

# Coronal caries experience in dentate Jordanian adults

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**Objective:** To assess the coronal caries experience and associated risk indicators among a sample of Jordanian adults. **Participants and methods:** A random sample of 1,096 dentate Jordanian adults in Irbid region were interviewed and clinically examined for coronal caries using the DMFS index. Descriptive summary statistics, bivariate, and regression analyses were employed. **Results:** Findings revealed that the mean numbers of coronal decayed surfaces (DS), missing surfaces because of caries (MS), filled surfaces (FS), decayed and filled surfaces (DFS) and DMFS were 6.3, 20.6, 8.0, 14.3 and 34.9 respectively. All subjects had coronal caries experience and 93% had untreated lesions. Subjects of older age, with less education, urban residence, lower incomes, no dental insurance, a smoking habit and irregular oral hygiene practices had a significantly higher coronal caries experience ( $p < 0.05$ ). Age, income, education, residence, smoking, brushing and flossing collectively explained 45% of the variance for the mean number of coronal DMFS. **Conclusions:** This study provided useful information on the coronal caries status of Jordanian adults. Modifications of several social factors could potentially reduce coronal DMFS, to improve oral health status and function in adults

**Keywords:** Caries, coronal, DMFS, Jordan, risk indicators

## Introduction

Dental caries has been reported as the most common type of oral disease of people at all ages (Douglass *et al.*, 2001; Hand *et al.*, 1988). Studies have found that caries continued to progress with increasing age and those new carious lesions continued to develop in adults (Chauncey *et al.*, 1989; Hand *et al.*, 1988). It was estimated that the occurrence of new carious lesions in adults could be similar to that in children (Glass *et al.*, 1987; Hand *et al.*, 1988). Furthermore, caries occurs more frequently among older adults than younger adult cohorts (Papas *et al.*, 1992).

Improvements in the oral health status, greater use of fluorides, new dental techniques, and an increased awareness of personal oral hygiene has resulted in an increase in the number retained natural teeth, (Weintraub and Burt, 1985) which could increase the prevalence of dental caries with age. Since many more teeth are at risk, it is apparent that the need for dental care in adults will be increased. (Douglass and Gammon, 1984).

Numerous epidemiologic studies have reported the prevalence and trends in dental caries, particularly among children in industrialized and some developing countries. However, few studies have been conducted on dental caries in adults. (Barrow *et al.*, 2003; Brodeur *et al.*, 2000; Brown *et al.*, 1996; Papas *et al.*, 1992; Winn *et al.*, 1996). Little information exists on the oral health status of people living in Jordan. Most of reports have targeted caries in school children (Albashaireh and al-Hadi Hamasha 2002); (Taani, 1997). However, no study specific to dental caries in Jordanian adults was found in a Medline search of articles published after 1966.

The purpose of this study was to measure the prevalence of coronal caries in a sample of the adult population of the Irbid governate of Jordan and to determine which factors were associated with coronal caries experience in these adults.

## Methods

A telephone directory of the Irbid governorate was obtained from the Jordan Telecommunications Company. A random sample of numbers was selected from the company telephone directory. Selected numbers were rang and residents were informed about the purpose of the study, and briefed about the clinical examination procedures. All dentate adults age 18 years and over in each home contacted were invited to participate in a dental examination. The participants were scheduled for dental examinations at the Jordan University of Science and Technology (JUST) dental clinics, and provided informed consent before the examinations. The study was approved by the JUST Ethics Committee of the Deanship of Scientific Research.

Data were collected by interviews and clinical dental examinations. Subjects were first asked questions regarding their date of birth, place of residence, education, family income, dental insurance, smoking habits, oral hygiene practices, dental visits, medical conditions, and medications. Clinical examinations were then performed under artificial light by both authors using a mouth mirror and dental explorer. All permanent teeth present were examined, including third molars. Diagnostic criteria for coronal caries examinations were adopted from criteria used by the World Health Organization (WHO, 1997).

Radiographs were not taken. Subject with untreated coronal caries were then referred to the Department of Restorative Dentistry clinics for free-of-charge treatment by dental students. Subjects who reported brushing and flossing their teeth seven or more times a week were considered to have regular oral hygiene practices.

Calibration of both examiners was undertaken in the dental clinics of JUST. A pilot sample involving 25 separate dental patients was examined by both examiners during a 2-week period before the clinical examinations and another 25 patients were examined midway through clinical examinations. Intraclass correlation coefficients for coronal DMFS scores were 0.93 before the clinical examinations, and 0.96 midway through the clinical examinations, respectively. The percentage agreements between both examiners for the DF coronal surfaces examined initially and midway were 89% and 92%, respectively. The percentage agreement between both examiners for M was 100% at both examinations.

Data were recorded on paper forms, and were then double entered and verified, processed and analyzed using a software package SPSS 9.0 (1998 SPSS Inc, Chicago, USA). Descriptive statistics (percentages, means and medians) and bivariate, and regression analyses were undertaken. Mann-Whitney and Kruskal-Wallis non-parametric tests were used to assess differences in coronal caries experience by gender, age, residence, education, income, dental insurance, smoking, brushing and flossing. The probability level for statistical significance was set at  $\alpha=0.05$ . Multiple linear regression analysis was performed with the coronal DMFS numbers as the dependent variable. First, forward stepwise regression analysis was performed between coronal DMFS numbers and each independent variable. Then, all of these qualified variables from the stepwise analysis were assessed simultaneously in the multiple linear regression model.

## Results

Of the total number of 1,000 telephone numbers that were called, 47 numbers were out of service, 23 homes were without adults and 118 homes refused participation in the study, leaving 812 homes eligible. Of the 1,501 adults who were contacted, 103 subjects claimed that they were edentulous, and 296 subjects did not attend their appointments. Of the 1,102 dentate subjects interviewed, 1,096 completed both the interviews and the clinical examinations.

The study sample consisted of these 1,096 adults, of which 47% (n=520) were males and 53% (n=576) were females. The mean and median ages were 33 and 30 years, respectively, with a range from 18 to 67 years. The study sample was relatively young with 81% younger than 45 years. The mean and median numbers of teeth present among these dentate subjects were 27.9 and 29.0 teeth, respectively with a range from 12 to 32 teeth. Approximately 28% of the subjects reported less than 12 years of education, 45% reported 12 to 15 years of education, and 27% reported 16 years and more of education. About 44% reported a monthly family income of JD200 (US\$300) or less.

Table 1 presents data on coronal caries experience by age and gender groups. Overall, the mean number of

untreated decayed surfaces (DS) was 6.3(SD=4.8). It was higher among the younger age groups (18-25 and 26-35 years) than older age groups, with no significant difference between males and females. The percentages of subjects with one or more surfaces of untreated coronal caries ranged from 84% to 100% for the different subgroups. About 85% of subjects (range 77%-100% for subgroups) had one or more missing teeth. The mean number of missing surfaces increased significantly with increasing age from approximately 10.3 (SD=8.7) surfaces in the younger age group to 62.5 (SD=30.1) surfaces in the older age group ( $p<0.001$ ). There was no statistically significant difference in the number of missing surfaces by gender (Mann-Whitney U = 147662,  $p=0.68$ ). The mean number of coronal surfaces with fillings was 8.0 (SD=6.9) with significant difference in filling numbers among different age groups ( $p<0.001$ ). Furthermore, more fillings were present in females compared to males ( $p<0.001$ ). The percentages of subjects with one or more filled surfaces ranged from 75%-98% for the different age groups. The mean number of coronal DMFS increased from 23.2 (SD=9.9) in the younger age group to 73.1 (SD=20.4) surfaces in the older age group ( $p<0.001$ ). However, the mean coronal DFS decreased from 16.6 (SD=7.3) in the 26-35 year age group to 10.6 (SD=10.8) in the 56+ age group. The mean DFS was higher in females compared to males. All subjects had previous coronal decay experience, with 93% having either DS or FS. The overall mean coronal DFS and DMFS were 14.3 (SD=7.6) and 34.9 (SD=20.1) surfaces, respectively. The proportion of the mean DMFS values attributable to the decayed (D), missing (M) and filled (F) components were 24%, 49% and 27% respectively. Approximately 47% of the DFS comprised the D component (data not shown).

Table 2 presents results from the bivariate analyses of the mean number of coronal DS, MS, FS, DFS, and DMFS by residence, education, income, dental insurance, smoking, brushing and flossing. Current smokers comprised 20% of the sample, and only 69% and 12%, respectively, claimed to brush and floss their teeth regularly. (Table 2). The mean number of coronal DMFS was significantly higher in urban residents. However, rural residents had significantly higher numbers of surfaces with untreated caries but fewer missing surfaces. Subjects with less than 12 years of education and family income of JD200 or less per month had significantly higher numbers of MS and DMFS and lower numbers of FS compared to those with higher education and income. Interestingly, dental insurance was significantly associated with higher DS, FS, and DFS and lower MS and DMFS. Smokers presented with significantly higher numbers of DS, MS, and DMFS, and lower numbers of FS. Subjects who regularly practiced brushing and flossing (at least once a day) were found to have significantly lower DS, MS, and DMFS, and higher FS than those who brushed and flossed their teeth irregularly.

With coronal DMFS as the dependent variable, multiple linear forward stepwise regression analysis was performed. The variables that were significantly related to more coronal DMFS were greater age, less income, less education, urban residence, smoking and irregular brushing and flossing. The best fit multiple regression model for this group of statistically significant and qualified

**Table 1.** Coronal caries status by age and gender.

Variable	No. of subjects	Mean No. of teeth	Mean No. of DS(SD)	No. (%) of subjects with DS	Mean No. of MS(SD)	No. (%) of subjects with MS	Mean No. of FS(SD)	No. (%) of subjects with FS	Mean No. of DFS(SD)	Mean No. of DMFS(SD)
<b>Category</b>										
<b>Age in years</b>										
18-25	396	29.9	7.0(4.5)	384 (97)	10.3(8.7)	304 (77)	5.8(5.1)	364 (92)	12.9(6.1)	23.2(9.9)
26-35	268	28.6	7.7(6.1)	248 (93)	17.2(14.1)	236 (88)	8.9(6.7)	252 (94)	16.6(7.3)	33.7(15.7)
36-45	224	27.6	4.6(3.7)	188 (84)	21.8(18.6)	196 (88)	11.0(7.6)	220 (98)	15.5(9.1)	37.3(20.1)
46-55	144	25.0	5.0(4.0)	136 (94)	35.0(17.7)	144 (100)	8.6(6.8)	136 (94)	13.6(5.8)	48.6(18.1)
56+	64	19.5	4.6(2.8)	64 (100)	62.5(30.1)	56 (88)	6.0(9.4)	48 (75)	10.6(10.8)	73.1(20.4)
<b>Gender</b>										
Males	520	27.8	6.5(5.1)	492 (95)	21.0(21.9)	432 (83)	6.9(6.6)	468 (90)	13.4(7.6)	34.4(20.1)
Female	576	27.9	6.1(4.8)	528 (92)	20.3(20.2)	504 (88)	9.0(6.9)	552 (96)	15.0(7.6)	35.4(20.6)
Total	1096	27.9	6.3(4.8)	1020 (93)	20.6(20.2)	936 (85)	8.0(6.9)	1020 (93)	14.3(7.6)	34.9(20.1)

Abbreviations: DS: decayed surfaces, MS: missing surfaces, FS: filled surfaces, DFS: decayed or filled surfaces, DMFS: decayed, missing or filled surfaces.

variables is presented in Table 3. Age, flossing, income, residence, smoking, education and brushing collectively explained 45% of the variance for the number of DMFS. Linear regression analyses with the mean DFS, DS, and FS as dependent variables were also performed. Independent variables that included age, education, income, oral hygiene practices, residence and smoking were not able to explain the higher proportion of the variance in the value of the dependent variable.

## Discussion

The population in this study was a random sample of those persons who had telephones in the Irbid region of northern Jordan, which represents one-fourth of the Jordanian population. Since a national listing of all Jordanian adults is not accessible for investigation, using the telephone directory is one of the best available methods to obtain a representative sample. However, generalizing the results should be considered with caution especially for those families without telephones, who comprises approximately 15% of Irbid residents. Another source of bias in this study might come from the initial exclusion of the 188 (19%) homes from our study and also the fact that a sizeable proportion of subjects selected did not participate. No data are available to compare the findings from those subjects who were examined to those not examined, to allow assessment of this possible bias.

The administered questionnaires filled during the interviews contain questions regarding age, gender, residence, education, income, employment, marital status, dental insurance, smoking, brushing, flossing, perceived dental health, number of dental visits in the past year, medical conditions and medication used. There were poor correlation with dental visits, medical conditions or medications used and perceived dental health with the DFMS values and these were not included in the regression analysis.

Clinical examinations were performed in dental clinics having good operator facilities: teeth were washed and dried with a 3-in-1 syringe, and saliva ejectors used. Thus, there is more confidence in the coronal caries status compared to field examinations. However, radiographs were not taken in this study, presumably leading to an underestimation of the caries experience. Inter-examiner reliability was tested before and during the clinical examinations, and the percentage of concordance between the two examiners was high. Individual mean components of the coronal DMFS scores were reported, along with total scores, in order to differentiate between treated and untreated carious lesions.

In this study, mean DS, MS, and DMFS in women were comparable to those in men. However, women had higher mean FS than did men, indicating different behavior regarding the use of dental services (Table 2).

Subjects with low family incomes and lower levels of education had their teeth extracted more often (Table 2). The decision to extract carious teeth rather than restoring them reflects lack of finance and current attitudes and beliefs toward dental care utilization (Mueller *et al.*, 1998). These attitudes could require policy-makers to develop oral health promotion activities specifically targeting the preservation of treatable teeth.

**Table 2.** Mean number and standard deviations of DS, MS, FS, DFS, and DMFS according to independent variables

Variable	Category	N‡	DS	MS	FS	DFS	DMFS
Residence	Urban	576	5.83(4.9)	23.37(20.8)	8.29(6.8)	14.13(7.6)	37.49(20.5)
	Rural	416	7.12(4.6)*	16.63(15.3)*	7.00(5.7)	14.12 (7.1)	30.75(16.2)*
Education (Years)	0-11	308	5.60(4.3)*	34.48(25.6)	6.38(5.5)*	11.97(6.8)*	46.45(24.1)*
	12-15	492	6.71(4.5)	15.61(15.1)	8.42(7.6)	15.13(7.8)	30.74(16.9)
	16+	296	6.24(5.7)	14.53(13.5)	9.01(6.7)	15.26(7.9)	29.78(15.1)
Income (JD/month)	≤200	464	6.37(4.2)	25.69(23.2)*	6.46(4.8)*	12.83(5.6)*	38.52(22.3)*
	>200	596	6.34(5.3)	15.94(15.7)	9.17(7.8)	15.51(8.6)	31.45(17.4)
Dental insurance	Yes	456	6.86(5.4)*	16.10(14.0)*	8.42(6.8)*	15.28(7.8)*	31.38(17.3)*
	No	640	5.85(4.3)	23.84(21.8)	7.71(6.9)	13.56(7.4)	37.41(21.6)
Smoking	Yes	224	7.27(5.8)*	25.18(25.6)*	6.75(6.0)*	14.02(7.6)	39.20(23.7)*
	No	872	6.01(4.5)	19.45(18.5)	8.33(7.1)	14.24(7.6)	33.79(19.0)
Brushing	Regular	760	5.98(4.9)	18.68(19.6)	9.05(7.3)	15.03(7.8)	33.72(20.0)
	Irregular	336	6.93(4.7) *	25.00(21.0)*	5.64(5.0) *	12.57(6.9)*	37.57(20.3)*
Flossing	Regular	128	5.38(4.1)*	12.66(10.4)*	10.66(7.9)*	16.03(7.2)*	28.69(13.9)*
	Irregular	968	6.39(4.9)	21.67(21.0)	7.66(6.6)	14.05(7.6)	35.72(20.7)

Abbreviations: DS: decayed surfaces, MS: missing surfaces, FS: filled surfaces, DFS: decayed or filled surfaces, DMFS: decayed, missing or filled surfaces.

‡ Number of subjects

\* Significant ( $p \leq 0.05$ )

**Table 3.** Final multiple regression model for factors influencing the DMFS\*

Variable	Beta	Significance	t	Explained variance
Age (5 subgroups)	+0.57	<0.001	19.29	0.33
Flossing (regular, irregular)	+0.15	<0.001	6.02	0.01
Family income (2 subgroups)	-0.13	<0.001	-4.47	0.02
Residence (urban, rural)	+0.15	<0.001	6.15	0.03
Smoking (yes, no)	-0.07	0.005	-2.84	0.01
Education (3 subgroups)	-0.08	0.01	2.53	0.17
Brushing (regular, irregular)	-0.05	0.04	2.08	0.01

\* Explained variance for all variables = 0.45

Previous reports on the prevalence of caries in Jordanian adults have not been published. Comparison of these results with studies from other countries should be done with caution because of differences in geographical location, fluoride exposure, social development, and economical growth. In addition, study designs and sampling procedures are different from one study to another. The mean coronal DMFS found in this study, 34.9 was comparable to that from the U.S. National Health and Nutrition Examination survey, 1988-1991 (Brown *et al.*, 1996; Winn *et al.*, 1996) (mean 41 surfaces), and a study of African American adults in New York (Barrow *et al.*,

2003) (range 21-64 surfaces). However the mean coronal DFS (approximately 14 surfaces) was lower than that of three North American studies (Barrow *et al.*, 2003; Brown *et al.*, 1996; Papas *et al.*, 1992). Lower figures for DMFS and DFS have been reported from a group of Haitian immigrants in the USA (Cruz *et al.*, 2001). The DMFS and DFS results from the present study were lower than those reported in Canadian adults aged 35-44 (Brodeur *et al.*, 2000). Although the mean DMFS in this study was comparable to that of many other nations, the unmet treatment need was very high indicating a major public health problem in Jordan.

In the present study, current smokers had more decayed and missing teeth, and fewer filled teeth. The DMFS was significantly higher in smokers than non-smokers (Table 2). These results were consistent with other reports (Aleksejuniene *et al.*, 2000; Tada and Hanada, 2002) and could be explained by lower awareness or priorities for oral health by smokers. In the present study, greater age, less education and income, urban residence, smoking and irregular brushing and flossing were found to be risk indicators for coronal caries. This is consistent with the results from two U.S. studies (Cruz *et al.*, 2001; Harris *et al.*, 1993).

### Conclusion

This study provided useful information on the coronal caries status of Jordanian adults. Subjects presented with a high prevalence of coronal caries experience and a high proportion of untreated lesions. The results establish baseline data, which will help in planning and evaluating future oral health programs. This study also suggested that modifications of social factors (education, income, smoking, and oral hygiene practices) would be associated with a reduction in the number of DMFS, leading to an improvement in the oral health status and function in adults.

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