

Public Awareness and Perception of Salivary Transmission of Cariogenic Bacteria: A Cross-Sectional Observational Study

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ABSTRACT

OBJECTIVE: To assess the public awareness and perception regarding the salivary transmission of cariogenic bacteria among the general population in Hyderabad

METHODOLOGY: An observational cross-sectional study was conducted from July, 2025 to October 2025 among the general population of Hyderabad, Sindh, Pakistan. A structured questionnaire, developed following a literature review and expert validation, was used to conduct a descriptive cross-sectional study using convenience sampling. Responses were gathered from 306 Hyderabad residents. Data were analyzed using descriptive statistics and reported as frequencies and percentages.

RESULTS: Out of 306 respondents, 79.4% lived in urban areas, and 63.7% reported visiting a dentist at least once. Only 39.2% of respondents thought dental caries could be transmitted between individuals, even though 74.2% had heard about “dental caries”. 94.8% of respondents agreed that salivary-related habits, including sharing utensils, using the same toothbrush, or making close mouth contact, could raise oral health risks, and a vast majority (90.2%) acknowledged that bacteria could spread through saliva.

CONCLUSION: The study shows a lack of public awareness regarding the spread of cariogenic bacteria through saliva. Public education campaigns that emphasize the transmissibility of caries and promote preventive practices are needed to improve oral health outcomes.

KEYWORDS: Dental Caries, Streptococcus mutans, Saliva, Oral Health

INTRODUCTION

Oral health is an essential component of overall health and well-being. One of the most prevalent dental health problems is dental caries. Although it can currently be prevented in its early stages, the disease remains common due to a lack of education and awareness¹. Dental caries is one of the major public health concerns. Approximately 2.5 billion people worldwide have untreated caries in their permanent teeth². A recent systematic review and meta-analysis conducted in Pakistan reported an overall dental caries prevalence of 56.6%, with Sindh showing a prevalence of 58.9%. Studies conducted in Hyderabad reported prevalence rates ranging from 49.6% to 90%, indicating a substantial burden of dental caries in the region³. Streptococcus mutans is considered one of the principal microorganisms involved in the initiation and progression of dental caries⁴. However, the cariogenic potential of this bacterium is influenced by several factors, including dietary habits and frequent sugar consumption⁵. Salivary exchange plays an important role in the transmission of Streptococcus mutans through both vertical and horizontal pathways⁶. Studies have demonstrated that mothers and close family members

frequently have similar strains of cariogenic bacteria, especially Streptococcus mutans, indicating that the transmission of cariogenic microorganisms commonly occurs within families⁷.

Additionally, individuals living in the same household have been shown to share substantially higher rates of oral bacterial strains than non-cohabiting individuals, highlighting person-to-person contact and shared environments as important contributors to the spread of cariogenic bacteria⁸. A systematic review and meta-analysis revealed additional evidence of horizontal transmission of Streptococcus mutans, with comparable genotypes shared by children in homes, schools, and daycare settings⁹. Among adults, direct salivary contact through oral-oral interactions, such as kissing, has been identified as an important mechanism for the exchange of oral microorganisms and the transmission of oral bacterial strains¹⁰.

Despite dental caries being one of the most prevalent diseases worldwide and a major public health concern, public awareness regarding the salivary transmission of cariogenic bacteria remains relatively underexplored, particularly in Pakistan. Previous studies have largely focused on the microbiological aspects of cariogenic bacteria, their transmission pathways, and preventive strategies. However, limited evidence is available regarding the public's awareness, perceptions, and understanding of these transmission mechanisms. Assessing the level of knowledge and identifying prevailing misconceptions may provide valuable insights for oral health professionals and policymakers in developing targeted

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educational interventions. Therefore, the present study aims to assess public awareness and perception of the salivary transmission of cariogenic bacteria and to highlight potential knowledge gaps that may influence preventive oral health behaviors.

METHODOLOGY

This cross-sectional observational study aimed to explore awareness levels, behavioral practices, and perceptions regarding the salivary transmission of oral bacteria using a non-probabilistic convenience sampling method. The study was conducted among the General population of the Hyderabad region between July 2025 and October 2025. Formal ethical approval was taken before data collection (LUMHS/REC/-974). A non-probabilistic convenience sampling method was used.

The sample size was calculated using the single population proportion formula based on the reported prevalence of dental caries in Pakistan (56.6%)³, a 95% confidence level, and a precision level of 5.6%. The minimum required sample size was estimated to be 301 participants. A total of 306 complete responses were obtained and included in the final analysis.

Responses were collected through online distribution across diverse areas of Hyderabad to maximize participant reach.

The questionnaire was developed following an extensive review of relevant literature on dental caries, oral health awareness, and salivary transmission of cariogenic bacteria. Content validity was assessed through expert review, and a pilot study involving 25 participants was conducted to evaluate the clarity, comprehensibility, and feasibility of the questionnaire. Data obtained from the pilot study were not included in the final analysis. Those living in the Hyderabad region, aged ≥ 18 years, and able to understand Urdu or English were included in the study. At the same time, incomplete responses, Non-residents of Hyderabad, and duplicate submissions were excluded. Participation was voluntary and anonymous. Before participation, respondents were provided with study information and electronic informed consent. The questionnaire remained accessible throughout the study period, and only complete responses were included in the final analysis.

Awareness was assessed descriptively through responses to individual questionnaire items addressing knowledge, perceptions, and practices related to salivary transmission of cariogenic bacteria. No composite awareness score was generated, and responses were analyzed on an item-by-item basis. The questionnaire consisted of closed-ended, multiple-choice questions in both English and Urdu to ensure clarity, uniformity, and ease of statistical analysis. Participants were questioned on their understanding of bacterial transmission through shared utensils, toothbrushes, and close interpersonal contact involving salivary exchange, while maintaining cultural

sensitivity in language.

This survey maintained the confidentiality of the participants, as no identifiable information was collected.

The data were entered and organized in Microsoft Excel, and analyzed using SPSS version 22. Since the study aimed to describe awareness and perceptions, only the descriptive statistics were applied. Inferential statistical tests were not performed because the study was descriptive.

RESULTS

A total of 306 individuals participated in the study. Demographic characteristics of the participants are summarized in **Table I**. Out of all respondents, 195 (63.7%) had visited a dentist at least once in their lifetime, while 111 (36.3%) reported never having visited one, which is shown in **Figure 1**.

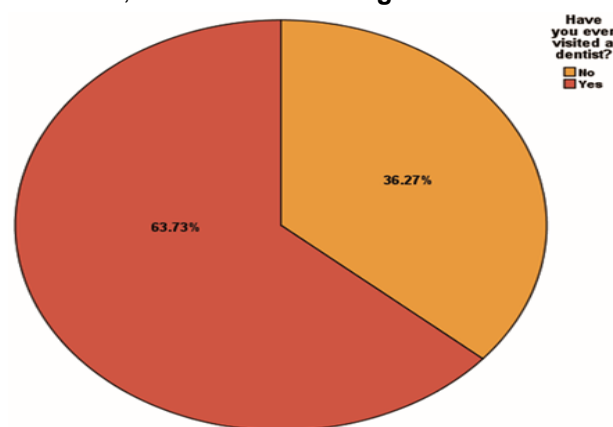


Figure 1: Ever visited a Dentist

Awareness and perception regarding dental caries are summarized in **Table II**.

Table I: Demographic Characteristics of Participants (n = 306)

Variable	Category	Frequency (n)	Percentage (%)
Residence	Urban	243	79.4
	Rural	63	20.6
Dental visit ever	Yes	195	63.7
	No	111	36.3
Gender	Female	188	61.4
	Male	115	37.6
	Prefer Not to Say	3	1
Education Level	Graduate or above	189	61.8
	Intermediate	97	31.7
	Primary	4	1.3
	Secondary	13	4.2
	No Formal Education	3	1

Figure 2 shows perceptions regarding the spread of dental caries, and **Figure 3** shows perceptions regarding the transmission of bacteria. Behaviors associated with salivary transmission of the participants are presented in **Table III**. **Table IV** summarizes the knowledge regarding bacteria, dental caries, and oral health of the participants. The preferred method regarding learning of prevention of transmission of cariogenic bacteria was Dentist consultation 75.8 (n=232).

Table II: Awareness and Perceptions Regarding Dental Caries

Question	Yes n (%)	No n (%)
Heard of the term "dental caries"?	227 (74.2)	79 (25.8)
Believe dental caries can spread person-to-person	120 (39.2)	186 (60.8)
Believe bacteria can be transmitted through saliva	276 (90.2)	30 (9.8)
Think salivary-related behaviors can increase oral health risks	291 (94.8)	15 (5.2)
Aware that harmful bacteria linked to caries can pass between people	191 (62.4)	115 (37.6)
Ever received info on the contagious nature of oral diseases	153 (50.0)	153 (50.0)
Willing to change hygiene habits if informed about salivary spread	268 (87.6)	38 (12.4)

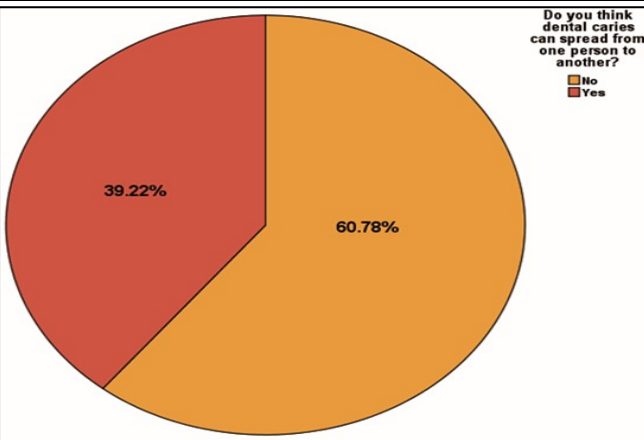


Figure 2: Perception of spread of dental caries

Table III: Behavior Associated with Salivary Transmission of Cariogenic Bacteria

Behavior	Frequency (n)	Percentage (%)
Sharing utensils/cups	140	45.8
Using the same toothbrush	240	78.4
Close mouth contact	139	45.4
Blowing on food	94	30.7

DISCUSSION

The study highlights public awareness of salivary transmission of dental caries across the Hyderabad

Figure 3: Perception regarding the spread of bacteria

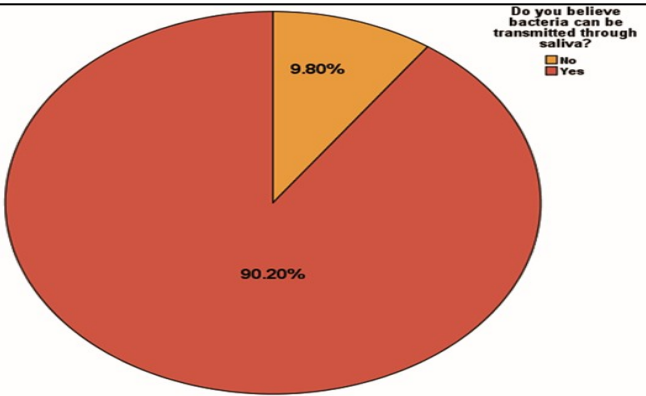


Table IV: Knowledge regarding bacteria, dental caries, and oral health

Knowledge Statements	Yes n (%)	No n (%)
Bacteria cause tooth decay	251 (82.0)	55 (18.0)
Bacteria can spread through kissing/close contact	142 (46.4)	164 (53.6)
Oral health affects overall systemic health	178 (58.2)	128 (41.8)
Caries is not communicable	52 (17.0)	254 (83.0)

region. Our findings revealed that while the majority of participants were aware of oral bacteria and their potential spread through saliva, they were still unaware of the communicability of dental caries; only a small proportion identified saliva as the route of transmission. This indicates a considerable knowledge gap regarding the infectious nature of caries, which has important implications for preventive strategies and public health education.

Out of 306 responses in our study, 276 (90.2%) believed bacteria can be transmitted through saliva, but only 120 (39.2%) believed caries are transmissible. Similar findings were reported by Ludovichetti et al.¹¹ in Italy, where substantial misconceptions regarding the infectious nature of dental caries were also observed: 53% were unaware of the transmissibility of carious lesions, and 42% believed that dental caries is not an infectious disease.

Regarding transmission-related behaviors, 140 (45.8%) identified sharing utensils, 240 (78.4%) identified toothbrush sharing, and 139 (45.4%) identified close mouth contact as potential routes of transmission. The research done by Jorma I. Virtanen et al.¹² indicates that the most common way of bacterial transmission from the mother's oral cavity to the child's oral cavity was kissing the child on the lips (38 %). This indicates negligence regarding the harmful effects of bacterial transmission, such as sharing utensils, close-mouth contact, etc.

The findings of the present study suggest that awareness regarding salivary transmission pathways

remains insufficient despite widespread recognition of oral bacteria. Similar knowledge gaps have been reported internationally, underscoring the need for targeted educational initiatives focused on preventive oral health behaviors and transmission-related risk factors. As for the idea of prevention after awareness, the participants of this study also agreed to improve their oral hygiene practices when they are aware of the pathogenicity or transmissibility of dental caries. 268 (87.6%) would change their hygiene habits. This shows a high level of concern about oral hygiene, as people are aware of the prevalence of dental caries over time.

The observed misconception about the transmissibility of dental caries may be attributable to the traditional perception that it is solely associated with sugar consumption and inadequate oral hygiene. Although these factors remain important contributors, increasing evidence demonstrates the role of cariogenic bacterial transmission through salivary contact. The discrepancy observed in the present study suggests that microbiological aspects of dental caries are not adequately communicated through routine oral health education programs.

Several limitations should be considered while interpreting the findings of this study. First, the use of convenience sampling may limit the generalizability of the results to the broader population of Hyderabad. Second, the study relied on self-reported responses, which may be subject to recall and social desirability bias. Third, the cross-sectional design provides a snapshot of awareness at a single point in time and does not allow causal inferences. Despite these limitations, the study provides valuable preliminary evidence regarding public awareness and perceptions of salivary transmission of cariogenic bacteria in a Pakistani population.

Future research employing larger, randomized samples and incorporating clinical assessments alongside self-reported data is recommended to enhance the validity and generalizability of findings.

CONCLUSION

The present study identified important gaps in public awareness regarding the salivary transmission of cariogenic bacteria. Although many participants recognized that bacteria can be transmitted through saliva, misconceptions about the transmissibility of cariogenic microorganisms and associated risk behaviors persisted. These findings underscore the need for targeted oral health education programs to improve public understanding of salivary transmission pathways and promote preventive practices that may reduce the burden of dental caries within the community.

Recommendations

The high proportion of respondents willing to modify their oral hygiene practices following awareness regarding salivary transmission is encouraging. This finding indicates that educational interventions

delivered through dental professionals, schools, social media platforms, and community outreach programs may effectively improve preventive oral health behaviors and reduce the burden of dental caries.

Ethical Permission: Liaquat University of Medical and Health Sciences, Jamshoro, Sindh, Pakistan, ERC approval letter No. LUMHS/REC/-974.

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Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

Statement of informed consent

Participants were informed about the study, and electronic consent was obtained before initiating data collection.

AUTHOR CONTRIBUTION

Bilal M: Conceived and designed the study, developed the research protocol, coordinated data collection, interpreted the data, drafted the manuscript, and critically revised the final version.

Devi S: Contributed to the study design, participated in data collection, assisted in data management, and reviewed the manuscript.

Raza F: Assisted in data collection, data organization, literature review, and manuscript revision.

Aabdani M: Participated in data collection and critical review of the manuscript.

Noor S: Contributed to data collection and data verification.

Mirza S: Supervised the study, critically revised the manuscript for important intellectual content, and approved the final version for publication.

REFERENCES

1. Tresna ST, Anggriani N, Napitupulu H, Ahmad WMAW, Setiawan AS. Mathematical Modeling for Contagious Dental Health Issue: An Early Study of *Streptococcus mutans* Transmission. *Mathematics* 2026; 14: 704. <https://doi.org/10.3390/math14040704>.
2. Jain N, Dutt U, Radenkov I, Jain S. WHO's global oral health status report 2022: Actions, discussion and implementation. *Oral Dis.* 2024; 30: 73–9. <https://doi.org/10.1111/odi.14516>.
3. Siddiqui AA, Alshammary F, Mulla M, Al-Zubaidi SM, Afroze E, Amin J et al. Prevalence of dental caries in Pakistan: a systematic review and meta-analysis. *BMC Oral Health.* 2021; 21. <https://doi.org/10.1186/s12903-021-01802-x>.
4. Spatafora G, Li Y, He X, Cowan A, Tanner ACR. The Evolving Microbiome of Dental Caries. *Microorganisms.* 2024; 12: 121. <https://doi.org/10.3390/micro12010121>.

- doi.org/10.3390/microorganisms12010121.
5. Abdulhadi TS, Nijris ON. Investigate the spread of *Streptococcus mutans* for patients with tooth decay in Samarra city. *Samarra J Pure Appl Sci.* 2023; 5: 89–97. <https://doi.org/10.54153/sjpas.2023.v5i4.422>.
 6. Esra K, Nurhan O, Yilmaz AD, Berrin O. Vertical and Horizontal Transmission of *Streptococcus Mutans* and Effective Factors: An In Vivo Study. *J Adv Oral Res.* 2020; 11: 172–9. <https://doi.org/10.1177/2320206820942694>.
 7. Dutta S, Mohapatra A. Early childhood caries-Etiology, prevention and management: A Review. *Arch Dent Res.* 2023; 12: 81–8. <https://doi.org/10.18231/j.adr.2022.015>.
 8. Valles-Colomer M, Blanco-Míguez A, Manghi P, Asnicar F, Dubois L, Golzato D et al. The person-to-person transmission landscape of the gut and oral microbiomes. *Nature.* 2023; 614: 125–35. <https://doi.org/10.1038/s41586-022-05620-1>.
 9. Manchanda S, Sardana D, Liu P, Lee GHM, Lo ECM, Yiu CKY. Horizontal Transmission of *Streptococcus mutans* in Children and Its Association with Dental Caries: A Systematic Review and Meta-Analysis. *Pediatr Dent.* 2021; 43: 1E-12E.
 10. Kort R. A sweet kiss with a bacterial touch: a potential positive feedback loop involved in shaping the oral microbiota. *Evol Human Behav.* 2026; 47: 106777. <https://doi.org/10.1016/j.evolhumbehav.2025.106777>.
 11. Ludovichetti FS, Zuccon A, Lucchi P, Cattaruzza G, Zerman N, Stellini E et al. Mothers' Awareness of the Correlation between Their Own and Their Children's Oral Health. *Int J Environ Res Public Health* [Internet]. 2022 Nov 1 [cited 2025 Aug 27]; 19(22). Available from: <https://pubmed.ncbi.nlm.nih.gov/36429685/>
 12. Virtanen JI, Vehkalahti KI, Vehkalahti MM. Oral health behaviors and bacterial transmission from mother to child: An explorative study. *BMC Oral Health.* 2015; 15(1): 1–7.

