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## Association Between Tobacco Dependence And Dental Caries

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**Abstract:** Tobacco is considered as the greatest disease-inducing substance globally associated with prevalent addictive habits and harmful influence on the behaviour of an individual and public health. Several studies have discussed the association between dental caries and tobacco consumption particularly in terms of smoking habits. The aim of this study is to evaluate the effects of smoking and chewing tobacco habits and its dependence on prevalence of dental caries. A retrospective study was conducted using case records of University hospital. Descriptive statistics was done to present the distribution of DMFT scores. Chi-square association was done to find the association. A total of 941 consecutive case records with registered DMFT index scores of age above 18 years was retrieved and analysed. All 941 consecutive case records were evaluated in this study. Patients of age group 21-30 years were predominantly seen with tobacco dependence (32.3%) when compared to the other age groups. Tobacco dependence was high with males (97.46%) when compared to females (2.55%). Most of the patients with tobacco dependence had DMFT scores of 0-5 (67.47%). A statistically significant association exists between tobacco dependence with age and gender ( $p < 0.05$ ) but no association with dental caries ( $p > 0.05$ ). Within the limits of the present study, tobacco dependence is associated with age and gender where males of age group 21-30 years show higher tobacco dependence. However, tobacco dependence and dental caries are not associated with more prevalence of dental caries among individuals with very low tobacco dependence.

**Keywords:** dental caries; smoking; tobacco; tooth loss

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### INTRODUCTION

Tobacco is considered as the greatest disease-inducing substance globally associated with prevalent addictive habits which influence the behaviour of an individual and public health with its deleterious and hazardous effects [(Chaitanya et al., 2018)]. Recent reports stated that about 5 million people are directly experiencing the adverse effects of long-term tobacco use, in which the number is expected to increase up to 10 million by the year 2030 with approximately 70% rate of deaths especially in developing countries [(Jha et al., 2006)]. Tobacco is often used orally in the form of smoking such as cigarettes, cigars and pipe or smokeless such as snuff and chewable form [(Winn, 2001)]. A previous report stated the presence of cigarette smoking habits in approximately 29% of the adult population throughout the world [(Anderson, 2006)].

It is widely known that a large amount of chemicals is present in a complex aerosol of cigarette which contains volatile gases with suspension of particulate matter [(Menon and Bhat, 2019)], [(Harini and Leelavathi, 2019)]. Long term use of tobacco may lead to various adverse effects such as discolouration of teeth, dental caries, periodontal diseases, altered taste sensation, nicotinic stomatitis and precancerous lesions such as leukoplakia and carcinoma with high rate of morbidity and mortality [(K et al., 2013)], [(Prabakar, John, I. M. Arumugham, et al., 2018)]. Prolonged use of tobacco is also associated with changes in the oral cavity which include mucosal irritation by toxins and carcinogenic particles, mucosal drying, increased intraoral temperature, changes in intraoral pH, altered immune response and increased susceptibility to infections [(Jitendra K, 2011)], [(Mohapatra et al., 2019)]. Various studies have described the association of tobacco smoking with periodontal diseases and tooth loss in which their prevalence and severity increase over time with an individual's smoking habit [(Clarke and Hirsch, 1995)], [(Kumar S, Prabu D, Kulkarni S, Dagli RJ, 2015)].

Dental caries is a polymicrobial disease which is influenced by multiple etiological factors [(Simón-Soro and Mira, 2015)], [(Prabhakar, Murthy and Sugandhan, 2011)], [(Samuel, Acharya and Rao, 2020)]. The development of dental caries is a complex process associated with diet and oral pH as it involves the dissolution of minerals

in the enamel and dentin by sugar-fermenting microorganisms [(Simón-Soro et al., 2013)],[(Prabakar, John and Srisakthi, 2016)]. Similarly, several studies have discussed the association between dental caries and tobacco consumption particularly in terms of smoking habit [(Modéer, Lavstedt and Ahlund, 1980)],[(Hirsch et al., 1991)],[(Skudutyte-Rysstad et al., 2009)]. A study by Axelsson et al reported on the significant relationship between dental caries and smoking with similar oral hygiene seen in both tobacco users and non-tobacco users [(Axelsson, Paulander and Lindhe, 1998)]. Earlier studies have reported the low incidence of dental caries in individuals with smoking habits [(Hart, 1899)],[(Gibbs, 1952)]. This finding is attributed to the presence of higher thiocyanate concentration in smoker's saliva which has a possible caries inhibiting effect [24]. However, various studies have opposed the finding by reporting the increased susceptibility to dental caries among smokers due to the low pH level, reduced buffering capacity of saliva and increased concentrations of lactobacilli and Streptococcus mutans [(Kassirer, 1994)],[(Mebin George Mathew et al., 2020)],[(Pratha, Ashwatha Pratha and Prabakar, 2019)].

According to a health survey done in 2001, it is concluded that long-term smokers show less tendency to visit a dentist as often as non-smokers and probability of an annual visit for routine dental check up decreases with an increase in the frequency of smoking per day [(Pavithra, Preethi Pavithra and Jayashri, 2019)],[(Neralla et al., 2019)]. A recent study reported a higher prevalence of dental caries among heavy smokers as compared to non-smokers and light smokers [(Campus et al., 2011)],[(Khatri et al., 2019)]. It is observed that there is an increased number of bacterial colonies and cotinine levels with increased exposure to tobacco smoking. A study by Zonuz et al mentioned an increase in the growth of Streptococcus mutans and Streptococcus sanguis in the saliva in the presence of cigarette smoke [(Zonuz et al., 2008)],[(Prabakar, John, I. Arumugham, et al., 2018)]. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J et al., 2018; Menon et al., 2018; Prabakar, John, I. M. Arumugham, et al., 2018; Rajeshkumar et al., 2018, 2019; Vishnu Prasad et al., 2018; Wahab et al., 2018; Dua et al., 2019; Duraisamy et al., 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshababu et al., 2019; Mehta et al., 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran et al., 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma et al., 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi et al., 2020; Samuel, Acharya and Rao, 2020)

This study was conducted to evaluate the association of tobacco dependence and prevalence of dental caries.

## **Materials and Method**

### **Study setting and design**

This retrospective study was conducted by reviewing 86,000 patient records of the authors University hospital for a period of nine months from June 2019 to March 2020.

### **Selection Criteria**

A total of 941 consecutive case records with signed informed consent and information on DMFT index scores were sorted. No gender restriction placed. Case records of patients age > 18 years were retrieved and analysed. An effort had been taken to confirm the case records of patients wearing complete dentures were excluded.

### **Ethical approval**

Prior permission to utilize and to analyse the data from the case records of patients were obtained from the University authorities with the ethical approval number of SDC/SIHEC/2020/DIASDATA/0619-0320.

### **Data collection**

Information on age, gender, DMFT scores and Fagerstrom scores were collected from the patient's records. DMFT index scores were calculated such that tooth with carious lesions or both restoration with dental caries was recorded as Decayed (D), tooth that has been extracted due to caries as Missing (M) and tooth with permanent or temporary filling or tooth with defective filling but not decayed as Filling (F). The sum of the three figures was recorded as the final DMFT score. Interpretation of Fagerstrom scores for tobacco dependence was described in terms of 0-2 (Very low dependence), 3-5 (Medium dependence), 6-7 (High dependence) and above 8 (Very high dependence). Age of the patients were categorized for statistical convenience as 21-30, 31-40, 41-50, 51-60, 61-70, 71-80 years.

### **Statistical analysis**

Data was entered in Excel and analyzed using SPSS software version 23.0. Descriptive analysis was done to assess the prevalence of the amount of plaque in age groups and gender. Chi-square test was used to evaluate the association of tobacco dependence with age, gender and DMFT index. Significant level test was set at p=0.05.

## **RESULTS AND DISCUSSION**

A total of 941 consecutive case records were evaluated in this study. Most of the participants had very low tobacco dependence (36.56%), followed by 35.39% participants with low tobacco dependence, 16.05% had high tobacco dependence and 12.01% with very high tobacco dependence. [Figure 1] About 15.52%, 9.25%, 6.48%,

3.72% 1.28% and 0.32% of the participants of age group 21-30, 31-40, 41-50, 51-60, 61-70 and 71-80 years had very low tobacco dependence respectively. Similarly 10.41%, 8.71%, 7.86%, 6.06%, 2.13% and 0.21% of the age group 21-30, 31-40, 41-50, 51-60, 61-70 and 71-80 years had a low tobacco dependence respectively. About 5.21%, 4.14%, 3.29%, 2.76% and 0.64% of the age group 21-30, 31-40, 41-50, 51-60 and 61-70 years had high tobacco dependence respectively. Approximately, 4.68% 4.14%, 2.55%, 1.81%, 1.91% and 1.06% of the participants of the age group 21-30, 31-40, 41-50, 51-60 and 61-70 had very high tobacco dependence respectively. A statistical significant association exists between age and tobacco dependence ( $p < 0.05$ ). [Figure 2].

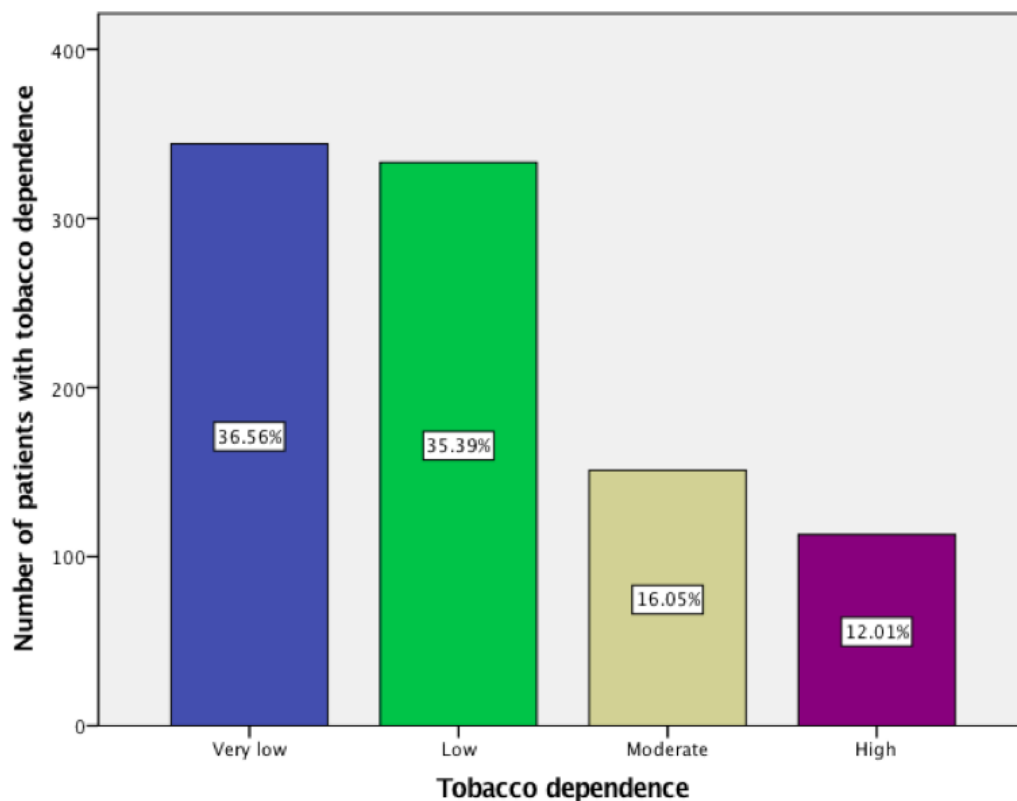
In terms of gender, about 36.24% males and 0.32% females had very low tobacco dependence. Similarly, 34.54% males and 0.85% females had low tobacco dependence. About 15.73% males and 0.32% females had high tobacco dependence. 10.95% males and 1.06% females had very high tobacco dependence. A statistical significant association exists between gender and tobacco dependence ( $p < 0.05$ ). [Figure 3] Most of the patients with tobacco dependence had DMFT scores of 0-5 (67.47%). No statistical significant association exists between tobacco dependence and dental caries ( $p > 0.05$ ). [Figure 4]

A previous study by Schmidt et al., reported that the increase in tobacco smoking is followed by a decrease in caries rate as it increases thiocyanate level in saliva which provides possible caries inhibiting effect [(Schmidt, 1951)]. However, recent studies have concluded that cigarette smoking is certainly associated with an increased caries rate. The decreased buffering effect of smoker's saliva and the higher number of Lactobacilli and Streptococcus mutans group may indicate an increased susceptibility to caries [(Tenovuo and Mäkinen, 1976)],[(Reibel, 2003)]. It has been suggested that smokers have poor oral hygiene, make fewer visits to dentists, and have lesser overall health standard than non-smokers, leading to increased caries rate, especially cervical, interproximal and root surface caries [(Vellappally S, Fiala Z, Šmejkalová J, Jacob V, Shriharsha P, 2007)],[(Ludwick and Massler, 1952)]. This finding is in line with a study by Hellqvist et al., which mentioned that tobacco users have less frequent dental visits and poorer oral hygiene habits than non-tobacco users [(Hellqvist, 2012)],[(Kannan et al., 2017)].

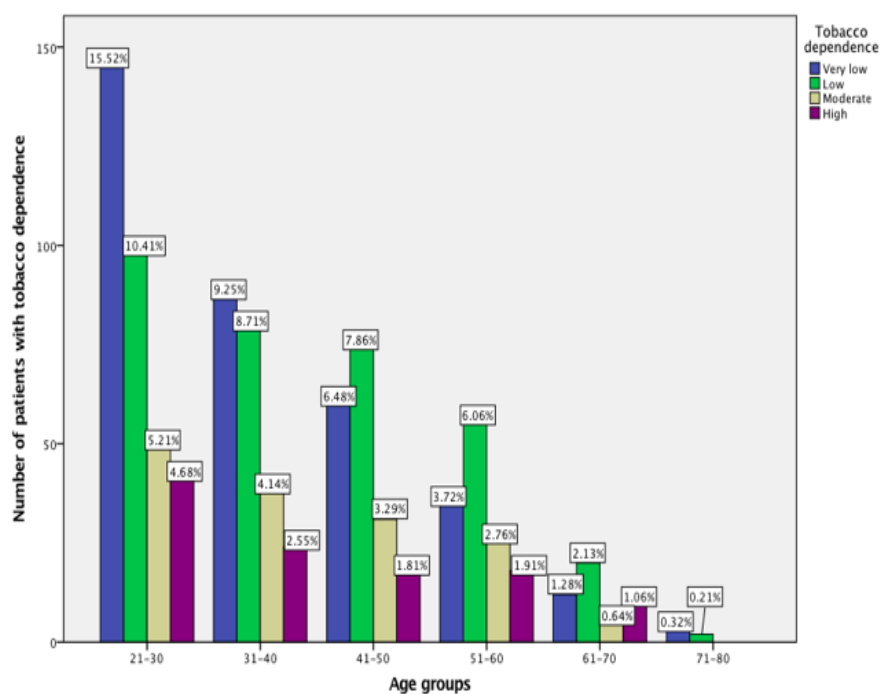
Based on a previous data by Mubeen et al., an average of 47.5% men and 10.3% women are tobacco consumers to date [(K et al., 2013)]. The prevalence of tobacco users globally is about four times higher among men (48%) than women (12%) [(Corrao et al., 2000)]. A previous study reported on the prevalence of tobacco smokers in males (35%) and females (28%), while smokeless tobacco users are seen in 18% men and 3% women, which indicates male predilection in both forms of tobacco [(Hellqvist, 2012)],[(Shafey O, Eriksen M, Ross H, Mackay J, 2009)]. However, according to the Global Youth Tobacco Survey, young girls smoke almost as much as young boys [(Warren CW, Lea V, Lee J, Jones NR, Asma S, McKenna M., 2009)]. Both male and female smokers are mostly represented among individuals with low education level and low socioeconomic status [(Kumar, Pradeep Kumar and Preethi, 2017)]. A previous study reported that the highest rates among both women and men are found in smokers who are unemployed [(Hellqvist, 2012)],[(Kumar, Pradeep Kumar and Vijayalakshmi, 2017)].

Previous studies mentioned that approximately one-third of the adult population in the world use tobacco in some form and of who half will die prematurely. Vellappally et al., reported the prevalence of tobacco smokers observed in 30-69 years of age, while Sharma et al., reported cases of tobacco users among individuals within 20-40 years of age [(Vellappally et al., 2007)],[(Sharma, Mishra and Mittal, 2018)]. Axelsson et al., did a study involving four different age groups (35,50,65 and 75 years of age) and found that smokers have a larger number of missing teeth surfaces in the 50, 65 and 75 year age groups than in the 35 year age group, which indicates a greater association between the two variables as the age increases [(Axelsson, Paulander and Lindhe, 1998)]. Vellappally et al., also mentioned the association between smoking and dental caries is well-documented in the older age group [(Sharma, Mishra and Mittal, 2018)]. This finding can be attributed to various factors such as poor oral hygiene habits and lack of awareness among different age groups. Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh et al., 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai et al., 2019; Sridharan et al., 2019; Vijayashree Priyadharsini, 2019; M. G. Mathew et al., 2020)

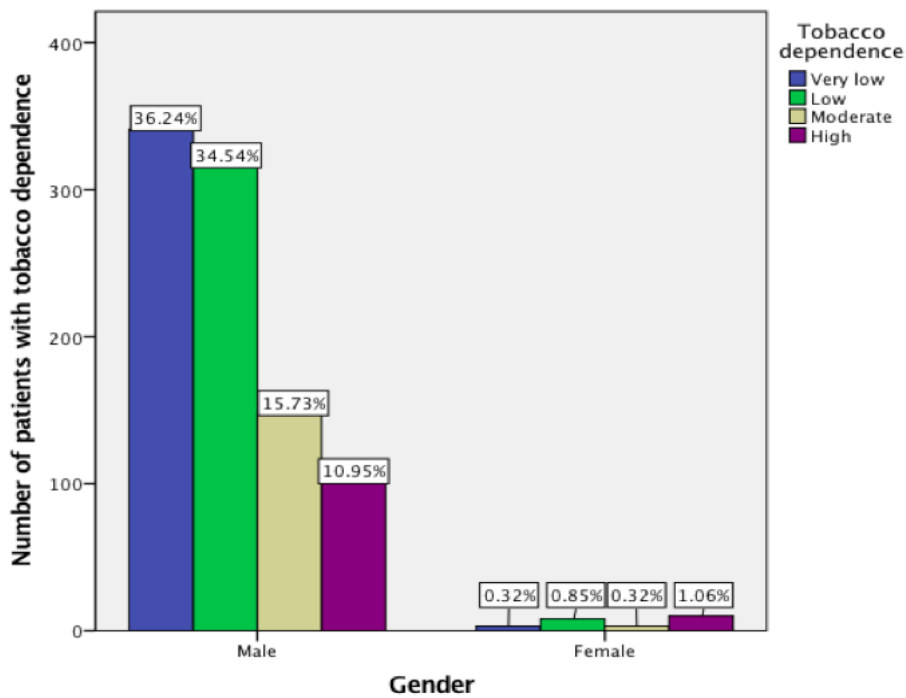
The present study had few limitations where the other contributing factors to dental caries have not been evaluated. Since it is a retrospective study, follow up of subjects was not possible to extrapolate the study results. Also this study lacked to assess the other confounding variables such as education and socioeconomic status, salivary flow and salivary pH. Further prospective study including all possible factors for dental caries has to be investigated to prove the hypothesis. Since tobacco is a harmful substance associated with various oral diseases particularly dental caries, tobacco awareness programs need to be inculcated in the educational program for all age groups.



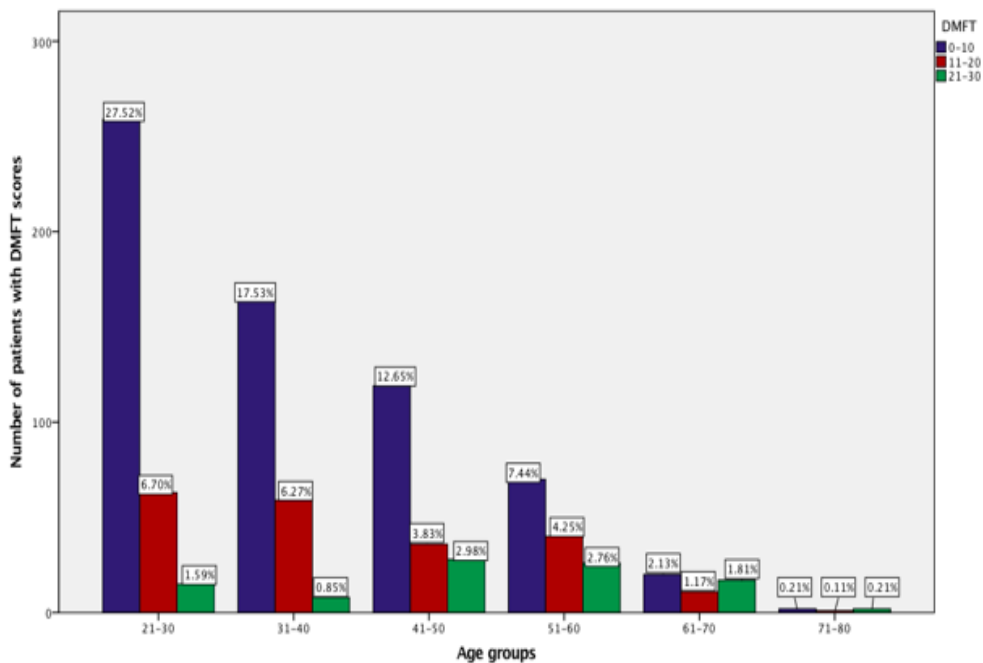
**Fig.1:** Bar graph depicts the frequency distribution of tobacco dependence among the patients. X-axis represents ordinal variables of tobacco dependence. Y axis represents the number of patients with tobacco dependence. Most of the patients (36.56%) had very low tobacco dependence.



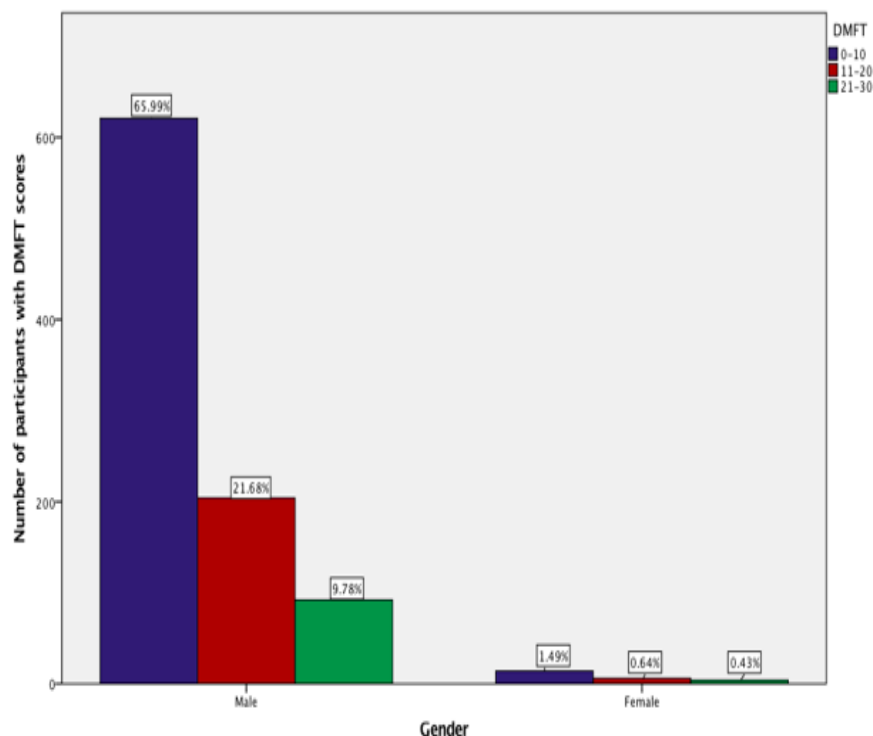
**Fig.2:** Bar chart showing distribution of tobacco dependence among the age groups. X - axis represents age groups in years. Y axis represents the number of patients with tobacco dependence in each age group. Chi-square test was done and found to be statistically significant [Pearson's chi square value - 27.451, df -15; p=0.025 (<0.05)]. Young adults (4.68%) have severe tobacco dependence compared to middle aged adults and elderly.



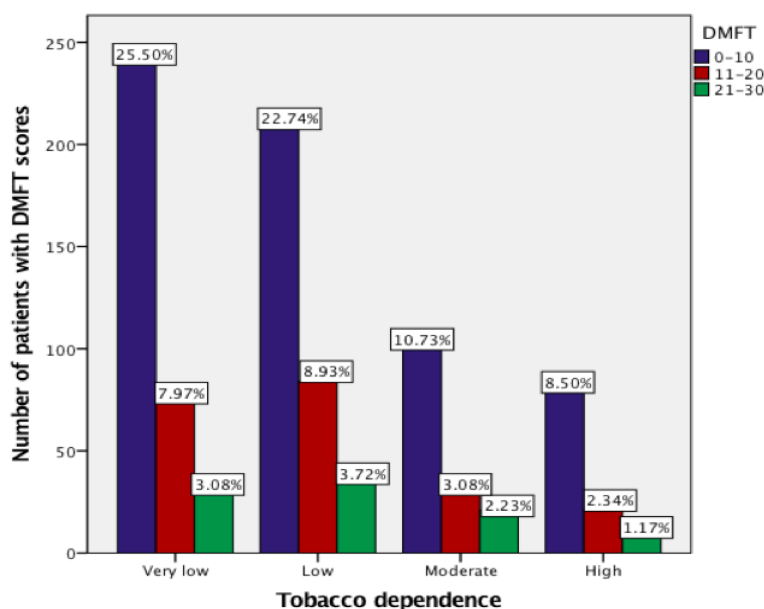
**Fig.3:** Bar chart showing distribution of tobacco dependence among males and females. X axis represents genders. Y axis represents the number of patients with tobacco dependence. Chi-square test was done and found to be statistically significant [Pearson's chi square value - 22.161, df-3; p=0.000 (<0.05)]. Males had significant tobacco dependence than females.



**Fig.4:** Bar chart showing distribution of dental caries (DMFT index) among patients of different age groups. X axis represents the age groups. Y axis represents the number of patients with DMFT scores. Chi-square test was done and found to be statistically significant [Pearson's chi square value - 92.946; df - 10; p=0.000 (p<0.05)]. DMFT score of 0-10, 11-20 was found significantly high in the younger (27.5% and 6.7%) age groups.



**Fig.5:** Bar chart showing distribution of dental caries (DMFT index) among patients of different genders. X axis represents the genders. Y axis represents the number of patients with DMFT scores. Chi-square test was done and found to be statistically not significant [Pearson's chi square value - 1.394; df - 2; p=0.498 (p>0.05)]. DMFT score of 0-10 was predominantly seen in both males (66%) and females (1.5%).



**Fig.6:** Bar chart showing distribution of dental caries (DMFT index) among patients with tobacco dependence. X axis represents tobacco dependence. Y axis represents the number of patients with DMFT scores. Chi-square test was done and found to be statistically not significant [Pearson's chi square value - 12.176, df -15; p=0.666 (>0.05)]. However, patients (25.5%) with very low tobacco dependence had high DMFT scores of 0-5.

## CONCLUSION

Within the limits of the present study, tobacco dependence is associated with age and gender where males of age group 21-30 years have higher tobacco dependence. Tobacco dependence and prevalence of dental caries are not associated however prevalence of dental caries is in individuals with very low tobacco dependence. There is a necessity for awareness programs on tobacco use and oral health among individuals of all age groups.

## Acknowledgement

We would like to thank Saveetha Dental College and Hospital for the contributions and involvement through this study.

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