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RESEARCH ARTICLE

Evaluation of Awareness and Perception Between Oral Hygiene and Cardiovascular Disease Prevention Among Urban and Rural Patients: A Comparative Cross-Sectional Study

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Abstract: ***Background***: Oral health plays a crucial role in overall systemic well-being. Accumulating evidence indicates a strong association between periodontal inflammation and cardiovascular diseases (CVDs) through inflammatory and microbial pathways. However, awareness about this connection remains limited, especially among the general population in developing regions. This study aimed to evaluate and compare awareness and perception regarding the relationship between oral hygiene and cardiovascular disease prevention among urban and rural patients. To assess the level of awareness and perception regarding the link between oral hygiene and cardiovascular disease prevention, and to compare responses between urban and rural populations. ***Materials and Methods***: A cross-sectional, questionnaire-based study was conducted among 200 patients attending medical and dental outpatient departments of a tertiary care hospital in Chennai, Tamil Nadu, from June to August 2025. Participants aged 18–65 years were included using convenience sampling. The validated questionnaire assessed demographic data, awareness, and attitudes toward oral–systemic health. Data were analyzed using SPSS Version 26, and associations between variables were tested using the Chi-square test, with $p<0.05$ considered statistically significant. ***Results***: Urban participants demonstrated significantly higher awareness than rural participants regarding the impact of oral hygiene on systemic and cardiovascular health ($p=0.021$). About 52% of urban participants believed oral health influences overall health compared to 21% in rural areas. Only 12% of rural respondents and 24% of urban respondents had heard that poor oral hygiene increases heart disease risk ($p=0.043$). Urban participants showed better oral hygiene practices, with 36% brushing twice daily compared to 23% in rural participants ($p=0.047$). Use of additional oral hygiene aids was significantly higher in urban populations (31%) than rural (7%) ($p<0.001$). Attitudinal differences were also noted, with urban participants more likely to consider oral hygiene "very important" for heart health ($p=0.047$). ***Conclusion***: The study highlights a considerable gap in awareness and perception between urban and rural populations. Urban participants exhibited greater knowledge and more positive attitudes, while rural participants showed limited understanding and poor oral hygiene practices. These findings underscore the need for targeted community-based educational initiatives integrating oral health awareness within cardiovascular disease prevention programs.

Keywords: Oral hygiene, Cardiovascular disease, Awareness, Perception, Periodontitis, Preventive dentistry.

INTRODUCTION

Oral health is a fundamental but often underestimated component of overall well-being. The oral cavity functions as the gateway to the body, reflecting and influencing systemic health through complex biological, inflammatory, and microbial interactions[1]. Over the past two decades, the traditional separation between oral and general health has gradually diminished as growing evidence has demonstrated bidirectional associations between oral diseases—particularly periodontal disease—and a range of systemic conditions such as diabetes mellitus, respiratory infections, adverse pregnancy outcomes, and cardiovascular diseases (CVD)[2,3]. Among these, the link between oral hygiene and cardiovascular health has attracted substantial scientific attention due to its potential implications for both clinical prevention and public health. Cardiovascular diseases remain the leading cause of mortality worldwide. According to the World Health Organization (WHO, 2023), CVDs account for nearly 17.9 million deaths each year, representing approximately 32 percent of all global deaths[4]. The majority of these deaths are attributed to coronary heart disease and cerebrovascular accidents. While classical risk factors such as hypertension, dyslipidemia, diabetes,

smoking, obesity, and sedentary lifestyle are well established, researchers increasingly recognize chronic inflammation and infection as additional contributors to the initiation and progression of atherosclerosis. This perspective has opened a new avenue of research exploring oral inflammation, particularly periodontitis, as a potential modifiable risk factor for cardiovascular pathology[5,6].

Periodontal disease is a chronic infectious condition characterized by progressive destruction of the supporting structures of the teeth. It arises from the complex interaction between bacterial biofilms and host immune responses[7]. Poor oral hygiene enables the accumulation of dental plaque, a structured microbial community that provokes a persistent inflammatory response in gingival tissues. If left untreated, this process leads to the release of inflammatory mediators such as C-reactive protein, interleukin-1β, tumor necrosis factor-α, and prostaglandin E_2, all of which can enter the systemic circulation. Experimental studies have demonstrated that these circulating inflammatory molecules contribute to endothelial dysfunction, lipid oxidation, and thrombogenesis—mechanisms central to atherosclerotic plaque formation and destabilization. Beyond biochemical mediators, viable oral bacteria have been isolated from atherosclerotic plaques, suggesting a direct microbial pathway linking the mouth and the cardiovascular system[8]. Common periodontal pathogens, including Porphyromonas gingivalis, Tannerella forsythia, and Aggregatibacter actinomycetemcomitans, have been detected in vascular lesions, reinforcing the concept that transient bacteremia during routine activities such as toothbrushing or mastication can transport microorganisms from inflamed gums into systemic circulation. Repeated exposure to such bacteremia may perpetuate vascular inflammation and promote plaque vulnerability, thereby increasing the risk of acute coronary syndromes[9].

Although the biological plausibility of this association is compelling, the clinical and public health relevance largely depends on community awareness and behavioral practices. In populations where oral hygiene is neglected, periodontal infections remain prevalent and may silently contribute to systemic inflammation. Lack of awareness regarding the oral–systemic connection prevents individuals from adopting preventive behaviors such as regular dental visits, professional cleaning, and early management of gum disease[10]. Consequently, promoting knowledge about oral health as an integral part of cardiovascular disease prevention could serve as a cost-effective strategy to reduce overall morbidity. Despite increasing scientific consensus, public perception of the relationship between oral hygiene and heart health remains limited. Many individuals still consider dental care primarily a matter of aesthetics or comfort rather than an essential component of systemic disease prevention. Previous surveys conducted in various countries, including India, have consistently shown inadequate awareness of oral–systemic links among both patients and even some healthcare providers. For instance, Gupta et al. (2021) reported that less than half of adult respondents in northern India were aware of any connection between periodontal infection and cardiovascular diseases. Similar results were found by Al-Zahrani et al. (2020) in Saudi Arabia, where only one-third of participants recognized that gum disease could influence heart conditions. These findings underscore a persistent knowledge gap that warrants urgent educational intervention[11].

The Indian population faces a dual burden of non-communicable diseases and oral health issues. National health surveys indicate a rising trend in CVD mortality, largely driven by lifestyle factors, stress, and poor preventive awareness. At the same time, periodontal disease affects more than 60 percent of adults, often remaining undiagnosed until advanced stages. This convergence of high prevalence and low awareness makes it critical to evaluate how much patients understand about the connection between oral hygiene and cardiovascular health[12]. The results can help formulate integrated preventive approaches aligning dental and medical services within the broader framework of primary health care. Another crucial dimension is the role of socio-demographic variables in shaping awareness and perceptions. Educational status, occupation, and frequency of dental visits are known determinants of health literacy. Studies have revealed that individuals with higher education and regular dental attendance tend to possess better knowledge about oral hygiene practices and their systemic implications. Conversely, socioeconomic disadvantages, cultural beliefs, and limited access to dental facilities contribute to misinformation or neglect. Exploring these associations can help identify target groups requiring focused awareness programs[13].

The perception of oral health also encompasses behavioral and attitudinal components. While awareness refers to factual knowledge, perception involves the personal interpretation of that knowledge—whether individuals believe oral hygiene genuinely affects their general health and whether they are motivated to change their habits accordingly. An individual might have heard of the oral–heart connection but may not perceive it as significant enough to warrant behavioral modification[14]. Therefore, both awareness and perception must be assessed simultaneously to design interventions that effectively translate knowledge into practice. From a clinical perspective, strengthening interdisciplinary collaboration between dentists and cardiologists is equally important. Cardiologists seldom screen for oral health issues, and dentists may overlook systemic implications of periodontal inflammation. Mutual referrals and cross-disciplinary education can ensure holistic patient management. Moreover, incorporating oral health counseling in cardiology clinics and vice versa can bridge the gap between theory and practice.

Such integration aligns with the modern concept of "oral health in all policies," advocated by the World Dental Federation (FDI), which emphasizes that oral health should be embedded into general health promotion frameworks[15]. In the context of India and other developing countries, where health resources are limited and disease burdens are high, understanding community awareness levels is a necessary precursor to implementing preventive strategies. Surveys evaluating public knowledge about oral–cardiovascular links are relatively scarce in the Indian setting, and those available often focus on healthcare professionals or dental students rather than lay patients. Assessing awareness among the general patient population visiting outpatient departments provides realistic insights into existing knowledge gaps and misconceptions. It also helps to evaluate the reach and effectiveness of current health-education initiatives. Given the above considerations, the present study was conceptualized to evaluate awareness and perception of the relationship between oral hygiene and cardiovascular disease prevention among patients attending outpatient departments in a tertiary care hospital. The study aimed to quantify the proportion of individuals aware of the oral–systemic link, identify prevalent misconceptions, and examine associations between awareness levels and socio-demographic variables such as age, gender, education, and dental-visit frequency. By understanding these parameters, the research intends to provide baseline data for designing comprehensive health-promotion programs integrating oral and cardiovascular disease prevention[16].

The significance of this study extends beyond individual behavior; it has implications for policy-making, curriculum development, and inter-professional collaboration. Increasing public awareness could lead to improved oral hygiene practices, early detection of periodontal problems, and reduced systemic inflammation, thereby lowering cardiovascular risk. Furthermore, recognizing oral health as a component of non-communicable disease control may facilitate unified strategies under national health missions[17]. Ultimately, enhancing knowledge and perception among patients can create a ripple effect—encouraging healthier behaviors, influencing families and communities, and reinforcing the shared responsibility between medical and dental practitioners in promoting holistic well-being.

MATERIALS AND METHODS

Study Design and Setting

This study was designed as a descriptive, cross-sectional questionnaire-based survey conducted among patients attending both dental and medical outpatient departments of a tertiary care hospital in Chennai, Tamil Nadu, India. The study was carried out over a period of three months from June to August 2025.

Study Population and Sample Size

The study included 200 participants selected through convenient sampling. The sample size was calculated based on a 95% confidence interval, 5% margin of error, and an expected awareness level of 50% from previous studies.

Inclusion Criteria

- Patients aged between 18 and 65 years.
- Individuals attending either dental or medical outpatient departments.
- Participants who provided informed consent.

Exclusion Criteria

- Healthcare professionals or dental students.
- Patients with cognitive or communication impairments.
- Individuals unwilling to participate.

Ethical Consideration

Ethical clearance was obtained from the Institutional Review Board (IRB) prior to data collection. Participants were informed about the study objectives, and written consent was obtained. Confidentiality of responses was strictly maintained.

Study Tool

A structured, self-administered questionnaire was developed based on previous literature and validated by subject experts. The questionnaire consisted of two sections:

1. Demographic data: age, gender, education level, and frequency of dental visits.
2. Awareness and perception section: 14 close-ended questions assessing participants' knowledge and attitude about the relationship between oral hygiene and cardiovascular disease prevention.

Data Collection Procedure

Participants were approached in the waiting areas of outpatient departments and requested to complete the questionnaire. Trained investigators were available to clarify doubts without influencing responses. The average time taken to complete the questionnaire was 10–15 minutes.

Statistical Analysis

Data were entered and analyzed using SPSS Version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics such as frequency and percentage were calculated for categorical variables, while mean and standard deviation were computed for continuous variables. The Chi-square test was applied to determine associations between awareness levels and sociodemographic characteristics. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The study comprised 200 participants—100 from urban areas and 100 from rural settings. The mean age of respondents was 47.6 years, with a male-to-female ratio of approximately 1.3:1. Most urban participants had at least secondary education, whereas rural participants predominantly belonged to lower educational backgrounds.

Awareness regarding oral and cardiovascular health: Table 1 demonstrates a significant disparity between urban and rural participants concerning awareness levels. Over half (52%) of urban respondents recognized that oral health affects general health compared to only 21% in rural respondents (p=0.021). Awareness that poor oral hygiene could increase heart disease risk was higher in urban participants (24%) than rural participants (12%) (p=0.043). Awareness about the bacterial spread from mouth to bloodstream affecting heart valves was reported by 10.5% of urban and 5.5% of rural respondents, though the difference was not statistically significant.

Attitude toward oral hygiene and heart health: Urban participants exhibited a stronger belief in the importance of oral hygiene in preventing heart diseases. Approximately 27.5% of urban respondents rated oral hygiene as "very important" compared to 21.5% of rural respondents (p=0.047). Similarly, 21.5% of urban respondents strongly agreed that maintaining oral hygiene can prevent cardiovascular diseases, whereas only 15.5% of rural participants shared this view (p=0.031). Additionally, 26% of urban respondents believed dental check-ups should be part of heart patients' routine evaluations compared to 10.5% in rural respondents (p=0.022).

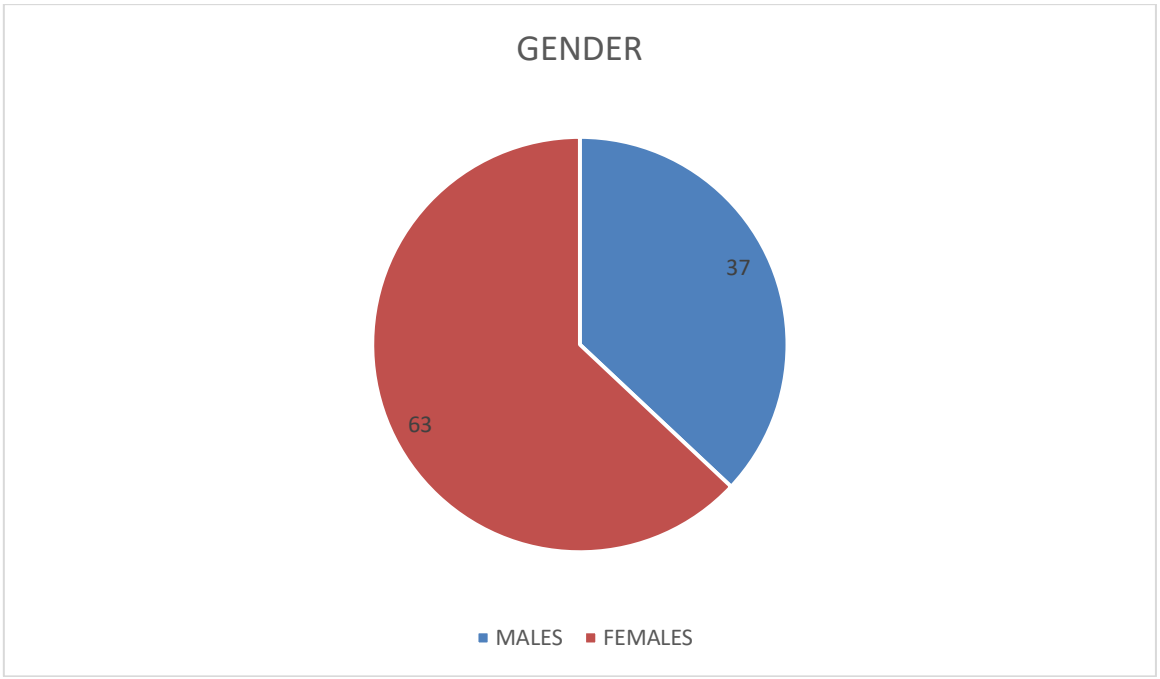
Oral hygiene practices: As shown in Table 3, daily oral hygiene practices varied markedly between groups. While 36% of urban participants brushed twice daily, only 11.5% of rural participants did the same (p=0.047). The use of oral hygiene aids like floss or mouthwash was reported by 31% of urban and only 7% of rural participants (p<0.001). Regular dental visits were more frequent among urban participants—22.5% visited every six months compared to 6.5% in rural areas (p=0.024). Notably, 36.5% of urban participants with heart disease discussed oral health with their cardiologist or dentist, while only 4% of rural respondents did so (p=0.029).

TABLE 1: KNOWLEDGE ON ORAL HEALTH AND HEART DISEASE AMONG STUDY PARTICIPANTS

QUESTIONAIRRE	OPTIONS	URBAN POPULATION (N-100)		RURAL POPULATION (N-100)		P-VALUE
		FREQUENCY (N)	PERCENTAGE (%)	FREQUENCY (N)	PERCENTAGE (%)	
Do you believe oral health has an impact on general body hea	Yes	52	26	21	10.5	0.021*
	No	26	13	31	15.5	
	Not sure	28	14	48	24	
Have you ever heard that poor oral hygiene can increase the risk of heart disease?	Yes	24	12	12	6	0.043*
	No	12	6	29	14.5	
	Not sure	64	32	59	29.5	
Do you know that gum disease (periodontitis) can increase inflammation in the body, affecting the heart?	Yes	22	11	13	6.5	0.083
	No	31	15.5	42	21	
	Not sure	47	23.5	45	22.5	
Do you think bacteria from the mouth can enter the bloodstream and affect heart valves or arteries?	Yes	21	10.5	11	5.5	0.091
	No	32	16	44	22	
	Not sure	47	23.5	45	22.5	
Are you aware that people with heart conditions need special precautions before dental treatment (e.g., antibiotics)?	Yes	32	16	15	7.5	0.095
	No	20	10	32	16	
	Not sure	48	24	53	26.5	
Which of the following dental	Bleeding gums	34	17	28	14	0.16

problems do you think may increase the risk of heart disease?	Tooth decay	23	11.5	21	10.5	
	Bad breath	13	6.5	11	5.5	
	Not sure	30	15	40	20	

GRAPH 1: DISTRIBUTION OF GENDER AMONG STUDY PARTICIPANTS



GRAPH 2: DISTRIBUTION OF POPULATION AMONG STUDY PARTICIPANTS

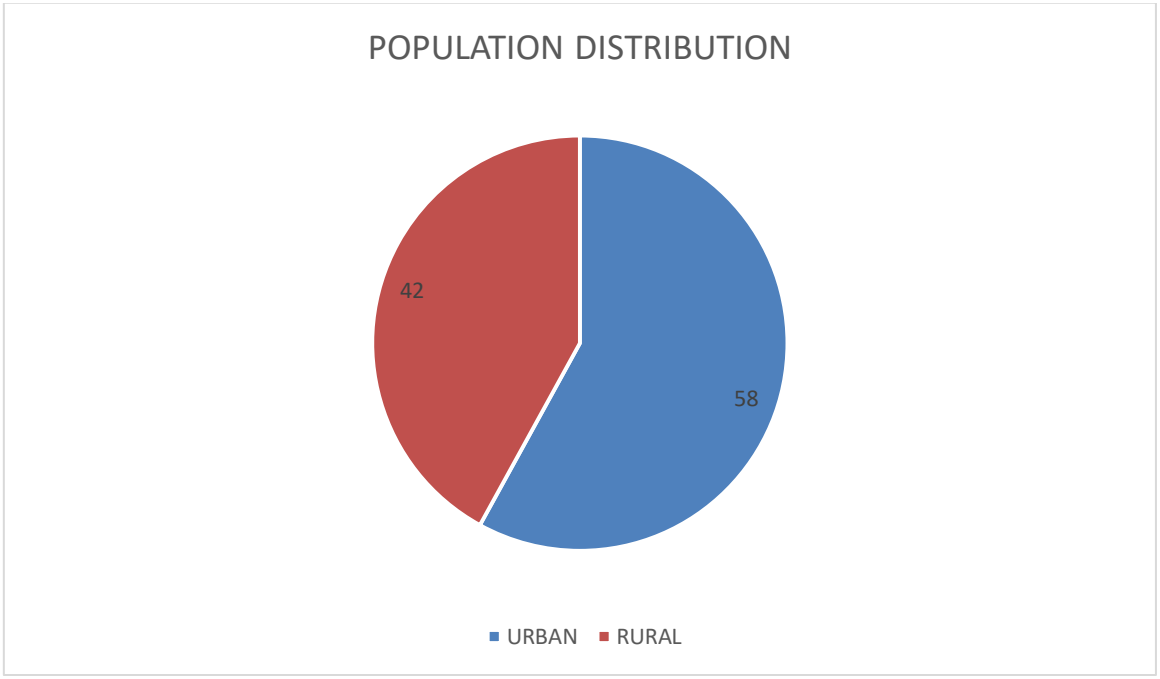


TABLE 2: ATTITUDE TOWARD ORAL HYGIENE AND HEART HEALTH AMONG STUDY PARTICIPANTS

QUESTIONAIRRE	OPTIONS	URBAN POPULATION		RURAL POPULATION		P-value
		FREQUENCY (N)	PERCENTAGE (%)	FREQUENCY (N)	PERCENTAGE (%)	

How important do you think maintaining oral hygiene is for heart health?	Very important	55	27.5	43	21.5	0.047*
	Somewhat important	42	21	36	18	
	Not important	3	1.5	21	10.5	
Do you believe maintaining good oral hygiene can help prevent cardiovascular diseases?	Strongly agree	43	21.5	31	15.5	0.031*
	agree	38	19	27	13.5	
	Neutral	10	5	24	12	
	Disagree	7	3.5	10	5	
	Strongly disagree	2	1	8	4	
Do you think dental check-ups should be part of routine health evaluations for heart patients?	Yes	52	26	21	10.5	0.022*
	No	26	13	31	15.5	
	Not sure	28	14	48	24	
Would you like to receive information from your dentist about how oral hygiene affects heart health?	Yes	68	34	53	26.5	0.018*
	No	13	6.5	35	17.5	
	Not sure	19	9.5	12	6	

TABLE 3: ORAL HYGEINE PRACTICES AMONG STUDY PARTICIPANTS

QUESTIONAIRRE	OPTIONS	URBAN POPULATION		RURAL POPULATION		P-values
		FREQUENCY (N)	PERCENTAGE (%)	FREQUENCY (N)	PERCENTAGE (%)	
How often do you brush your teeth?	Once daily	63	31.5	72	36	0.047*
	Twice daily	36	18	23	11.5	
	Occasional	1	0.5	5	2.5	
Do you use any additional oral hygiene aids (floss, mouthwash, interdental brush)?	Yes	62	31	14	7	0.01*
	No	38	19	86	43	
How frequently do you visit a dentist?	Every 6 month	45	22.5	13	6.5	0.024*
	Once in a year	41	20.5	27	13.5	
	Only when there is pain	9	4.5	43	21.5	
	Never	0	0	7	3.5	
If you have heart disease, have you ever discussed your oral health with your cardiologist or dentist?	Yes	73	36.5	8	4	0.029*
	No	27	13.5	92	46	

DISCUSSION

The present study evaluated the awareness and perception regarding the interrelationship between oral hygiene and cardiovascular disease prevention among urban and rural populations. The findings clearly demonstrated a significant knowledge and practice gap between the two groups, highlighting the influence of sociodemographic factors on oral–systemic health awareness. The association between periodontal disease and cardiovascular pathology has been well documented in global research. Chronic periodontal inflammation promotes systemic dissemination of inflammatory

mediators such as interleukin-1β, C-reactive protein, and tumor necrosis factor-α, which contribute to atherosclerosis and endothelial dysfunction. Periodontal pathogens, including Porphyromonas gingivalis and Aggregatibacter actinomycetemcomitans, have also been detected in atherosclerotic plaques, providing a microbial basis for the connection[18]. However, translating these scientific findings into public understanding remains a challenge, especially in developing nations where oral health education is often neglected.

In the current study, urban participants displayed higher awareness levels about oral–cardiovascular links than rural participants. This can be attributed to better access to education, exposure to digital media, and availability of healthcare services in urban regions. Similar trends were reported by Gupta et al. (2021)[19], who observed that awareness was directly proportional to literacy and socioeconomic status. Conversely, rural populations exhibited limited understanding, likely due to lack of dental facilities, low literacy levels, and limited preventive orientation toward oral health[20]. The findings also reveal that although a majority of urban participants acknowledged the importance of oral hygiene, only a small fraction demonstrated optimal practices. For instance, while 36% brushed twice daily, the remaining continued suboptimal routines. This emphasizes that awareness alone does not guarantee behavioral change—a finding consistent with Loos et al. (2022)[21], who stressed the need for motivational and behavioral reinforcement in oral health promotion. Interestingly, only 24% of urban and 12% of rural respondents had heard that poor oral hygiene could increase the risk of heart disease. These figures underscore the limited dissemination of integrated health education despite robust scientific evidence. Public health communication has traditionally treated oral and systemic health as separate entities. Bridging this divide through interdisciplinary collaboration is imperative. Dentists should emphasize the systemic implications of oral diseases, and cardiologists should include oral health screening in preventive care protocols[22,23].

The gap in preventive dental behavior is another important finding. Rural participants showed poor oral hygiene practices and minimal use of adjunctive aids like floss or mouthwash. Only 7% of rural participants used any additional oral hygiene measures compared to 31% in urban populations. This mirrors the disparities reported in national oral health surveys, where rural populations consistently lag behind in preventive care utilization. Regular dental visits were also infrequent, indicating reactive rather than preventive dental-seeking behavior[24,25]. Gender and education also influenced awareness and perception. Educated individuals and females tended to exhibit better awareness scores, aligning with global trends that link education with health literacy. Educational interventions tailored for low-literacy populations—such as visual aids, community demonstrations, and vernacular media campaigns—may help bridge the knowledge gap[26]. The findings carry significant public health implications. Integrating oral health education within general health programs, particularly in rural settings, could yield substantial benefits. Campaigns emphasizing that "a healthy mouth supports a healthy heart" can be implemented through primary health centers, schools, and community outreach programs. Additionally, incorporating oral health modules into medical curricula and cardiology practice guidelines would promote interdisciplinary awareness among healthcare providers[27]. From a policy standpoint, the results advocate for a shift toward integrated non-communicable disease (NCD) prevention frameworks. Since oral diseases and CVDs share modifiable risk factors—such as smoking, diet, and poor hygiene—joint prevention strategies are both feasible and cost-effective. Routine oral examinations should be encouraged as part of CVD screening and management[28,29].

CONCLUSION

The study highlights a pressing need to enhance public awareness of the oral–cardiovascular health connection, particularly in rural populations. While urban participants demonstrated relatively higher knowledge, the overall awareness remained inadequate. Strengthening health education through community-based programs, interdisciplinary collaboration, and public policy integration can substantially improve oral hygiene practices and reduce cardiovascular risk burden across populations.

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