

# Oral health status of CHD and non-CHD adults of Lahore, Pakistan

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## Abstract:

**Background:** Evidence on association of oral health and coronary heart diseases (CHD) is mounting in the literature. This study was designed to observe an association between status of oral health and cardiac diseases in Pakistani adults. **Materials and Methods:** A case-control study was conducted on CHD and non-CHD adults aged >30 years. Age-gender matched individuals without CHD, fulfilling the inclusion criteria as for CHD patients were selected for comparison. Bleeding on probing (BOP), periodontal pocket depth (PPD) and tooth loss were noted as oral health parameters. **Results:** 45 CHD patients and 35 non-CHD individuals were examined. 53.75% were males and 46.25% females, 37.5% subjects were uneducated, 65% belonged to lower income group, 58.75% subjects were  $\geq$  obese and 88.75% were non-smokers. Mean of percent sites of BOP ( $P=0.007$ ), PPD ( $P=0.031$ ) and tooth loss ( $P=0.021$ ) were significantly higher in study group. In stepwise logistic regression analysis, BOP and tooth loss showed a significant positive association with CHD; however, association of PPD was not significant. **Conclusion:** Oral health parameters were significantly higher in CHD patients. Bleeding on probing and tooth loss was positively associated with CHD after adjusting for other socio-demographic variables.

## Key words:

Oral health status, adults, coronary heart disease

## INTRODUCTION

Coronary heart diseases (CHD) rank as the leading cause of death in the world<sup>[1]</sup> and are on the rise in developing world.<sup>[2]</sup> Chronic inflammation plays an important role in the pathology of cardiac diseases.<sup>[3,4]</sup> Periodontal infection is reported to significantly enhance/alter the natural course of systemic conditions.<sup>[5]</sup> Studies report significant association of periodontal disease with CHD.<sup>[6,7]</sup> The association between periodontal and cardiac diseases is explained through various pathophysiological pathways of microbial<sup>[8,9]</sup> and inflammatory nature<sup>[10,11]</sup> as well the traditional socio-demographic risk factors of age, gender, marital status, education, obesity, income (social status) and smoking (behavioral),<sup>[12-14]</sup> which are common to both periodontal and cardiac diseases. Periodontal disease as a low-grade chronic infection is becoming a potential risk factor for CHDs.<sup>[15]</sup> The reported co-existence of periodontal and heart diseases and growing evidence of their significant association may have public health implications. This has given importance to further research on the status of oral health in different populations. An age-gender matched case-control study was designed to observe the status of oral health and investigate a link between oral and cardiac diseases in population of this geographical area. This case-control study observed the status and association of oral health parameters with CHD in a Pakistani population.

## MATERIALS AND METHODS

### Study design and study population

A case-control study was designed to evaluate the status of oral health in cardiac patients. A consecutive selection criterion was adopted to enroll the subjects for study. Patients attending the outpatient clinic of Punjab Institute of Cardiology, Lahore, Pakistan, during six working days, 11<sup>th</sup> to 16<sup>th</sup> June 2006 (Monday to Saturday) were screened for selection of cases. Formal approval from the ethical committee of Punjab Institute of Cardiology was obtained. Patients aged >30 years, with CHD, clinically established by a cardiologist on the basis of angiography,<sup>[16]</sup> non-smoker/former smoker (who quit smoking 6 months before enrolment in this study), systemically healthy (not suffering from any acute/chronic systemic disease (such as pulmonary diseases, hepatic diseases, chronic arthritis, kidney diseases, acute infections), non-pregnant females were recruited.

Age-gender matched healthy controls fulfilling the same inclusion criteria as for cases and without cardiac disease (screened on the basis of questions related to the diagnosis of cardiac disease and declared non-CHD by the physician) were recruited during the one-week period, 18<sup>th</sup> to 23<sup>rd</sup> Jun 2006, from outpatient clinic of Services Hospital Lahore. All cases and controls were questioned and examined for oral health status at Dental Health Center of Punjab Institute of

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Cardiology, Lahore. Socio-demographic factors of age (years), gender (male, females), marital status (unmarried, married), education (un-educated, Secondary, Graduate), income (Low, middle/high), smoking (nonsmokers/former-smokers) and obesity (Body Mass Index, BMI in kg/m<sup>2</sup>) were noted. An informed written consent of the subjects was obtained at recruitment.

### Measurement of oral health status

Oral health status was noted through periodontal parameters of bleeding on probing (BOP) and periodontal pocket depth (PPD) and tooth loss. Bleeding on probing and PPD was measured using the Michigan O probe with William markings at levels of 1–3, 5, 7–10 mm (Pak made). Mesial, mid and distal sites of buccal and palatal/lingual surfaces of all present teeth excluding the third molars were examined for BOP that was noted within 30 s of probing.<sup>[17]</sup> BOP score was calculated in percentage by dividing the numbers of sites with gingival bleeding by the total number of sites examined and multiplied by 100. Periodontal pocket depth<sup>[18]</sup> was recorded to the long axis of the tooth, at mesial, mid and distal sites of buccal surfaces and palatal/lingual surfaces. Mean pocket depth was calculated by adding the pocket depths of all sites and divided by the total number of sites examined. Numbers of teeth missing in the mouth were noted. Periodontal examination was performed by a single examiner (Bokhari).

Statistical significance of association between/among study variables was analyzed through chi-square test, student's *t*-test, non-parametric tests of significance and logistic regression analysis using the SPSS version 11.5.

## RESULTS

### Socio-demographic data of study subjects

Forty five cases and thirty five controls fulfilling the inclusion criteria were examined in this study. Mean age of the subjects was 41.08±5.99 years. Study group had mean age of 41.67±5.11 years and controls were 40.31±6.96 years old. Educationally, 30 (37.5%) were uneducated; 29 (36.25%) had secondary and 21 (26.25%) graduate/higher education. Economically, 84.44% of cases and 40.00% of controls were from lower income group. Seventy one (88.75%) subjects were non-smokers and 11.25% former smokers; 33 (41.25%) subjects were observed with BMI of ≤ desirable and 47 (58.75%) in ≥ obese categories. All socio-demographic characteristics except income showed no statistical significant difference between the cases and controls [Table 1].

### Status of oral health parameters in study subjects

Table 2 presents data of BOP, PPD and tooth loss. Cardiac patients had significantly more sites with BOP, higher levels of PPD and higher tooth loss. Mean of percent sites of BOP was 53.66±18.237% in cardiac patients and 41.91±24.00% in controls that was significant (*P*=0.007). Mean PPD was 2.22±0.83 mm in cases and 1.94±0.75 mm in controls with *P*=0.031. Mean tooth loss was significantly higher (*P*=0.021) in cardiac patients (3.96±3.23) than in controls (2.40±3.05). Subjects with BOP ≥ 20% were 43 (95.55%) in cases and 27 (77.14%) in controls, which was statistically significant (*P*=0.018) between groups.

### Oral health parameters and socio-demographic variables

Table 3 shows an association of BOP, PPD and tooth loss with

**Table 1: Socio-demographic variables of study subjects**

Variable	Cases (CHD) No (% age)	Controls (Non-CHD) No (% age)	P-value*
Study sample	45 (56.25)	35 (43.75)	
Age yrs			
Mean±SD	41.67±5.112	40.31±6.965	0.062
Age cohorts			
31–40 years	23 (51.11)	18 (51.42)	0.041
41–50 years	22 (48.88)	17 (48.57)	
Gender			
Male	26 (57.77)	17 (48.57)	0.542
Female	19 (42.22)	18 (51.42)	
Educational status			
Uneducated	18 (40.00)	12 (34.28)	0.183
Secondary	18 (40.00)	11 (31.42)	
Graduate	9 (20.00)	12 (34.28)	
Income			
≤ 10,000	38 (84.44)	14 (40.00)	<0.001
>10000	7 (15.55)	21 (60.00)	
Smoking			
Non-smoker	40 (88.88)	31 (88.57)	0.61
Former smoker	5 (11.12)	4 (11.42)	
BMI			
≤ Desirable	18 (40.00)	15 (42.85)	0.449
≥ Obese	27 (60.00)	20 (57.14)	

\*Chi-sq test, significance level *P*≤0.050

**Table 2: BOP, PPD and tooth loss in cases and Controls**

Variables	Cases (CHD) N=45	Controls (Non-CHD) N=35	P-value/or (CI)
BOP (Mean ± SD)	53.66±18.237	41.91±24.00	0.007*
PPD (Mean±SD)	2.22±0.838	1.94±0.757	0.031*
Tooth loss (Mean±SD)	3.96±3.233	2.40±3.051	0.021*
Number of subjects with BOP ≥ 20%	43 (95.55%)	27 (77.14%)	0.018** 6.37 (1.258-32.271)

\**t*-test, \*\*Chi-sq test, Significance level *P*≤0.05

**Table 3: Association of BOP, PPD and tooth loss with socio-demographic variables**

Variable	BOP (Mean ± SD)	PPD (Mean±SD)	Tooth loss (Mean±SD)
Age cohorts			
31–40 years	50.91±23.11	2.01±0.757	3.15±3.135
41–50 years	46.00±48.52	2.19±0.863	3.41±3.362
Gender			
Male	45.87±20.953	2.13±0.755	2.91±3.04
Female	51.60±22.268	2.07±0.880	3.70±3.423
Educational status			
Uneducated	51.30±19.868	2.16±0.778	4.17±3.435
Educated	44.83±23.08	2.00±0.874	2.89±3.038
Income			
≤ 10000	51.93±22.858*	2.24±0.763*	3.92±3.054*
>10000	42.18±17.811	1.84±0.845	2.07±3.254
Smoking			
Non-smoker	49.83±21.675	2.14±0.802	3.18±3.173
Former smoker	38.22±19.30	1.78±0.854	4.00±3.775
BMI			
≤ Desirable	43.06±20.85*	1.97±0.883	3.12±2.924
≥ Obese	52.35±21.542	2.19±0.751	3.38±3.455

\**t*-test, \*Significance level *P*≤0.05

sociodemographic variables. Bleeding on probing was higher in lower-age group (31–40 years), females, uneducated subjects, lower income group, non-smokers and obese/very obese subjects. PPD was higher in male gender and those with higher

age, no education, low income, non-smoking and with obesity. Older subjects with female dominance, and with no-education, low income, former smoking and obesity showed higher tooth loss. A statistical significance ( $P < 0.05$ ) was observed for BOP, PPD and tooth loss with income only.

### Statistical analysis of oral health parameters

Stepwise logistic regression was fitted with cases (cardiac patients) as dependant variable and BOP, PPD, tooth loss, and socio-demographic factors as independent variables. The model was significant at step 5 with  $\chi^2$  (Chi-square) 13.910 ( $P < 0.001$ ). BOP and tooth loss were found to be significant with  $P < 0.012$  and  $P < 0.011$ , respectively, whereas PPD was non-significant. The odds ratios for BOP and tooth loss were found as 1.027 (CI=1.006–1.049) and 1.22 (CI=1.047–1.422) respectively. Among the socio-demographic factors; male gender, income and smoking were significantly associated with cardiac patients ( $P < 0.050$ ). Males with low income showed moderate association of BOP and mild association of tooth loss and no association of PPD to increased likelihood of having CHD.

## DISCUSSION

This is the first study to report status of oral health in cardiac patients from Pakistan. Pakistanis are part of an ethnic group which suffers from the highest prevalence rates of CHD and CHD manifests at a younger age with a significant narrowing of the sex difference.<sup>[19]</sup> Common risk factors for CHD observed in a Pakistani study were cigarette smoking (43.07%), hypertension (28.61%), diabetes mellitus (22.59%) and family history (13.85%).<sup>[20]</sup>

Possible confounding factors such as diabetes and smoking that could bias the association of oral health and cardiac diseases were excluded from the study. Non-modifiable socio-demographic characteristics noted in this study were age, gender, education, income, obesity and non/former-smoking. Increasing age, smoking, social status is potential confounding factors common to both periodontal and cardiac diseases.<sup>[14,21]</sup> Age and income were significantly associated with cardiac patients in this study. This study is comparable to other case-control studies<sup>[12,22-24]</sup> for matching of socio-demographic factors in cases and controls.

We used two clinical parameters (BOP and PPD) of periodontal diseases and tooth loss to observe the association of oral health to CHD. Periodontal parameters of BOP and PPD were observed as percentage of positive sites of bleeding and mean of PPD, which have been used by other studies<sup>[25,26]</sup> for evaluation of periodontal association with CHD. Oral health parameters of BOP, PPD and tooth loss has been observed higher in the cases as compared to controls in this study. Higher BOP in cardiac patients reflects poor oral health and more active periodontal disease as compared to controls. The subjects, with higher tooth loss were 1.22 times and with more gingival bleeding 1.027 times, had more chance to have cardiac diseases. These oral health parameters showed a positive association to lower age group (31–40 years), females, illiteracy, low income, and former smoking. BOP, PPD and tooth loss were related to obesity. BOP, PPD and tooth loss were significantly associated with cardiac disease independent of other socio-demographic factors. The higher prevalence of tooth loss and

levels of periodontal parameters observed in this study may be supported and explained for significant association to CHD by similar studies<sup>[18,23]</sup> and are in agreement with other case-control studies on the association of periodontal and cardiac diseases.<sup>[27,28]</sup>

Tooth loss is marker of past dental caries/periodontal diseases; the reported<sup>[29]</sup> higher tooth loss but low levels of periodontal disease in females correspond with our findings in the case group. However, PPD was higher in female controls in our study. Association of severity of periodontal disease and less number of present teeth with CHD independently of other factors as observed in this study is reported by other studies.<sup>[29-32]</sup> The studies show higher frequency of bleeding increase periodontal disease progression. This case-control study may have limitations of small sample size, undocumented history of past periodontal treatment, reason for tooth extractions and changes in lifestyle-related factors; therefore, the relationship between periodontal disease and CHD observed here may not be interpreted as causal.

In summary poor oral health (periodontal disease and tooth loss) were significantly higher in cardiac patients than controls and were statistically associated with CHD independent of confounding factors. Socio-demographic risk factors of age, gender, education, income, obesity and smoking were associated with periodontal parameters and cardiac disease. Keeping in view the limitations of study, mentioned above, further longitudinal studies are warranted from this Asian region to reveal the status and association of oral health with CHD.

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