RESEARCH ARTICLE

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Prevalence of Oral Precancerous Lesions and Conditions among Rural Population of Karnataka: A Community-based Cross-Sectional Study

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Abstract

Background: Globally, Oral Cancer alone is responsible for more than 6 million deaths each year, with nearly 10 million new cases diagnosed annually. India alone accounts for one-third of the world's oral cancer cases. India is considered as the oral cancer capital of the world, with an estimated 1% of the population having oral premalignant lesions. Early detection of oral precancerous lesions is practically possible and associated with a high expectation of the prevention of deformity, relapse, and mortality. The present study aims to estimate the magnitude of oral precancerous lesions and conditions among the rural population of Karnataka, India. **Methods:** A community-based analytical cross-sectional study was conducted among the 6010 rural population of Belgaum. Participants were recruited through stratified cluster random sampling and were screened for oral precancerous lesions and conditions through visual examination and toluidine blue application. The data on socio-demographic variables, tobacco consumption, medical & dental history was collected and analyzed using IBM SPSS version 22. Logistic regression and Chi-square test were used to analyze inferential data at 95% confidence interval. Descriptive data were analyzed using percentage and proportion.**Results:** The majority of participants were females (53.9%), and the mean age was 40 years. The prevalence of precancerous lesions and conditions was 16.38%. Among them, 4.5% had tobacco pouch keratosis, and 4.4% Oral Sub Mucous Fibrosis (OSMF). Age was associated with all types of lesions and conditions and similarly, cigarette and bidi smoking are associated with smoker's palate. 4.2% leukoplakia and smoker's palate were found in 1.6%. A high prevalence of Smokeless tobacco consumption was found, and among them, gutkha was most commonly used. These lesions were associated with age, education, tobacco, type of diet and sharp cusps. **Conclusion:** The overall prevalence of precancerous lesions and conditions was high. It was high among the elderly, except for OSMF which was more prevalent among the younger age group.

Keywords: Oral precancerous lesions- rural area- prevalence- smoking- smokeless tobacco

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Introduction

A thorough understanding of the health needs of the population forms the base of any planning process. A comprehensive survey that includes causes of premature death, disability and major risk factors, forms the foundation for understanding public health needs. A major global public health problem that needs urgent attention is oral cancer. Identifying oral pre-cancerous lesions and conditions in their early stages can result into prevention of deformity, relapse, and mortality [1]. Oral cancer alone is responsible for more than 6 million deaths each year globally, with about 10 million new cases diagnosed annually. Hence, it is the 6th most common cancer in the world [2]. India alone accounts for one third of the world's oral cancer [3]. India, has the highest incidence of oral cancer in the world, because lifestyle-related habits such as cigarette consumption both smoking and smokeless form, and drinking alcohol are highly prevalent in this population [4, 5].

Tobacco causes about one-third of all deaths in India. These include cardiovascular diseases, chronic obstructive lung diseases and tobacco related cancers [6], all of which are preventable morbidities and mortalities. In some countries of Asian pacific region oral cancer is one of the most common cancers. According to Global Cancer Observatory (GLOBOCAN) 2020, oral cancer is one of the top three cancers that affect the Indian population [7]. It accounts for 30% of all cancers in India [2], & annually more than one lakh new cases are identified [8].

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Most people affected by oral cancer are from lower socio-economic strata of society due to the higher prevalence of life style risk factors [9]. Tobacco is a product that contains thousands of carcinogens which makes oral cavity more vulnerable to cancer.

Early consumption is directly proportional to early occurrence of carcinoma. Tobacco quid (smokeless forms, including pan masala, khaini, gutkha) placement in the sulcus and buccal mucosa have been considered as a major contributor in development of cancer in India. Similarly in western countries tongue and floor of mouth carcinoma are more common due to consumption of alcohol and smoking [10]. Even though the oral cavity is accessible for visual examination and that oral cancers and premalignant lesions have well-defined clinical diagnostic features, oral cancers are typically detected in their advanced stages. In India, 60–80% of patients present with advanced disease [11].

According to World Health Organisation (WHO), there are six oral conditions described as potentially malignant disorders (PMDs) previously known as precancerous lesions & conditions. Oral Sub-mucous fibrosis (OSMF) and squamous cell carcinoma have a high rate of transformation to oral cancer [12]. In India among all forms of oral cancers, Oral Squamous Cell Carcinoma (OSCC) is one of the most common proceeded by precancerous lesions and conditions and the major risk factor is tobacco consumption [13]. Early detection of oral precancerous lesions is practically possible and associated with a high expectation of the prevention of deformity, relapse, and mortality [14]. Hence this study was conducted to estimate the prevalence of oral precancerous lesions and conditions among the rural population of Karnataka.

Materials and Methods

Methodology

The present Community-based analytical cross-sectional study was carried out amongst the population residing in area covered by three Primary Health Centers (PHC) of Belgaum namely Vantamuri, Handignur, and Kinaye which are situated 26km, 14km and 21 km respectively from the Jawaharlal Nehru Medical College (JNMC). These three PHCs are adopted by Jawaharlal Nehru Medical College under Public Private Partnership (PPP) scheme. These three primary health centers cater 59 villages with a population of 136533.

Sample Size calculation: $n= (z_{1-\alpha})^2 q/d^2 p$ $Z_{1-\alpha}= 1.96$.

Value of Z statistics at $\alpha = 0.05$ i.e. 95% confidence interval.

p= Prevalence of all precancerous lesion and conditions ---- 6% q= (1-p) = 94%

d^2= allowable error (10%),

Total sample = 6010 Study population

Population of age 18(completed years) and above who were permanent residents of the rural area under three primary health care centres were recruited and participants with non-pathological conditions such as, leukoedema, lingual varices, Fordyce granules, benign migratory glossitis and fissured tongue and those who did not give consent were excluded. Every participant who met the inclusion criteria were recruited in the study after obtaining written informed consent. Stratified cluster random sampling with optimum allocation was implemented. Sample size from village was fixed as per smallest village sample. The number of cluster selected was made as large as possible for fixed sample size to increase the efficiency of sampling design i.e. from 1 1.2. 81 Stratification was made based on population size: 2 strata (strata 1 - villages had population above 1500 and second strata villages having less than 1500 population).

Data collection procedure: Training manual and Manual of Operation was prepared for training Auxiliary Nurse Midwife (ANM). Ethical clearance was obtained from KLE Academy of Higher Education and research (KAHER) institutional ethics committee. Those who gave consent were trained. The training was held in 2 sessions followed by Hands on training program at the center and in the field. Data was collected by trained ANMs. Data of 10% of the sample was randomly collected by the investigator and cross verified with ANMs data to assure with quality of data collected. It was collected by interviewing the participants through house to house visit using pre-tested structured questionnaire. Pilot testing of the tool was done on 10% of the total sample (600) and results are published. Data was entered in IBM SPSS software version. 22 and analyzed using the descriptive statistics for describing demographic data & inferential data using logistic regression.

Results

Socio-demographic factors: A total of 6010 participants were recruited in the study out of which 28.7 % participants belonged to the age group of 20-29 years, 23.8% belonged to 30-39years of age group, 19.9% were between the age of 40-49 years and 12% were from 50-59years of age group. 4.2% participants belonged to the age group of 70-79 years. Majority 53.9% of the participants were females and remaining 46.1% were males, majority 57.9% belonged to joint family, 74.8% belong to Hindu religion, 28.8% were illiterate and 71.2% were literate (secondary level, Higher education, Pre University Course (PUC)/Diploma, graduation and post-graduation) (Table 1).

Among total 6010 participants, 31.9% (1920) had one or the other tobacco habit. 5.3% participants used smoking form of tobacco and among them 3.7% (221) were smoking bidi and 1.8% (108) smoked cigarettes. Smokeless form of tobacco was used by 27.28% participants and among them tobacco and lime 38.6% (634) was most commonly used second being guktha 20.24% (332). Tobacco with pan was consumed by 17.07% (280) and pan supari was consumed by 11.5% (190). There were 1.16% (19) participants who used more than 3 types of smokeless tobacco (tobacco, gutkha and pan supari only) (Table 2).

Prevalence of OPMD

the overall prevalence of precancerous lesions and conditions is 16.38%. Among these tobacco pouch keratosis was high (4.5%). Prevalence of OSMF was

Table 1. Distribution of Participants According to Demographic Variables

Variables	Number (%)
Age (years)	
20-29	1726 (28.7)
30-39	1430 (23.8)
40-49	1195 (19.9)
50-59	724 (12.0)
60-69	631 (10.5)
70-79	254 (4.2)
80 and above	50 (0.8)
Gender	
Male	2771 (46.1%)
Female	3239 (53.9%)
Type of family	
Joint	3481 (57.9%)
Nuclear	2529 (42.1)
Religion	
Hindu	4498 (74.8)
Muslim	1032 (17.2)
Christian	59 (1.0)
Others	421 (7.0)
Marital status	
Unmarried	820 (13.6)
Married	4733 (78.8)
Widow	371 (6.2)
Widower	67 (1.1)
Divorced	7 (0.1)
Separated	12 (0.2)

Table 2. Types of Tobacco Consumption by Participants

Types of Smoking tobacco	Frequency (%)
Cigarette	108 (32.8)
Bidi	221 (67.2)
Total	329 (100)
Types of Smokeless Tobacco	Frequency (%)
Tobacco & lime	634 (38.66)
Gutkha	332 (20.24)
Khaini	56 (3.41)
Supari only	420 (2.56)
Pan Supari only	190 (11.59)
Mawa	18 (1.10)
Tobacco+Gutkha	69 (4.21)
Tobacco+Pan	280 (17.1)
More than 3 types of smokeless tobacco	19 (1.16)
Total	1640 (100)

Table 3. Prevalence of Oral Pre -Cancerous Lesions and Conditions

Types of Precancerous Lesions & conditions	Frequency (%)
Lichen planus	49 (0.8)
Erythroplakia	52 (0.9)
Smokers palate	102 (1.6)
Leukoplakia	250 (4.2)
OSMF	263 (4.4)
Tobacco pouch keratosis	269 (4.5)
No lesions	5025 (83.6)
Total	6010 (100)

4.4% and Leukoplakia was 4.2%. Prevalence of lichen was less that is 0.8% whereas erythroplakia was 0.9% and prevalence of Smoker's palate was 1.6%. OSMF was prevalent (50%) among younger age as compared to leukoplakia which is high (48%) in age 50years and above. Tobacco pouch keratosis was high in elderly population. Majority of the lesions were on buccal mucosa and tongue (Table 3, 4).

Risk factor analysis

Majority were non-vegetarian and had normal form of diet. Among total 6010 participants, 31.9% (1920) had one or the other tobacco habit, majority (85.4%) being smokeless tobacco users. Among these 38.6% were tobacco and lime users followed by (20.2%) Gutkha users and in smokers bidi was most commonly used. Age of initiation and frequency of tobacco consumption was gathered and it was observed that they almost initiated at the age 20-25years and majority consumed 1-5times per day. Among males 33.4% had OSMF, 25.4% tobacco pouch keratosis and among females 36.4% had leukoplakia. Among females lichen planus was high as compared males. Statistical significant association was

Table 4. Comparison of Participants According to Prevalence of Lesions and Conditions with Age

Age *	Luekoplakia	Erythroplakia	OSMF	Lichen planus	Smoker palate	Tobacco pouch keratosis	Total
20-29	21 (8.4)	1 (1.9)	65 (24.7)	1 (2.0)	4 (4.1)	18 (6.7)	110 (11.2)
30-39	25 (10)	2 (3.8)	70 (26.6)	3 (26.5)	13 (13.4)	54 (20.1)	17 (18.1)
40-49	37 (14.8)	13 (25.0)	78 (29.7)	16 (32.7)	19 (19.6)	69 (25.7)	232 (23.7)
50-59	44 (17.6)	11 (21.2)	27 (10.3)	8 (16.3)	21 (21.6)	47 (17.5)	158 (16.1)
60-69	78 (31.2)	15 (28.8)	15 (5.7)	10 (20.4)	26 (26.8)	56 (20.8)	200 (20.4)
70-79	39 (15.6)	6 (11.5)	4 (1.5)	1 (2.0)	11 (11.3)	22 (8.2)	83 (8.5)
80 & above	6 (2.4)	4 (7.7)	4 (1.5)	0 (0.0)	3 (3.1)	3 (1.1)	20 (2.0)
Total	250	52	263	49	97	269	980

Table 5. Association between FrequeQncy of Tobacco Smoking Duration and Lesions

Smoking type of tobacco		Oral precancerous lesions and conditions						
Cigarette	Frequency per day	Luekoplakia (%)	Erythroplakia	OSMF	Lichen planus	Smokers palate*	Tobacco pouch keratosis	Total
	1-5	4 (100)	1 (100)	6 (100)	1 (100)	24 (96)	3 (100)	39
	6-10	0 (0)	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)	1
	11-15	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	16-20	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	Total	4	1	6	1	25*	3	40
	Chi square	χ^2 =0.398 P= 0.820	χ^2 =0.183 P=0.913	χ^2 =1.64 P=0.440	χ^2 =0.204 P=0.903	χ^2 =297.5 P=0.000	χ^2 =1.127 P=0.569	
Bidi	Frequency per day	Luekoplakia	Erythroplakia	OSMF	Lichen planus	Smokers palate*	Tobacco pouch keratosis*	
	1-5	13 (61.9)	4 (100)	6 (85.7)	1 (100)	46 (98.4)	16 (64)	
	6-10	5 (23.8)	0 (0)	1 (14.3)	0 (0)	20 (21.2)	8 (32)	
	11-15	3 (14.3)	0 (0)	0 (0)	0 (0)	2 (2.2)	1 (4)	
	16-20	0 (0)	0 (0)	0 (0)	0 (0)	3 (3.2)	0 (0)	
	Total	21*	4	7	1	95*	25*	
		χ^2=28.60 P=0.00	χ^2=5.699 P=0.337	χ^2 =3.33 P=0.649	χ^2 =1.072 P= 0.952	χ^2=1246.5 P= 0.000	χ^2 =33.354 P= 0.000	

found with males and OSMF, females and Leukoplakia at p≤0.05. Form of diet was associated with leukoplakia, OSMF and tobacco pouch keratosis. Tobacco consumption was associated with OPMD was statistically significant (p≤0.00), similarly Smoker's palate and Tobacco pouch keratosis were statistically significant at P ≤0.05 with the frequency of smoking tobacco use (Table 5).

Leukoplakia was more common in the older age group as compared to the younger age group (as per multivariate analysis). Participants in age groups 60 to 69 (OR: 4.02; 95% CI) and participants between 70-79 years (OR: 4.8; 95% CI) are 4.0 times more likely to develop leukoplakia than the participants in age group 20-29years. Age, gender, tobacco consumption and sharp cusps were statistically significant with leukoplakia. Similarly, erythroplakia showed statistically significant association with education and tobacco consumption and also sharp cusp. OSMF is also statistically associated with sex, age, socioeconomic status, and tobacco use and is significant at a 0.05 P value. Lichen planus & tobacco pouch keratosis (keratosis tobacco pouch) were associated with tobacco consumption, age and sharp cusps. Similarly smoker's palate was associated with sex, age& tobacco use (Table 6, 7)

Discussion

Average age group of subjects with precancerous lesions and conditions in other studies was 40.8 years [15-18], with an overall range from 9 to 84 years, which is similar to the present study. In studies conducted at south India, Sri Lanka and Japan had the mean age group of 25 years [19-22] which was similar to present study findings where many belonged to a younger age group that is less

Table 6. Association of Lesions and Conditions with Demographic Variables

Variables	Lesions & conditions	Tobacco pouch keratosis		OSMF		Luekoplakia		Erythroplakia		Lichen planus		Smoker's palate	
		P Value	OR	P Value	OR	P Value	OR	P Value	OR	P Value	OR	P Value	OR
Sex(1)	Female		1		1		1		1		1		1
	Male	0	1.79	0	5.22	0.17	1.12	0.113	1.57	0.002	0.35	0	24.2
Age	20-29	0		0		0	1	0		0.057	1.0	0	
	30-39	0	3.72	0.12	1.32	0.22	1.45	0.472	2.45	0.008	15.8	0.029	3.2
	40-49	0	5.81	0	1.78	0	2.59	0.005	18.9	0.002	23.4	0.001	5.6
	50-59	0	6.58	0.97	0.99	0	5.25	0.002	26.6	0.005	19.3	0	10.8
	60-69	0	9.24	0.1	0.62	0	11.45	0	42	0.002	27.8	0	15.9
	70-79	0	8.99	0.09	0.41	0	14.73	0.001	41.7	0.175	6.82	0	15.6
	80 and above	0.005	6.05	0.14	2.22	0	11.07	0	150	0.998	0	0	29.9
Tobacco	No		1		1				1		1		1
	Yes	0	47.5	0	71.6			0	60.6	0	10.9	0	30.1
Sharp Cusp	No		1		1				1		1		1
	Yes	0.943	1.03	0.15	0.47			0.048	2.92	0.518	1.6	0.261	0.32

Table 7 Association of Lesions and Conditions with form of Diet

Forms of diet	Leukoplakia *	Erythroplakia	OSMF*	Lichen Planus	Smoker's palate	Tobacco pouch keratosis*	Total
Normal	(62.8)157	(55.7)29	(57.7)152	(57.1)28	(56.7)55	(57.6)155	576
Spicy	(36.8)92	(42.3)22	(41.8)110	(40.8)20	(43.3)42	(42.0)113	399
Bland	(0.4)1	(1.9)1	(0.4)1	(2.0)1	(0.0)0	(0.4)1	5
Total	250*	52	263*	49	97	269	980
Chi-square	χ^2=16.62	χ^2 =4.029	χ^2 =6.548	χ^2 =5.270	χ^2 =3.177	χ^2 =5.804	
p value	P=0.001	P=0.258	P=0.018	P=0.153	P=0.365	P=0.122	

* χ^2 Chi Square- P=0.05

than 30 years. However studies conducted in Karnataka [23], Cuttack [16], Ohio [15], and Telangana [17], have revealed that the majority of subjects were between the ages of 40 and 60 years. Females were in (53.9%) majority and most of them were housewives, while many studies have shown higher participation by males [16, 24-27], this may be because data was collected during the working hours and in villages most males were in the field.

A study at Udupi has reported that 26% participants had schooling above 10th standard. 54.4% had primary schooling. This may be due to high literacy rate due to easy access to educational institutions in at area [22]. in our study majority were illiterates (27.5%). Another study at Iran has also an association with education where subjects with bachelor level of education had high prevalence of lesion and conditions as compared other level of education [28].

Tobacco and lime was consumed was high as compared to other forms which is similar to the study in Belagavi where tobacco consumption in both forms was high [29]. this may because the study area was also tobacco growing area and hence the consumption was high.

Another study in Upudi has shown that 32% of the participants consumed tobacco, and among them, 23.3% used smokeless tobacco. It was also reported that 1/5th were alcohol consumers [22].

The overall prevalence of OPMD is high as compared to other studies at Hyderabad12.3% [17], Telangana4.26% [21]. The prevalence was 12.3%, which is less than the present study findings. This could be because they are hospital based studies, as only advanced cases attend the hospital. studies at Cuttack [16], Hyderbad [17],have shown high prevalence of individual lesions as compared to our study findings, because the present study is a community based study and other are hospital study that have considered biopsy cases only. This reveals that community based early screening helps to identify the cases in early stage. Hence community based studies are required.

This present study has shown 48.44% of prevalence of precancerous lesions and conditions among tobacco users and is statistically significant at P=0.00. In present study erythroplakia had an Odd Ratio of 60.1, for OSMF OR: 71.0, smoker's palate OR: 30.1. Similarly for lichen planus it was OR: 10.8 and for Tobacco pouch keratosis OR: 47.4. In a hospital study conducted at Moradabad India has reported 19.8 Odds ratio (OR) for erythroplakia among tobacco users [30]. Overall Odd Ratio between tobacco and lesions ranged from 8 to 29 in studies conducted at Ohio [15] & Germany [31]. Indian studies at Kerala [19] and Aurganbad [32] have also reported association between lesions and tobacco use. As the present is a community based study and prevalence of tobacco chewing is very high hence the Odds ratio values are high. In a review conducted by Nair.et.al in Mumbai lesions in the lower lip, floor of mouth and lateral tongue have shown more malignant changes as compared to other sites [33]. Limitation: Histopathological confirmation, which was not performed in this study, represents a limitation as it would have provided a definitive diagnosis of the lesions.

Conclusion and recommendation

This study concludes that the prevalence (16.4%) of oral precancerous lesions and conditions is high within the population, with oral submucous fibrosis being the most common lesion observed. These conditions were significantly associated with factors such as age, level of education, tobacco use, dietary habits, and the presence of sharp teeth. Comprehensive awareness camps should be conducted to educate the public about risk factors and early signs of oral precancerous lesions and conditions. Health educational programs on tobacco and its impact on oral health should be conducted at rural areas.

Author Contribution Statement

Dr Ashwini Narasannavar: developed research question, conducted the study and drafted manuscript. Dr Mubashir Angolkar: Corrected the draft. Dr A S Wanatmutte: Helped in all stages of the study and corrected the final draft.

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If any scientific Body approved it/ if it is part of an approved student thesis

It is a PhD Thesis

Any conflict of interest

No Conflict of interest.

How the ethical issue was handled (name the ethical committee that approved the research)

Written Informed was obtained from one every participant. Approval was obtained from KLE Academy of Higher Education and Research (KAHER) Ethics Committee.

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