuable from a family-centered perspective, as maternal behaviors, beliefs, and oral health practices can influence the establishment of oral health routines within the household and the early development of the child's oral health. Therefore, combining IOCKAP and CAPSOM[23] may support a more integrated assessment of maternal–child and family oral health needs and help guide preventive and educational interventions during pregnancy and early childhood.

The present study has limitations. It was conducted at only one healthcare center, limiting the generalizability of the results to other populations. Although content validity, construct validity, and internal consistency were assessed, other psychometric properties, such as temporal stability or predictive validity, were not analyzed, so further research is needed. As with all instruments designed to assess health concepts, social desirability bias is possible. Several steps were taken to minimize potential sources of bias. An expert review using quantitative criteria (CVR' and CVI') was conducted to ensure content validity and reduce investigator subjectivity. Items with low validity, poor discrimination, excessive difficulty, or insufficient scientific support were removed to avoid measurement bias. Internal consistency was assessed using Cronbach's alpha to reduce random error. Predetermined statistical thresholds guided item retention, limiting arbitrary decisions. The tool was developed based on current guidelines and evidence, reducing conceptual bias. Incomplete questionnaires were excluded to prevent missing-data bias.

In addition, the Practices domain assesses intended rather than observed postnatal behaviors; therefore, scores should not be interpreted as evidence of actual infant oral care practices. Finally, the three-component structure was prespecified and evaluated

using principal component analysis in a single sample; independent confirmation of the dimensional structure is warranted.

CONCLUSIONS

The IOCKAP demonstrated evidence of content validity, an interpretable three-component internal structure, and acceptable internal consistency for assessing pregnant women's knowledge, attitudes, and intended practices regarding infant oral care in this Mexican primary care sample. Its brief administration time may help identify prenatal oral health educational needs. Further studies should evaluate its temporal stability, external validity, and predictive ability in independent and more diverse populations before broader clinical or population-level implementation.

LIST OF ABBREVIATIONS

α: Cronbach's alpha; BRFQ: Early Childhood Caries Basic Research Factors Questionnaire; CAPCOB: Conocimientos, Actitudes y Prácticas de Cuidado Oral del Bebé; CAISES: Comprehensive Care Center for Essential Health Services; CVI': Content Validity Index; CVR': Content Validity Ratio; d: Item difficulty index; D: Average difficulty index of the tool; ECC: early childhood caries; ENES: National School of Higher Studies (*Escuela Nacional de Estudios Superiores*); IOCKAP: Knowledge, Attitudes, and Intended Practices on Infant Oral Care tool; KAP: knowledge, attitudes, and practices; Kaiser-Meyer-Olkin (KMO); SD: Standard Deviation; UNAM: National Autonomous University of Mexico (Universidad Nacional Autónoma de México).

DECLARATIONS

Ethics approval and consent to participate

The study protocol was approved by the Research Ethics Committee of the National School of Higher Studies, León Unit, National Autonomous University of Mexico(UNAM) CEI.18_013_S1. All participants provided written informed consent before participation.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

MART, FCAD, MCVV: designed the study, performed data collection and draft of the manuscript. JFH, LAGC: Drafted the work or substantively revised it. All authors read and approved the final manuscript.

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Use of Large Language Models

During manuscript preparation, the authors used ChatGPT (OpenAI; GPT-5.6 Sol) as an auxiliary tool for English language editing, grammatical correction, and manuscript organization. The tool was not used to formulate the research question, study design, data generation, data processing, statistical analysis, interpretation of the results, or the scientific conclusions. The authors critically reviewed, verified, and revised all AI-assisted suggestions and language modifications.

REFERENCES

1 Aguayo VM, Britto PR. The first and next 1000 days: a continuum for child development in early life. The Lancet. 2024;404(10467):2028-2030. doi: 10.1016/S0140-6736(24)02439-5.

2 Draper CE, Yousafzai AK, McCoy DC, et al. The next 1000 days: building on early investments for the health and development of young children. Lancet. 2024;404(10467):2094-2116. doi.org/10.1016/S0140-6736(24)01389-8.

3 Giacaman RA, Fernández CE, Sandoval CM, et al. Understanding dental caries as a non-communicable and behavioral disease: Management implications. Frontiers in Oral Health. 2022;3:764479. doi: 10.3389/froh.2022.764479.

4 Valenzuela MJ, Waterhouse B, Aggarwal VR, Bloor K, Doran T. Effect of sugar-sweetened beverages on oral health: a systematic review and meta-analysis. Eur J Public Health. 2021;31(1):122–129. doi: 10.1093/eurpub/ckaa147.

5 Touger-Decker R, van Loveren C. Sugars and dental caries. Am J Clin Nutr. 2003;78(4):881S-892S. doi: 10.1093/ajcn/78.4.881S.

6. Soares RC, da Rosa SV, Moysés ST, Rocha JS, Bettega PVC, Werneck RI, Moysés SJ. Methods for prevention of early childhood caries: Overview of systematic reviews. Int J Paediatr Dent. 2021;31(3):394-421. doi.org/10.1111/ipd.12766.

7 Toumba KJ, Twetman S, Splieth C, Parnell C, van Loveren C, Lygidakis NA. Guidelines on the use of fluoride for caries prevention in children: an updated EAPD policy document. Eur Arch Paediatr Dent. 2019;20(6):507-516. doi: 10.1007/s40368-019-00464-2.

8 Secretaría de Salud [Ministry of Health]. Mexican Official Standard NOM-013-SSA2-2015, for the prevention and control of oral diseases [Internet]. Mexico City: Diario Oficial de la Federación; 2016 Nov 23 [cited 2026 Sep 3]. Available from: https://dof.gob.mx/nota_detalle.php?codigo=5462039&fecha=23/11/2016.

9 Tenenbaum A, Azogui-Levy S. Oral Health Knowledge, Attitudes, Practices, and Literacy of Pregnant Women: A Scoping Review. Oral Health Prev Dent. 2023;21:185-98. doi: 10.3290/j.ohpd.b4100965.

10 American Academy of Pediatric Dentistry. Oral health care for the pregnant pediatric dental patient. In: The Reference Manual of Pediatric Dentistry. Chicago (IL): American Academy of Pediatric Dentistry;2019:354-363.

11 American Academy of Pediatric Dentistry. Perinatal and infant oral health care. The Reference Manual of Pediatric Dentistry. Chicago, (IL): American Academy of Pediatric Dentistry;2019:337-341.

12 Kline R. Principles and practice of structural equation modeling. 4th ed. New York: The Guilford Press 2016.

13 Albino J, Tiwari T, Gansky SA, et al. The basic research factors questionnaire for studying early childhood caries. BMC Oral Health. 2017;17(1):83. doi: 10.1186/S12903-017-0374-5.

14 Martignon S, Bautista-Mendoza G, González-Carrera M, Lafaurie-Villamil G, Morales V, Santamaría R. Instrumentos para Evaluar Conocimientos, Actitudes y Prácticas en Salud Oral para Padres/Cuidadores de Niños Menores. Rev salud pública. 2008;10(2):308–314.

15 American Academy of Pediatrics. A pediatric guide to children's oral health. Elk Grove Village (IL): American Academy of Pediatrics; 2013.

16 World Health Organization. Ending Childhood Dental Caries. WHO Implementation manual. Geneva 2019.

17 Latin American Association of Pediatric Dentistry. Infant oral health guide for pediatricians. 2017.

18 American Academy of Pediatric Dentistry. Policy on social determinants of children's oral health and health disparities. The Reference Manual of Pediatric Dentistry. Chicago, IL: American Academy of Pediatric Dentistry; 2017:47-51.

19 American Academy of Pediatric Dentistry. Policy on Early Childhood Caries (ECC): Consequences and Preventive Strategies. The Reference Manual of Pediatric Dentistry. 2021;34:96–100. doi: 10.1111/ipd.13140.

20 Finlayson TL, Gupta A, Ramos-Gomez FJ. Prenatal Maternal Factors, Intergenerational Transmission of Disease, and Child Oral Health Outcomes. Dent Clin North Am. 2017;61:483–518. doi: 10.1016/j.cden.2017.02.001.

21 Fisher-Owens SA, Gansky SA, Platt LJ, Weintraub JA, Soobader MJ, Bramlett M, Newacheck PW. Influences on children's oral health: A conceptual model. Pediatrics. 2007;120(3):e510-520. doi: 10.1542/peds.2006-3084.

22 Wagner Y, Heinrich-Weltzien R. Risk factors for dental problems: Recommendations for oral health in infancy. Early Hum Dev. 2017;114:16–21. doi: 10.1016/j.earlhumdev.2017.09.009.

23 Ramírez-Trujillo MA, Villanueva-Vilchis MC, Aguilar-Díaz FC, de la Fuente-Hernández J, Gaitán-Cepeda LA. Validation of an instrument to determine oral health knowledge, attitudes, and practices during pregnancy. BMC Oral Health. 2021;21(1):554. doi: 10.1186/S12903-021-01898-1.

24 Tristán-López A. Modificación al modelo de Lawshe para el dictamen cuantitativo de la validez de contenido de un instrumento objetivo. Avances en medición. 2008;6:37–48.

25 Romero Jeldres M, Díaz Costa E, Faouzi Nadim T. A review of Lawshe's method for calculating content validity in the social sciences. Front Educ (Lausanne). 2023;8:1271335. doi.org/10.3389/feduc.2023.1271335.

26 de Abreu MHNG, Cruz AJS, Borges-Oliveira AC, Castro R, Freitas F. Perspectives on Social and Environmental Determinants of Oral Health. Int J Environ Res Public Health. 2021;18(24):13429. doi: 10.3390/ijerph182413429.

27 Watson JC. Establishing Evidence for Internal Structure Using Exploratory Factor Analysis. Measurement and Evaluation in Counseling and Development. 2017;50:232–8. doi: 10.1080/07481756.2017.133693127.

28 Haloi R, Ingle NA, Kaur N. KAP Surveys and Oral Health: A Detailed Review. Journal of Contemporary Dentistry. 2014;4:99–105. doi: 10.5005/jp-journals-10031-1077.

29 Streiner DL. Starting at the Beginning: An Introduction to Coefficient Alpha and Internal Consistency. Journal of Personality Assessment. 2003;80(1):99-103. doi:10.1207/S15327752JPA8001_18.

30 Santana Praxedes RC, Gubert F do A, de Barros Sousa G, et al. Saúde bucal na infância: construção e validação de instrumento sobre conhecimento, atitude e prática de cuidadores. Cien Saude Colet. 2023;28(8):2203-2214. doi: 10.1590/1413-81232023288.07042023.

31 Zeeshan M, Rafiq A, Rafique A, et al. Assessment of Knowledge of Pregnant Women Regarding Benefits of Breastfeeding. Journal of Fatima Jinnah Medical University. 2024;18:59–63. doi: 10.37018/JFJMU/5963.

32 Aguilar-Navarro HJ, Coronado-Castilleja A, Gómez-Hernández OJ, et al. Adaptación de la Iowa Infant Feeding Attitude Scale en población mexicana. Acta Pediatr Mex. 2016;37(3):149–158.

33 Navarro G, Reyes I. Validación Psicométrica de la Adaptación Mexicana del Child Feeding Questionnaire. Acta Investig Psicol. 2016;6(1):2337-2349. doi: 10.1016/S2007-4719(16)30054-0.

34. Romero-Martínez M, Shamah-Levy T ,Barrientos-Gutiérrez T, Cuevas-Nasu L, Bautista-Arredondo S, Colchero MA, Gaona-Pineda EB, Martínez-Barnetche J, Alpuche-Aranda C, Gómez-Acosta LM, Mendoza-Alvarado LR, Rivera-Dommarco J, Lazcano-Ponce E. Encuesta Nacional de Salud y Nutrición 2023: metodología y avances de la Ensanut Continua 2020-2024. Salud Publica Mex. 2023;65:394-401.https://doi.org/10.21149/15081.