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Research Article**Prevalence and Distribution of Oral Submucous Fibrosis Occurrence Among Schoolchildren in Karachi, Pakistan**

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Abstract

Oral submucous fibrosis (OSF) is a chronic, progressive disease characterized by fibrosis of the oral mucosa, leading to restricted mouth opening and potentially malignant transformation. While traditionally more prevalent among adults in South Asian countries, recent studies have shown an alarming increase in OSF cases among children, particularly in urban areas like Karachi, Pakistan. This study was approved by the ethical committee board of Dow University of Health Sciences, Karachi. The aim was to assess the geographical distribution of OSF cases among school-going children in Karachi, Pakistan, and identify potential risk factors associated with the disease. A cross-sectional study was conducted among school-going children aged 5-16 years in Karachi. A stratified random sampling technique was used to select schools from different geographical regions of the city. After verbal and written consent from students and school authorities, children were examined for clinical signs of OSF, including reduced mouth opening, palpable fibrous bands, and mucosal stiffness. Demographic data, dietary habits, oral hygiene practices, and exposure to risk factors such as areca nut and tobacco use were recorded through a structured questionnaire. An alarming prevalence of 0.7% of OSF was found among small children which is unexpected for a disease that is potentially malignant and previously found only in adults. The most affected areas in Karachi were Saddar and Liaqatabad town. Government school children were mostly affected. This study concluded that the prevalence of OSF was high in the group of schoolchildren and the sale of commercial preparation of areca nut may play a part in this increase. The town-wise pathology split shows the area of Gadap and Liaqatabad town should be targeted for intervention strategies followed by other towns in Karachi. This is crucial for effective public health interventions aimed at reducing the burden of this potentially debilitating disease among school-going children in Karachi.

Keywords: OSF, oral submucous fibrosis, school-going children, areca nut, Gutka, addiction

1. Introduction

In general, Oral submucous fibrosis (OSF) is a chronic, progressive, potentially malignant disorder of the oral mucosa, characterized by fibrosis and inflammation (Qin, Ning et al. 2023). It is primarily associated with the habit of chewing areca nut, often in combination with other ingredients such as tobacco and slaked lime. OSF

is a significant public health concern in many parts of Asia, particularly in India, Pakistan, Bangladesh, and Sri Lanka, where the areca nut is commonly consumed in various forms (Kujan, Mello et al. 2021). In a recent study in Pakistan, it was revealed that the prevalence in adults in Pakistan is 29% (AKHLAQ, KHAN et al. 2021). Another study revealed the prevalence of

precancerous lesions (OSF and leukoplakia) found among children in Karachi as high as 6.94% (Ahmed, Haider et al. 2017).

The pathogenesis of OSF is complex and multifactorial, involving a combination of genetic, immunological, and environmental factors (Jones, Veale et al. 2024). Areca nut contains alkaloids such as arecoline, which are believed to play a key role in the development of fibrosis by stimulating collagen production and altering the immune response in the oral mucosa (Peng, Li et al. 2020). Other factors such as nutritional deficiencies, genetic predisposition, and chronic irritation from spicy foods or hot beverages may also contribute to the development of OSF.

Clinically, OSF is characterized by progressive fibrosis of the oral mucosa, leading to limited mouth opening (trismus), mucosal stiffness, and the formation of fibrous bands. Patients with OSF may also experience a burning sensation in the mouth, altered taste sensation, and difficulty in eating and speaking. In advanced cases, OSF can lead to significant functional impairment and an increased risk of oral cancer (Peng, Li et al. 2020).

Diagnosis of OSF is based on clinical examination, including assessment of mouth opening and the presence of fibrous bands. Histopathological examination of biopsy specimens may also be performed to confirm the diagnosis and assess the degree of fibrosis and inflammation.

Karachi, the largest city in Pakistan, is located on the southern coast of the country along the Arabian Sea. It is the capital of the Sindh province and serves as a major financial and economic hub. The city is known for its diverse population, with people from various ethnic, cultural, and religious backgrounds. It is divided into several administrative districts.

The total number of school-going children, studying in class III-VIII, in Karachi city was our study's target population. It is reported that the lowest estimate of school-going children in Karachi was 4 million, of whom only 27.3% (1.1

million) actually go to school (Ahsan, Saleh et al. 2020).

OSF is a complex oral disorder with significant morbidity and potential for malignant transformation. Prevention efforts should focus on raising awareness about the health risks associated with areca nut and tobacco use, promoting oral hygiene practices, and encouraging early detection and treatment of OSF. The aim of the study was to determine the prevalence of OSF and other areca nut-chewing habit-associated pathologies in the oral mucosa of school children and to assess the area-wise disease burden in Karachi, Pakistan.

2. Material and Methods

This research project received approval from the Institutional Review Board (IRB) at Dow University of Health Sciences with no. ERB-109/DUHS-09. The sample size was determined using the OpenEpi, Version 3, open-source calculator SSPropor, resulting in a calculated sample size of 2,818. An additional 10% (281) was added to account for potential dropouts, bringing the total sample size to 3,099, with a 97% confidence interval and an anticipated prevalence of 60% for areca nut chewing habit as a strong etiological factor of oral submucous fibrosis, with a margin of error of ± 2 .

In our study, each town in Karachi was treated as a distinct group. To simplify our research, we chose nine towns out of the total eighteen based on similar socioeconomic status. We then randomly selected one town from each pair. Schools served as our clusters for data collection. We obtained a list of all government and private schools in Karachi from the 'City Schooling System of Karachi City District Government' (CDGK). Subsequently, we randomly selected one private and one government school from each of the chosen towns. We sought permission from the school principals to conduct our study. From every school, classes/grades from III-VIII were included in the study. As whole classrooms were

examined, the sample turned out to be larger than the actual calculation. Assessing OSF in children aged 7-15 in Karachi was carried out by a combination of clinical examination, and medical history review. Informed verbal and written consent was taken from each and every child and school authorities.

The students of class III-VIII of both genders, who were present in school on the day of data collection and gave consent to participate in the study, from the randomly selected government and private schools from selected towns, were included in the study. Children having any systemic disease or any orofacial lesions, malignancies, and conditions of limited mouth opening other than OSF (trauma, fracture of maxillofacial bones, TMJ ankylosis, mental disorder, tetanus, inflammation, etc.) were excluded from the study. School officials were requested to leave the classroom to eliminate the potential bias and insurance of confidentiality of students' habits. Clinical Examination involved a thorough examination of the oral cavity for signs of OSF, such as restricted mouth opening, blanching and fibrosis of the oral mucosa, and palpable fibrous bands. A dental mirror, probe, and tongue depressor were used for this examination. A questionnaire was used to collect information about the child's habits of tobacco use (if any), betel nut chewing, dietary habits, and any symptoms (e.g., burning sensation in the oral cavity).

The severity of OSF was assessed with the classification of the lesion as mild OSF, betel chewers mucosa, leathery pale mucosa, and areca-induced lichenoid reaction and OSF, which take into account factors like the color and flexibility of oral mucosa, the extent of fibrosis and the degree of mouth opening restriction.

Data was entered in "Windows Statistical Package for Social Services SPSS version 17.0". Descriptive statistics included frequencies for categorical and continuous variables. The chi-square test was applied for the cross-tabulation and to find the

significant difference between different variables. An Independent sample t-test was applied for the difference of means of mouth opening of normal subjects and OSF subjects. Pearson correlation was used for the correlation of age and mouth opening.

3. Results

The prevalence of OSF among schoolchildren in Karachi was found to be 0.7%. The distribution of cases across different towns varied, with Saddar town having the highest prevalence (1.8%) followed by Gulberg (1.6%). Private schools had a slightly lower prevalence (0.6%) compared to government schools (1.0%), but the difference was not significant. Among both, government and private school students, Saddar town had the highest prevalence (6.3%) and (1.5%) respectively. Regular areca nut chewers had a higher prevalence of OSF (1.9%) compared to occasional or non-chewers. Class 8 had the highest prevalence (1.5%) among different classes, and secondary school students had a higher prevalence (1.0%) compared to primary school students (0.4%). OSF was more prevalent among male students (1.3%) compared to female students (0.3%), and this difference was significant

The distribution of OSF among schoolchildren in Karachi varies across different age groups, with the highest prevalence found among 16-year-olds (4.8%) and 14-year-olds (1.7%). The youngest student with unilateral OSF was 9 years old. There was a significant difference in OSF prevalence among different age groups (Chi square=35.533, $p=0.000$).

Ethnicity also seems to play a role, with Balochi-speaking students having the highest prevalence (1.4%) followed by Urdu-speaking students (0.9%). However, the difference in OSF prevalence between ethnic groups was not significant (Chi square=1.648, $p=0.949$).

The type of areca nut chewed also seems to influence OSF prevalence, with significant differences observed among different brands. For example, the prevalence of OSF was higher among

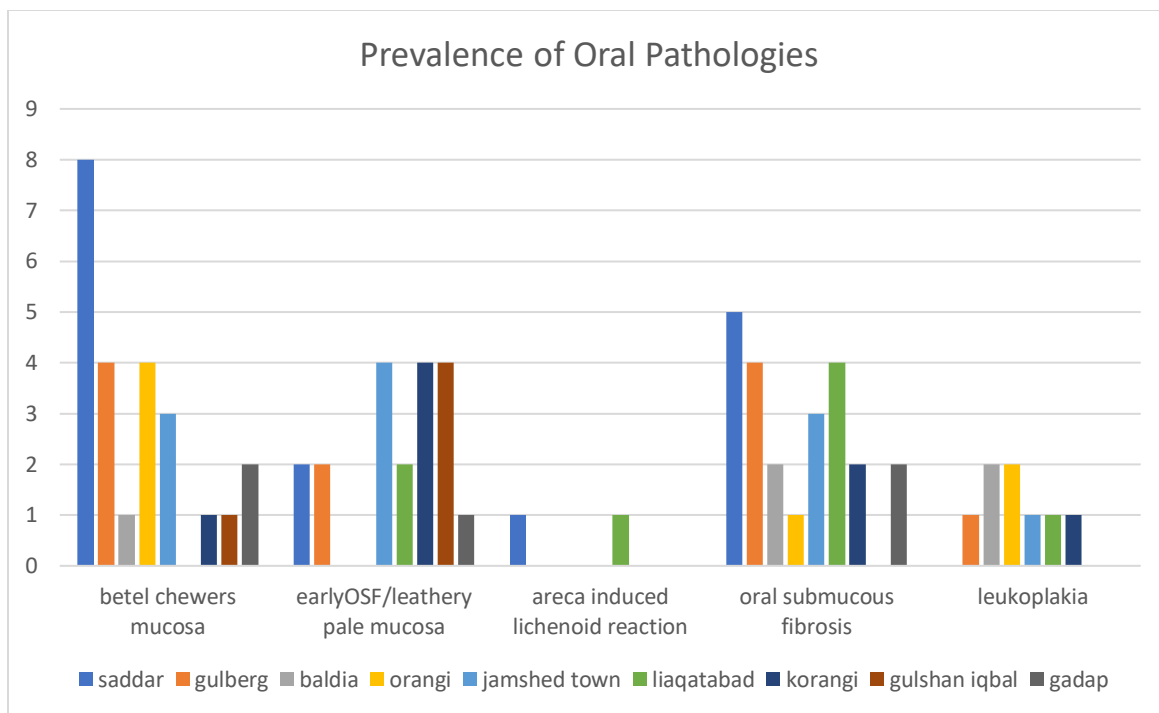


Figure 1: Prevalence of oral pathologies associated with areca nut chewing among students of different towns of Karachi.

chewers of Tara Gold (1.3%), J.M (16.7%), and Tasty (1.5%) compared to non-chewers of these brands.

Awareness of the carcinogenicity of areca nut did not significantly impact OSF prevalence, nor did water intake habits. However, students with OSF were more likely to experience difficulty in swallowing solid food (13.0%) compared to students with normal mucosa (2.1%). They were also more likely to experience a burning sensation on eating spicy foods (39.1% vs. 10.8%).

Figure 1 describes the OSF as well as the other areca nut chewing-associated oral pathologies in children in Karachi. This figure also shows the spectrum of disease as being mild namely betel chewers mucosa, then leathery pale mucosa as initial OSF, then frank OSF. All pathologies are found in the oral mucosa of school children of Karachi.

4. Discussion

Our study on the prevalence of OSF among schoolchildren in Karachi provides valuable

insights into the epidemiology of this condition in the region as well as the concentration of the problem in town-wise locations. The overall prevalence of 0.7% indicates that OSF is present in a notable proportion of the school-age population. As we know this disease is irreversible and bears the potential for malignant transformation, the situation in this age group is alarming. The distribution of cases across different towns, with Saddar town having the highest prevalence, suggests that there is a connection of etiological factors of more chewing habit of areca nut found in the school-going children in Saddar town. (Sarfraz, Ali et al. 2014)

The study also highlights differences in OSF prevalence between private and government school students, although the difference was not statistically significant. This finding suggests that factors other than school type may play a role in the development of OSF among children such as dietary habits, socioeconomic status, and access to healthcare in Pakistan. This is consistent with the studies performed on the same population of

Karachi which found that male patients with lower socioeconomic status are the main target of this disease as well as the oral cancer (Anwar, Pervez et al. 2020).

The higher prevalence of OSF among regular areca nut chewers compared to occasional or non-chewers is consistent with previous research linking areca nut chewing to the development of OSF (Sarfaraz, Ali et al. 2014). This finding underscores the importance of public health interventions aimed at reducing the prevalence of areca nut use, especially among children. The gender disparity in OSF prevalence, with higher rates among male students, is an important finding. Understanding the reasons behind this disparity as an acceptable habit of using tobacco by male students is a social norm in Karachi (Anwar, Pervez et al. 2020). The higher prevalence of betel chewer's mucosa among both genders in Saddar town is also an alarming situation as this does not bode well for school children at such a young age (Muhammad, Saleem et al. 2022).

The findings regarding the age-wise distribution of OSF among schoolchildren in Karachi reveal important insights into the epidemiology of this condition in the region. The higher prevalence of OSF among 16-year-olds (4.8%) compared to other age groups suggests that this age may be particularly vulnerable to developing OSF (Merchant, Haider et al. 1997). This finding could be attributed to factors such as increased exposure to risk factors like areca nut chewing or other behaviors associated with OSF development (Shah, Merchant et al. 2002).

The presence of OSF in children as young as 9 years old is concerning and highlights the need for early detection and intervention. A similar case of OSF in a nine-year-old girl was reported from a neighboring country (Agrawal, Airen Sarkar et al. 2011). Identifying OSF at an early age can help prevent its progression and minimize its impact on oral health.

The study also explores the influence of ethnicity on OSF prevalence, with specific ethnic students

showing the highest prevalence. While the difference in OSF prevalence between ethnic groups was not significant, the findings suggest that there may be cultural or genetic factors that contribute to the development of OSF in certain populations. The association between OSF prevalence and the type of areca nut chewed is noteworthy. Brands like Tara Gold, J.M, and Tasty were associated with higher OSF prevalence, indicating that the composition or processing of these brands may increase the risk of OSF development. This finding underscores the importance of regulating the sale and distribution of areca nut products to protect public health. The study also highlights the impact of OSF on swallowing and sensitivity to spicy foods. Students with OSF were more likely to experience difficulty swallowing and a burning sensation on eating spicy foods, which are common symptoms of OSF. These findings emphasize the importance of early diagnosis and management of OSF to prevent complications and improve quality of life (Sharif, Hammash et al. 2024).

Key recommendations include implementing clear policies and strict control measures to curb areca nut addiction and prohibiting the advertisement and sponsorship of areca nut products. Our study emphasizes the importance of school-led initiatives that incorporate educational content about areca nut, gutka, tobacco hazards, and signs of OSF and oral cancer into secondary school curricula. Schools should also encourage self-oral examination as part of the curriculum. Furthermore, awareness campaigns with slogans and themes to discourage areca nut use among young people should be scheduled.

5. Conclusions

In conclusion, this study finds the prevalence of oral submucous fibrosis high i.e.7.4%. It also provides valuable insights into the factors influencing OSF prevalence among schoolchildren in Karachi. These findings will help in exploring the underlying mechanisms and risk factors

associated with OSF development in this population. These findings can inform public health strategies aimed at preventing and managing OSF in the region. This study sheds light on the importance of primary prevention, specifically addressing the habit of areca nut chewing in relation to oral potentially malignant disorders. Given that oral cancer is preventable, focused efforts are necessary to educate the general public about the hazards associated with areca nut consumption. Overall, this study provides valuable insights into the factors influencing OSF prevalence among schoolchildren in Karachi, highlighting the importance of age, ethnicity, areca nut chewing habits, and symptoms such as difficulty swallowing and burning sensation in assessing and managing this condition.

Conflict of Interest

The authors declare that they have no competing interests.

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Study Approval

This research project received approval from the Institutional Review Board (IRB) at Dow University of Health Sciences with no. ERB-109/DUHS-09.

Consent Forms

Consent was taken and signed forms are available with the authors.

Authors Contribution

MZ was responsible for conceptualizing, designing, funding, assembling the research team, ensuring ethical conduct, and managing data analysis and dissemination, AA was responsible for the supervision of the project, project's design, execution, and management.

Data Availability

Data is available upon reasonable request from the corresponding author.

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