

# Oral health among prisoners of District Jail, Haridwar, Uttarakhand, India - A cross-sectional study

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## ABSTRACT

**Aim:** Prisoners are at risk from a range of health related problems, caused by a number of factors. This study was conducted to assess the impact of incarceration on oral health among the prisoners of Haridwar District Jail, Uttarakhand state.

**Material and method:** A total of 573 inmates (534 males and 39 females) comprised the total study population. Oral health was examined with the Decayed, Missing, Filled Teeth (DMFT) index, and by measuring pocket depth (PD) and clinical attachment loss (CAL).

**Results:** The age of the study participants ranged between 18 to 90 years with a mean age of  $46.14 \pm 15.29$  years. The overall mean DMFT score was  $5.40 \pm 6.49$ , with a prevalence of 77%. A significant difference ( $P=0.001$ ) was found when the mean score of DMFT was compared to the period of incarceration, where the highest mean score was  $6.97 \pm 7.69$  for 5-10 years.

**Discussion:** There was a significant difference found for DMFT among inmates based on a period of incarceration. Gender and period of incarceration had no significant impact on the severity of periodontal diseases among jail inmates. Longitudinal studies are required to find out the causal association between incarceration and oral health. Comprehensive and timely oral health care is required for this vulnerable population.

**Conclusion:** The level of oral disease among jail inmates was high. There was a significant difference for DMFT among inmates based on the period of incarceration.

**Key words:** prisoners; oral health; dental caries; periodontitis; gender.

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## INTRODUCTION

Health has been regarded as a fundamental human right for every single citizen. The concept of health has shifted from the mere absence of disease to encompass a broader aspect of improving the quality of life. Public health focuses on the identification of underprivileged groups, estimating the burden of disease among them, and planning comprehensive health care programs to improve their health<sup>1</sup>.

Prisons are an environment with challenges for healthcare delivery when compared to the general population. The reasons for this include restricted autonomy, low access to health care and social exclusion. For these reasons, prisoners are at a greater risk of a range of health related problems<sup>2,3</sup>. Although they are imprisoned, inmates retain their fundamental right of health and to access to health care.

Oral health is an inseparable component of general health. Like other general health issues, prisoners

are at high of oral diseases due to limited resources. Negligence in oral hygiene maintenance, addiction to drugs and tobacco use can further contribute to their poor oral health. Inequalities in the burden of oral disease among these vulnerable groups have been found worldwide. There is a growing recognition that there is a direct link between oral health and lifestyle related diseases such as heart disease, arthritis etc. Lack of attention in maintaining oral hygiene is reflected in their overall health status. Improving oral health can improve overall health<sup>3</sup>. Periodontal diseases have been linked to cardiovascular diseases, high blood pressure, stroke, diabetes, dementia, respiratory diseases, and mortality, where an inflammatory pathway has been suggested.<sup>1</sup> Associations have been seen between the number of teeth, dental caries, and general health among older adults and children, indicating a nutritional pathway.

There is an alarming situation in developing countries like India, where the number of inmates and persons awaiting trial continue to increase. In India, the occupancy rate of inmates in all prisons was reported as 118.5% with 159% occupancy rate in Uttarakhand state, the second highest among all states, followed by Uttar-Pradesh. In December 2019, the highest rate of female occupancy in Uttarakhand state was 170%<sup>4,5</sup>.

Few studies have been conducted across India to analyze the poor oral health status with high prevalence of dental caries and periodontal disease among jail inmates<sup>4,6-10</sup>. To the best of our knowledge and according to the results taken from a review of the literature, there are no previous studies on the burden of oral disease among jail inmates in Haridwar district in Uttarakhand state. This study was therefore carried out to assess caries and the periodontal status among jail inmates of Haridwar district, in Uttarakhand state. The impact of incarceration on caries and periodontal status in this group was also determined. The findings obtained from the study will help in making recommendations which in turn will result in a comprehensive strategy formulation to improve not only oral health but also the oral health-related quality of life among such underprivileged jail inmates.

## MATERIAL AND METHOD

Prior permission to conduct the study was sought from the competent authorities of the jail administration for three months. The purpose of study was explained to the participants and written consent was taken from those who were willing to participate in the study.

## Study design

This cross-sectional study was carried among the jail inmates of the district jail of Haridwar district, Uttarakhand.

## Ethical clearance

A Protocol for the study was submitted to the Institutional Ethical Committee of Patanjali Bhartiya Ayurvedigyan Evam Anusandhan Sansthan and permission to conduct the study was obtained (letter no. PAC/1003/2018).

## Inclusion and exclusion criteria

All male and female inmates who were willing to participate and gave written consent were enrolled in the study. Those subjects who were uncooperative and persons awaiting trial who were contraindicated for oral health examination were excluded from the study.

## Sample size

As the present study was a complete enumeration survey, sampling methodology was not adopted. A total of 573 inmates (534 males and 39 females) comprised the total study population.

The scheduling for oral health examination was carried out in accordance with the permission granted by the jail authorities. Details on age, gender and period of incarceration were recorded in personal interviews.

## Clinical examination

The clinical examination was conducted by a principal investigator who was accompanied by a well-trained recorder. The principal investigator was pre-calibrated to establish good intra-examiner reliability (Kappa coefficient = 0.75). The oral examination was conducted in natural daylight, using a plain mouth mirror, WHO periodontal probe and dental explorer and all the disinfection protocols were followed. Participants were asked to sit upright on a stool. Dental caries were recorded using the WHO modified DMFT index<sup>11</sup>, for periodontal disease pocket depth probing (PD), and clinical attachment loss (CAL) were included as a clinical record. These were recorded at at least four sites per tooth and the highest score was recorded. Periodontitis was classified as mild when there was a PD < 5 mm and CAL < 2 mm, moderate periodontitis was classified in cases of PD ≥ 6 mm and CAL 3 to 4 mm, and severe periodontitis with PD ≥ 7 mm and CAL ≥ 5 mm in accor-

dance with the American Academy of Periodontal Disease<sup>12</sup>.

### Statistical analysis

The collected data were coded and tabulated. SPSS version 21.0 was used for statistical analysis. The data were presented as proportions, mean  $\pm$  standard deviation. To check whether the data is normally distributed or not, the *P* value was considered after applying the Kolmogorov Smirnov normality test. A *P* value of  $<0.05$  indicated that the data was not normally distributed. Hence, non-parametric tests, Mann Whitney U test, and the Kruskal Wallis test were applied to establish whether any significant difference exists when the median values were compared. A Chi-square test was used for the association between the severity of periodontal disease and demographic characteristics. A *P* value  $<0.05$  was considered statistically significant.

## RESULTS

Table 1 shows the demographic characteristics of the study participants. The age of the study participants ranges from 18 to 90 years and the mean age was  $46.14 \pm 15.29$  years. Of the 573 participants, 40% were 18-40 years (40.50%) and 41-60 years (39.80%) age groups. Male study participants outnumbered ( $n=534$ , 93.20%) their female ( $n=39$ , 6.80%) counterparts. More than half of the study participants ( $n=321$ , 56%) were incarcerated for less than five years.

The overall mean DMFT score was  $5.40 \pm 6.49$ , with a prevalence of 77%. The mean score of

DMFT among the study participants were compared to the demographic variables (Table 2). The mean score was  $19.29 \pm 9.62$  for the subjects over 65 years, showing a statistically highly significant result ( $P < 0.001$ ). The mean score of DMFT was significantly high ( $P = 0.002$ ) for female subjects ( $7.77 \pm 6.188$ ) as compared to male subjects where the mean score was  $5.22 \pm 6.485$ . A significant difference ( $P = 0.001$ ) was found when the mean score of DMFT was compared to the period of incarceration, where the highest mean score was  $6.97 \pm 7.69$  for 5-10 years.

394 (68.80%) of the 573 subjects have moderate periodontitis. Table 3 shows the proportion of periodontal status among the study participants when compared to the demographic variables. Moderate periodontitis was observed among 163 (28.40%) subjects in the age group of 41-60 years, followed by 145 (25.30%) subjects with moderate periodontitis in the 18-40 years age group. This difference was statistically highly significant ( $P < 0.001$ ). No significant difference ( $P = 0.22$ ) was observed when the proportion of periodontal status was compared gender wise. The periodontal status was poor among male subjects. A total of 215 (37.50%) subjects imprisoned for less than 5 years had moderate periodontitis, almost similar proportions were observed for the period of 5-10 years (16.80%) and more than 10 years (14.50%). This difference was found to be statistically insignificant ( $P = 0.19$ ).

## DISCUSSION

Health care systems face the challenge of delivering appropriate health services at the right time to inmates, but there is also a window of opportunity for them to deliver equitable health care. The results of this study can serve as baseline data for the impact of incarceration on oral health among inmates and can serve as a guide to plan comprehensive oral health care services in the prison environment.

The prevalence of dental caries in this study was found to be about 77%, which is similar to the results reported in studies conducted by Fotedar S et al<sup>6</sup> (71.8%) and Osborn M et al<sup>13</sup>, but higher than the ones mentioned by Sharma A et al<sup>4</sup> where they found a prevalence of dental caries of 55%. The overall mean DMFT score was  $5.40 \pm 6.49$ , which matches the results obtained by Fotedar S et al<sup>6</sup> ( $5.10 \pm 2.10$ ). However this result was on the higher side when compared to the findings of Sharma et al<sup>4</sup>, Bolin K et al<sup>14</sup>, and Agrawal N et al<sup>15</sup>.

Table 1. Demographic details of study participants.

Variables	N = 573	%
Age groups (in years)		
18-40	232	40.50
41-60	228	39.80
61-80	106	18.50
>80	7	1.20
Gender		
Male	534	93.20
Female	39	6.80
Period of incarceration		
<5 years	321	56.0
5 to 10 years	144	25.1
>10 years	108	18.8

Interestingly a very high mean DMFT was  $17 \pm 8.9$ , reported by Vainionpaa R et al<sup>16</sup> among Finnish inmates. Furthermore, several factors need to be considered when interpreting findings and comparing them with other studies. First, given the heterogeneity within the prison population in terms of their sociodemographic, cultural, and geographical background, diversities persist within the racial/ethnic and age strata as presented in this study, and no doubt vary according to the prison. The criteria used for the detection of dental caries were not enti-

rely consistent with those used in previous surveys as some of them used radiographs to detect dental caries.

The mean DMFT score for the prisoners significantly increased with age, which was highest among adults aged 80 or more, as is the norm for any population. The high prevalence of dental caries can be influenced by many factors that include lifestyle, type of diet, lack of oral hygiene measures and cultural factors before coming to jail. Inmates also depend on the prison authorities to arrange dental care.

Table 2. Comparison of mean DMFT score with demographic variables of study participants.

Variables	Mean $\pm$ SD	Median	IQ range	P value
<b>Age groups (in years)</b>				
18-40 (n = 232)	2.66 $\pm$ 3.39	1.00	4.00	<0.001*‡
41-60 (n = 228)	5.28 $\pm$ 5.390	4.00	7.00	
61-80 (n = 106)	10.72 $\pm$ 8.843	9.00	13.00	
>80 (n = 7)	19.29 $\pm$ 9.62	16.00	16.00	
<b>Gender</b>				
Male (n = 534)	5.22 $\pm$ 6.485	3.00	6.00	0.002†§
Female (n = 39)	7.77 $\pm$ 6.188	7.00	9.00	
<b>Period of incarceration</b>				
<5 years (n = 321)	4.43 $\pm$ 5.45	3.00	7.00	0.001†‡
5 to 10 years (n = 144)	6.97 $\pm$ 7.69	4.00	10.00	
>10 years (n = 108)	6.19 $\pm$ 7.10	4.00	7.00	

**Note.** \* $P < 0.001$ : Highly Significant. † $P < 0.05$ : Significant. ‡Kruskal Wallis test. §Mann Whitney test. DMFT: Decayed, Missing, Filled Tooth Index; SD: Standard Deviation; IQ: Interquartile Range.

Table 3. Comparison of proportion of periodontal status with demographic variables of study participants.

Variables	Mild (n=84)	Moderate (n = 394)	Severe (n = 95)	P value
<b>Age groups (in years)</b>				
18-40 (n = 232)	57 (9,90)	145 (25,30)	30 (5,20)	<0,001*
41-60 (n = 228)	20 (3,50)	163 (28,40)	45 (7,90)	
61-80 (n = 106)	6 (1,0)	81 (14,10)	19 (3,30)	
>80 (n = 7)	1 (0,2)	5 (0,9)	1 (0,2)	
<b>Gender</b>				
Male (n = 534)	75 (13,10)	368 (64,20)	91 (15,90)	0,22
Female (n = 39)	9 (1,60)	26 (4,50)	4 (0,70)	
<b>Period of incarceration</b>				
<5 años (n = 321)	52 (9,10)	215 (37,50)	5 (9,40)	0,19
5 a 10 años (n = 144)	24 (4,20)	96 (16,80)	24 (4,20)	
>10 años (n = 108)	8 (1,40)	83 (14,50)	17 (3,0)	

**Note.** Chi square test; \* $P < 0,001$ , Highly Significant.

In this study, the mean DMFT was  $7.77 \pm 6.188$  among female inmates, which is almost less than the one observed by Soares GH et al<sup>17</sup> where they found a mean DMFT of  $11.70 \pm 6.33$ . The mean DMFT score was statistically higher among females than males. It is not clearly understood why females have such a high prevalence of dental decay in comparison to males in the vulnerable population. Timing of tooth eruption among females may be one of the reasons, since there is longer exposure to cariogenic substances. Other factors could be differences in dietary choices and patterns, variations in physiological process and dental morphological patterns<sup>18</sup>.

There was a significant difference for DMFT among inmates based on the period of incarceration. Mean DMFT was comparatively lesser among inmates incarcerated for less than five years than DMFT among inmates imprisoned for longer. A statistically significant relation was observed between period of incarceration and dental caries. This may be attributed to the fact that dental treatment services are not easily accessible and available to the inmates; moreover this finding highlights the negligence of oral health among prison inmates and the lack of dental treatment.

Similar findings were observed by Mixson JM et al<sup>19</sup> where they found that dental service utilization rates were less in inmates incarcerated for longer periods. Reduced dental care utilization rates may be a factor associated with the increased burden of dental caries. Imprisonment influences oral hygiene practices, food preferences, the psychology of the patient, the attitude of the parents towards dental care etc. These factors play a vital role in the increased burden of dental caries.

Gender and period of incarceration had no significant impact on the severity of periodontal diseases among jail inmates in this study. On the other hand, a significant correlation was found between age groups and the severity of periodontal disease. Most of the inmates in our study had moderate periodontitis in all age groups, which contradicts the findings of Fenol A et al<sup>20</sup> where they found that inmates had severe periodontitis. Healthy periodontium and gingival bleeding were more commonly found among younger prisoners while periodontal pockets were more frequent in older ones. These findings match those observed by Hurlen B et al<sup>21</sup>. Similarly Nobile CGA et al<sup>22</sup> found that deep pockets were more likely in older subjects.

The reason for these findings might be that the long waiting periods for treatment required are one of the reasons for poor periodontal health among the older inmates, as limited treatment is rendered to

inmates inside prison premises. Advanced periodontal disease requires surgical treatment and can only be carried out at a place with proper facilities. The lack of support staff and transport and the need for security mean that inmates cannot access treatment facilities, which is one of the reasons for poor periodontal health.

Some limitations should be mentioned before considering the conclusions. This study was limited to a single prison, so care should be taken when drawing general conclusions from the results. A complex mechanism can serve for correlation between health conditions and period of incarceration<sup>23</sup>. The study design was cross-sectional. A longitudinal study would be more appropriate to establish the actual association between the disease and time, based on multi-centre approach at different prisons in India.

The cross-sectional nature of the study means that prior information on the dental status of prisoners before entering prison, was not included. To the best of our knowledge, and after carrying out a review of the published literature, there are no previous studies on the oral health of adults in the same geographic area.

## CONCLUSIONS

It is evident from the findings of this study that the burden of oral disease is high among jail inmates. Moreover, it deteriorated more with the length of imprisonment.

Our results present an alarming situation in jail, especially with oral health care needs among inmates and measures need to be taken to improve their oral health.

The periods of incarceration can provide an excellent opportunity for oral health care policymakers to render services to achieve oral health among jail inmates that is on a par with that of the general population.

## RECOMMENDATIONS

Oral health education programs should be conducted in prisons to increase oral health awareness among jail inmates. Oral hygiene campaigns including demonstrations of proper tooth brushing technique and oral hygiene kit distribution should be planned as part of preventive dental treatment.

As this underserved group is restricted to a confined environment and has limited access to basic

oral needs, regular oral screening programs along with essential dental treatment camps for common dental ailments should be organized with the prison authorities, followed by an effective referral service. Such initiatives will not only help to cure dental diseases but also will aid in the overall improvement in oral health-related quality of life for such neglected groups.

## CORRESPONDENCE

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