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Review Article

THE CORRELATION BETWEEN ORAL HEALTH AND CARDIOVASCULAR DISEASE INCIDENCE

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Abstract

A population-based cluster sampling method was used to recruit 5900 Kerman residents aged 15 to 75 years old. Participants were interviewed for CVD risk factors after providing informed consent. Some oral health markers were evaluated, including DMFT, Gingival Inflammation Index, and Community Periodontal Index. Multivariate regression models were used to investigate the link between oral health indicators and CVD risk variables. Results. The participants' average age was 33.5 years, and 45.1 percent of them were men. In 67.6% of the subjects, there was moderate gingival irritation. Participants were more likely to have sub- or supragingival calculus (90 percent). Cigarette smoking, increased with age (RR from 2.7 to 3.88). (RR = 1.49), and high blood glucose (RR = 1.41) showed an increased risk for oral diseases after adjustment for different covariates including established CVD risk factors. In the presence of some CVD risk factors, the study found an increase in periodontal disorders. As a result, both illnesses may have a bilateral but independent relationship, and a joint risk factor approach preventive program is strongly recommended.

Keywords: Periodontal disease, cardiovascular disease (CVD), atherosclerotic cardiovascular disease (ASCVD).

Introduction

It has been shown that periodontal disease and the prevalence of cardiovascular disease (CVD) have been linked, with emerging evidence suggesting that periodontal disease is a risk factor for atherosclerotic cardiovascular disease (ASCVD). People with poor oral health (such as gum disease or tooth loss) have higher rates of cardiovascular disorders such as heart attack or stroke than people with good oral health, according to many studies [1]. Three-quarters of the global burden of cardiovascular disease (CVD) is predicted to occur in developing countries. Unfortunately, it appears that, due to the high prevalence of risk factors and the aging of their populations, CVD mortality and morbidity in most developing nations will skyrocket in the next decades [2]. Iran, a developing country with a population of more than 70 million people, is also dealing with a CVD epidemic. In Tehran, the capital, the prevalence of coronary artery disease is as high as 20%. Myocardial infarction is one of the top three causes of death in Iran [3.4], and according to the results of a dynamic model, roughly 53 myocardial infarctions per million population occur daily. CVD has a complicated etiology that is influenced by a variety of risk factors, including genetic, socioeconomic, and environmental factors. In the meantime, the role of inflammation in CVD has been studied in a variety of scenarios in recent years, and a growing body of evidence is accumulating in favor of inflammation's participation in the pathogenesis of CVD. Mouth infections and periodontal disease have been proposed as CVD risk factors in this regard. In 2002, a countrywide survey of periodontal health status of 3100 Iranian adults aged 35–44 revealed that more than 55 percent of the population had periodontal disease [5]. Some epidemiological research looked into the link between dental health and CVD and found that people with periodontal disease have a 25% increased risk of CVD. According to one study, 84.4 percent of people with CVD had periodontal disease, compared to only 22.5 percent of people without CVD [6.7]. According to a recent meta-analysis, periodontal disease and poor oral health may have a role in the pathophysiology of CVD [8-10]. The link between oral health and CVD has yet to be confirmed, although Frisbee et al. found a link between dental hygiene and CVD risk variables. This study relied on self-reported oral hygiene behavior [12-14] and did not include a clinical oral examination to look into the relationship between various risk factors for both disorders [15-20].

As a result, the goal of this study was to look at the relationship between oral health (gingival inflammation, periodontal health, the presence or absence of microbial plaque, and dentition status) and CVD risk factors in a reasonably large and diverse age group of Iranians [21].

Material and Methods

Participants and study design

This research is part of the KERCADR Study, which looked at CVD risk factors in Kerman, Iran's largest province in the south-east. A single stage cluster sampling method was used to recruit 5900 persons aged 15 to 75 years old for the study. The first preliminary report of the study covered the sampling and sample size computation in detail. In a nutshell, 250 postal codes (as clusters) were chosen at random from a newly updated list of four residential regions at the provincial post office. Families were visited in groups by the research coordinators. All eligible members (15–75 years old) were listed in the Kish Household Coversheet and recruited to the study after being briefed by the household's members. In the event that a home was absent for two consecutive days, another neighbouring household from the right was enlisted. The recruitment process was continued until each cluster had 24 subjects. All participants were given an appointment card with the date, time, and location of their blood draw, face-to-face interview, and clinical and dental examination at a participating clinic. They were instructed to fast for 12–14 hours before their morning session and to carry their medications with them. Data about demographics was gathered (a minimum of one-year residency in Kerman was as an inclusion criteria for entering the study). Clinical examination and a piloted multipage questionnaire using certain standard validated charts were used to obtain data on CVD risk variables such as behavioural risk factors, smoking and addiction status, and biological risk factors, hypertension and diabetes, depression and anxiety. The majority of the above-mentioned measurement details can be found in the study's initial preliminary report. In other words, the measures were as follows: opium addiction (based on DSM4 criteria), daily cigarette smokers (more than 5 cigarettes per day), hypertension (BP 140/90 mmHg or taking drugs), severe anxiety (Beck anxiety questionnaire: BAI score > 25), severe depression (Beck depression questionnaire: BDI score > 46), opium addiction (based on DSM4 criteria), daily cigarette smokers (more than 5 cigarettes per day), hypertension (BP 140/90 mmHg or taking drugs), Obesity (BMI 25–29.9/30 or higher), diabetes (FBS 126 mg/dL or using medication or insulin), cholesterolemia (Chol > 200 mg/dL), and triglyceridemia (TG > 200 mg/dL) are all risk factors for heart disease. A trained dentist examined the patient's mouth under the light of a dental mirror and a WHO (CPI) probe. The presence of microbial plaque, natural teeth or dentures, any symptom of infected teeth, and the quantity of infected teeth were all documented. Dentition status was assessed using WHO standards and codes. Each person's decayed, missing owing to caries, and filled teeth (DMFT) index was determined. The standard Silness and Leo gingival inflammation index (GI) [17] was used to assess gingival health. Mild (score = 0.1–1.0), moderate (score = 1.1–2.0), and severe (score = 2.1–3.0) GI inflammation were scored. The community periodontal index (CPI) was used to determine periodontal health, and index' teeth were checked in the sextants. 1 = bleeding on probing, 2 = supra- or subgingival calculus, 3 = pocket of 4-5 mm depth, and 4 = pocket > 6 mm depth. The GI and CPI scores were computed using the reference instructions [17, 18], and the results were entered into the appropriate box on the record sheet.

Statistical Analysis

The level of oral health indicators was investigated in the full samples as well as in subgroups after the findings were corrected for the clustering impact of sampling using "survey commands" in Stata version 11. The levels of oral health indicators were then analyzed using a multivariate poisson regression model, with exploratory variables, demographic variables, and other variables thrown in for good measure.

Results

Participants were 33.5 4 years old on average, with 45.1 percent of them being male. A chronic or acute dental infection was found in 33.3 percent of dentate survey participants, with an average of 2.5 affected teeth. A full denture was worn by 20% of the participants, while 4.4 percent were edentulous and had no denture. The most common conditions among the individuals were moderate gingival irritation (GI score = 2) and the presence of calculus (CPI score = 2). Men and women had significantly different GI scores (P = 0.05), as did different age groups (P 0.0001) [22]. There was no difference in CPI ratings between male and female groups, however there was a significant difference (P 0.001) between different adolescent groups among different age groups (Tables (Tables 1 and and 2).

Table 1

Standardized prevalence of GI scores of males and females and in different age groups of participants.

GI score		1 (%)	2 (%)	3 (%)	*P* value
Sex	Male	27.4	69.7	2.9	**0.05**
	Female	31.7	65.4	2.9	
	Total	**29.6**	**67.6**	**2.8**	
Age groups	15–24	51.9	46.6	1.5	**<0.001**
	25–34	25.5	73.2	1.3	
	35–44	12.2	83.3	4.5	
	45–54	10.6	84.9	4.5	
	55–64	8.3	85.2	6.5	
	65–75	8.6	83.7	7.7	
	Total	**29.7**	**67.6**	**2.8**	

GI score: 1: mild inflammation, 2: moderate inflammation, and 3: severe inflammation.

Table 2

Standardized prevalence of CPI scores of males and females and in different age groups of participants.

CPI score		0 (%)	1 (%)	2 (%)	3 (%)	4 (%)	*P* value
Sex	Male	0.0	3.7	90.8	5.2	0.3	**0.34**
	Female	0.0	4.7	89.9	5.3	0.1	
	Total	**0.0**	**4.2**	**90.4**	**5.3**	**0.1**	
Age groups	15–24	0.0	6.5	90.7	2.7	0.1	**<0.001**
	25–34	0.0	4.9	91.6	3.4	0.1	
	35–44	0.0	1.7	90	8.3	0	
	45–54	0.0	1.8	90.5	7.3	0.4	
	55–64	0.0	1.2	86.1	12.3	0.4	
	65–75	0.0	2.1	86.3	11.4	0.2	
	Total	**0.0**	**4.2**	**90.4**	**5.3**	**0.1**	

CPI score: 0: healthy, 1: bleeding on probing, 2: supra- or subgingival calculus, 3: pocket 4-5 mm, and 4: pocket > 6 mm.

The mean DMFT of dentate participants was 12.47 for all age groups, with MT having the highest score (mean = 11.96) in the 65–75-year-old group, DT being higher (mean = 10.03) in the 25–34 year old group, and the 65–75 year old group having more filled teeth (mean = 5) than the 25–34 year old group (Table 3). The difference in DMFT between male and female subjects was substantial (P = 0.003) [23].

Table 3

Standardized mean of DMFT, DT, MT, and FT in males and females and in different age groups of participants.

Mean		DMFT	Decayed teeth (DT)	Missed teeth (MT)	Filled teeth (FT)
Sex	Male	12.18	8.89	4.55	3.17
	Female	12.76	9.37	4.70	3.8
	P value	**0.003**	**0.011**	**0.453**	**0.196**
Age group	15–24	9.48	8.89	2.12	2.76
	25–34	12.12	10.03	3.73	3.76
	35–44	14	9.31	5.53	3.62
	45–54	15.74	8.83	7.85	4.3
	55–64	17.24	7.98	9.95	4.18
	65–75	18.94	7.55	11.96	5
Total		**12.47**	**9.12**	**4.62**	**3.48**

Table 4 illustrates the results of the poisson regression model before and after covariate adjustment for CVD risk variables. Cigarette smoking (RR = 0.99) and opium addiction (RR = 0.99), respectively, increased the risk of plaque buildup. Factors like as growing age have been linked to an increase in gingival inflammation (RR from 1.54 to 1.89). There was not a significant association between gingival inflammation and other CVD risk factors after adjustment for age, sex, and other risk factors.

Table 4

Association of oral health indicators with other CVD risk factors using multivariate adjusted regression.

CVD risk factors	Oral health indicators					
	Presence of plaque		GI scores (moderate and severe)		CPI scores (3 and 4)	
	Crude RR *P* value	Adjusted RR$^{\partial}$ (95% CL) *P* value	Crude RR *P* value	Adjusted RR$^{\infty}$ (95% CL) *P* value	Crude RR *P* value	Adjusted RR§ (95% CL) *P* value
Male*	1.0	1.0 (0.99–1.00)	0.96	0.93	1.06	1.05
Female	0.9	0.9	0.02	0.001	0.6	0.8
Age 15–24*						
25–34	0.99 0.08	0.99 (0.98–1.00) 0.09	1.54 <0.0001	1.54 (1.40–1.7) <0.0001	1.26 0.5	1.27 (0.51–3.15) 0.6
35–44	0.99 0.2	0.99 (0.98–1.00) 0.3	1.81 <0.0001	1.80 (1.64–1.97) <0.0001	3.10 <0.0001	2.7 (1.16–6.65) 0.02

Table 4

Association of oral health indicators with other CVD risk factors using multivariate adjusted regression.

45–54	0.98 0.001	0.98 (0.97–0.99) 0.00	1.85 <0.0001	1.83 (1.67–2.01) <0.0001	2.90 0.001	2.42 (1.00–5.85) 0.04
55–64	0.99 0.04	0.99 (0.98–1.00) 0.13	1.91 <0.0001	1.89 (1.73–2.07) <0.0001	4.81 <0.0001	3.88 (1.60–9.38) 0.003
65–74	0.99 0.2	0.99 (0.97–1.01) 0.5	1.92 <0.0001	1.87 (1.69–2.07) <0.0001	4.13 <0.0001	3.25 (1.25–8.40) 0.01
Cigarette smoking						
No*	0.99	0.99 (0.99–1.00)	1.13	1.03 (0.98–1.07)	1.52	1.49 (1.38–1.55)
Yes	0.1	0.02	<0.0001	0.17	0.02	0.05

Table 4

Association of oral health indicators with other CVD risk factors using multivariate adjusted regression.

Opium addiction						
Never*	0.99	0.99 (0.991–0.997)	1.18	1.01 (0.96–1.06)	1.53	1.04 (0.63–1.68)
Dependent	<0.0001	0.00	<0.0001	0.4	0.06	0.9
On occasion	0.99 <0.0001	0.99 (0991–0.997) 0.00	1.10 0.002	0.97 (0.92–1.04) 0.5	1.31 0.3	1 (0.59–1.67) 0.9
Raised FBS	0.99 0.3	0.99 0.2	1.14 <0.0001	1.01 (0.97–1.05) 0.4	2.01 <0.0001	1.41 (1.01–1.95) 0.04
Triglyceridemia (TG > 200)	0.99 0.2	0.998 (0.994–1.00) 0.6	1.07 <0.0001	0.97 (0.93–1.01) 0.18	1.31 0.06	0.99 (0.73–1.33) 0.9
Cholesterolemia (Chl > 200)	0.99 0.08	0.998 (0.993–1.00) 0.4	1.13 <0.0001	1.01 (0.98–1.04) 0.3	0.95 0.7	0.68 (0.65–0.720) 0.006
Overweight and obesity	0.99	0.999 (0.994–1.00)	1.04	0.97 (0.94–1.01)	1.50	1.14 (0.85–1.50)

Cholesterolemia (Chl > 200)	0.99	0.998 (0.993–1.00)	1.13	1.01 (0.98–1.04)	0.95	0.68 (0.65–0.720)
	0.08	0.4	<0.0001	0.3	0.7	0.006
Overweight and obesity (BMI ≥ 30)	0.99	0.999 (0.994–1.00)	1.04	0.97 (0.94–1.01)	1.50	1.14 (0.85–1.50)
	0.3	0.9	0.01	0.1	0.003	0.4
Anxiety (yes)	1	1.00 (0.99–1.00)	1	1.02 (0.98–1.06)	N/A	N/A
	0.1	0.08	0.9	0.2		
Depression (yes)	0.99	0.997 (0.992–1.00)	0.96	0.99 (0.96–1.03)	N/A	N/A
	0.03	0.2	0.6	0.9		

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*Reference group.

[δ]Adjustment for age, nutrition, education, and addiction status.

[∞]Adjustment for age, sex, smoking and addiction status, and nutrition.

[§]Adjustment for age, job, education, addiction, BMI, FBS, and lipid status.

N/A: not available.

The periodontal disease index (CPI) has also risen in people over the age of 35. (RR from 2.7 to 3.88). When many variables, including recognized CVD risk factors, were controlled for, periodontal disease risk rose only with elevated fasting blood sugar (RR = 1.41) and cigarette smoking (RR = 1.49).

For participants under the age of 45, the association of DMFT with other CVD risk variables was investigated. Some risk factors, such as opium addiction (RR = 2.06) and cigarette smoking (RR = 3.05), resulted in a considerable increase in the score.

Discussion

This study aims to investigate the link between oral health indicators as a risk factor for cardiovascular disease and other CVD risk variables. The study's findings revealed that some background variables, such as age, may raise the risk of oral diseases in the same way as they may increase the risk of cardiac disorders. The study's findings also demonstrated that some well-known CVD risk factors, such as cigarette smoking, opium addiction, and high blood glucose, increased the likelihood of oral health problems even when other factors were taken into account. Many factors, including age, cigarette use, and systemic diseases like diabetes, have been linked to the advancement of periodontal disease and tooth caries. When the risk variables for gingival inflammation and periodontal disease were adjusted for, the results of this study agreed with earlier findings, indicating that the factors stated had a higher likelihood of increasing gingival inflammation and periodontal disease. Some research suggested a relationship between oral health and CVD, however the association between oral hygiene and oral health is widely known. Periodontal and dental disease are caused by microbial plaque, which has been recognized as an oral hygiene indicator [24]. Oral disease has been associated to CVD in several studies due to a reaction that can also occur with mouth disorders. These investigations found that microbial plaque, induced periodontal disease, and tooth infection can all trigger an inflammatory response, which can lead to heart attacks. It's critical in this study since 99 percent of the participants had visible plaque on their teeth, potentially putting them at risk for inflammation and cardiac events. The current study's findings are significant from two perspectives: first, the data were collected from a general population sample, whereas many previous studies have focused on particular risk groups or clinically diagnosed cardiac patients. Second, it appears that several similar risk factors for oral disorders and cardiovascular disease (CVD) contribute to the severity of both conditions. As a result, the findings of the study on the relationship between CVD risk factors and dental health as a risk factor for heart illnesses may be evaluated independently. Because, aside from cigarette smoking and diabetes, which are both CVD risk factors that can impair oral health, as the study found, other factors are not directly linked to oral health. It's understandable that most people with a lot of risk factors for heart disease have a lot of issues, which puts dental health and hygiene at the bottom of the priority list. In this context, Frisbee et al. revealed a substantial link between self-reported oral cleanliness, systemic inflammation, and various CVD risk factors, as the results of the current investigation showed many of those risk variables could affect dental health independently. However, due to the large sample size and funding constraints in the current study, we did not measure markers of systemic

inflammation, and screening the population for heart disorders by clinical examination was not the study's purpose. However, with 70% of the individuals having gingival inflammation, periodontal disease, and at least 95% having plaque deposition on their teeth, how could they be vulnerable to inflammatory reactions and probable cardiac diseases. Another key component of certain common risk factors between oral disorders and CVD that was supported by the study results is an increased risk for damaged or missing teeth in older age, which is associated with cigarette smoking and opium addiction. The possibility of a link between dental health and cardiovascular disease was examined in a recent scientific statement from the American Heart Association. Observational studies could not support a casual association between two conditions, according to the review. Furthermore, it was claimed that periodontal and cardiovascular illnesses have a number of risk variables that are common and significant disease promoters, such as cigarette use, diabetes, and aging. The findings of this study corroborated those of the previous review. As a result, while many CVD risk variables were not linked to oral health status in this investigation, several similar risk factors for both illnesses may be presumed. According to the study, these common characteristics could operate as a risk factor for dental health and cardiac problems on their own. Because both diseases are frequent and cause substantial public health concerns, prevention initiatives based on a single risk approach may be the best method to avoid both problems [25].

Conclusion in the presence of some CVD risk factors, the study found an increase in periodontal disorders. As a result, both illnesses may have a bilateral but independent relationship, and a joint risk factor approach preventive program is strongly recommended.

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