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# Reverse Smoking and its Effects among Indian Reverse Smokers: A Scoping Review

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## Abstract

Reverse smoking is a unique style of tobacco use in which the smoker places the lit end of a chutta into his or her mouth while smoking and then inhales the smoke from the lit end. The purpose of this scoping review is to explore reverse smoking and identify its effects among Indian reverse smokers. Literature search was conducted using PubMed, PubMed Central, Embase, and CINAHL Plus. Boolean operators AND/OR was used with the search terms. Search was limited to the original research articles, English language articles, and full-text articles. Finally seven original articles were selected for the scoping review. The studies were conducted between 1971 and 2016, where more studies were identified in the 21<sup>st</sup> century (2002–2016). Four themes emerged from the data analysis. The first themes explore the palatal mucosal changes in reverse smokers; the second theme presents carcinoma and reverse smoking; third theme focuses on effects of keratinization on detection of epithelial atypia, and lastly, the fourth theme focuses on reverse smoking and psychosocial factors. Reverse smokers are more likely to develop precancerous palatal alterations and squamous cell carcinoma of the palate. To make healthy choices, a strong focus on health promotion is required, which includes initiatives that emphasize the need of educating individuals about disease risks.

**Keywords:** India, reverse smoking, scoping review, smoking

## INTRODUCTION

Tobacco smoking is by far the most widespread form of smoking today and it is one of the leading causes of death and disease in India, with about 1.35 million people dying each year.<sup>[1]</sup> India is also the world's second-largest tobacco consumer and manufacturer. In the country, a wide range of tobacco products are offered at extremely affordable prices. Tobacco is smoked and chewed in a variety of ways in India. According to the Global Adult Tobacco Survey India, 2016–17, about 267 million adults (15 years and older) in India (29% of all adults) use tobacco.<sup>[1]</sup> In India, smokeless tobacco is the most popular type of tobacco. Tobacco usage is one of the most serious public health hazards worldwide. It not only results in the loss of lives but it also has significant social and economic consequences.<sup>[2]</sup> In India, the total economic losses linked to tobacco smoking from all diseases for people aged

35 years and up totalled INR 177 341 crores in 2017–18.(USD 27.5 billion).<sup>[1]</sup> The WHO indicates that by 2020, tobacco deaths in India can surpass 1.5 million annually.<sup>[3]</sup>

Reverse smoking is a unique style of tobacco use in which the smoker places the lit end of a chutta into his or her mouth while smoking and then inhales the smoke from the lit end. Chuttas are cheroots that have been coarsely processed and range in length from 5 to 9 cm. In Andhra Pradesh's coastal districts, particularly Visakhapatnam and Srikakulam, reverse chutta smoking is common.<sup>[4]</sup> Unlike males, who smoke chuttas in either the traditional or reverse manner, women almost exclusively smoke chuttas in the reverse manner, which they regard to be a more feminine form of smoking. As a chutta

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**Table 1: Inclusion and exclusion criteria**

Inclusion criteria	Exclusion criteria
All research studies including RS in India	Any studies that are not involving RS in India
Researches involving effects of RS in India	Researches that are related to other than effects of RS in India
Primary research articles, quantitative studies, qualitative studies, articles published in English language, included articles published without any time limit	Review articles, commentaries, letter to the editors, case studies, other than English language articles are not included

RS: Reverse smoking

lasts longer when smoked in this manner, the reverse smoker typically smokes up to two chuttas every day. The most common argument for reverse smoking is that the chutta is less likely to be extinguished by water sprayed on it during domestic chores, as well as the threat of hot ashes falling on nursing infants.<sup>[4]</sup> In various parts of the world, reverse smoking has been documented with similar explanations.<sup>[5]</sup> Reverse smoking has been linked to a variety of oral mucosal changes, ranging from minor changes such as leukoedema, melanosis, and smoker's palate to more serious potentially malignant illnesses or lesions like leukoplakia and erythroplakia, which can eventually lead to oral cancer.

A research study states that the relationship between a reverse smoker and their family members was statistically significant. Family members played a big role in influencing the participants to take up reverse smoking, whether intentionally or unknowingly, where classmates and friends impacted them after their parents at home.<sup>[6]</sup> Few studies focused on the relationship between the type of smokeless tobacco and the risk of cancer;<sup>[7]</sup> tobacco products and their health issues;<sup>[8]</sup> mortality among reverse chutta smokers in South India;<sup>[9]</sup> smokeless tobacco and oral potentially malignant disorders in South-east Asia,<sup>[10]</sup> but there is no previous review on reverse smoking and its effects among Indian reverse smokers. The aim of this scoping review is to explore reverse smoking and identify its effects among Indian reverse smokers. We also examine the need for additional study in this area as well as the feasibility of implementing interventions.

## METHODOLOGY

### Study design

This scoping review has included both quantitative and qualitative primary research studies.

### Search strategy

The databases used for the initial review of literature were PubMed, PubMed Central, Embase, and CINAHL Plus.

A wide range of literature search was conducted on published literature to identify different types of publications. The literature search was limited to the country India only as smokeless tobacco is most common in India<sup>[1]</sup> and there is no search limit of publication period. The text words and

relevant indexing was used in the search strategy to capture the concept of reverse smoking and its effects on the reverse smokers in India.

The search terms were employed using Boolean operators (AND/OR) and for indexing articles the medical subject headings browser was used.

The literature search in the databases used the following keywords:

- Reverse smoking, reverse chutta smoking, reverse chutta smokers, Indian reverse smokers, tobacco, conventional smoking, and smokeless tobacco
- Oral neoplasms, precancerous conditions, dietary nutrients, premalignant lesions, epidemiology, carcinoma, hyperparakeratosis, hyperorthokeratosis, and dyskeratosis
- India.

Search was limited to the original research articles, English language articles, and full-text articles.

In addition, reference lists of the included studies were searched to identify relevant studies known as reference harvesting.

To avoid duplication bias, duplicate articles were removed before the implementation of inclusion and exclusion criteria.

### Implementation of inclusion and exclusion criteria

Initially, articles were screened for the study design that resulted after applying limitations as shown in [Table 1]. Further for the relevant articles, titles and abstracts against inclusion criteria were scanned and then followed by screening of full articles which are identified in the initial screening as relevant potential articles. The articles that are not with sufficient information on reverse smoking and its effects were excluded. Editorials, letters to the editors, review articles, and commentaries were excluded. After the implementation of inclusion and exclusion criteria, seven papers were chosen for the thematic analysis.

## RESULTS

### Distribution of studies

The search revealed only seven articles discussing reverse smoking and its effects on oral cavity among reverse smokers in India. The studies were conducted between 1971 and 2016, where more studies were identified in the 21<sup>st</sup> century (2002–2016). The characteristics of the studies are shown in [Table 2].

The following four themes emerged from the data analysis. The first themes explores the palatal mucosal changes in reverse smokers, the second theme presents carcinoma and reverse smoking, third theme focuses on effects of keratinization on the detection of epithelial atypia, and finally, the fourth theme focuses on reverse smoking and psychosocial factors.

### Palatal mucosal changes in reverse smokers

The clinical manifestations of reverse smoking-related mucosal alterations are diverse. When compared to traditional smokers, the clinical appearance of oral mucosa changes.<sup>[6]</sup> Tobacco's effects on the oral mucosa range from mild mucosal changes to

**Table 2: Characteristics of Included Studies**

Author and Year	Research aim	Study design	Sample size	Study setting/ location	Key findings	Limitations
Mehta <i>et al.</i> (1972)	To study the effect of keratinization upon the exfoliation of atypical cells in RS	Correlative study	Out of 10,169 individuals (males and females) above 15 years of age, 348 had undergone histo cytological examinations	Villages of Srikakulam, Andhra Pradesh, India	Leukoplakia was seen in 88.2% of the sample. Other palatal lesions such as Carcinoma (1.7%), and Pre leukoplakia (3.2%) were minor among them 91% have the habit of RS Among 348, 296 cases were nonatypia, 46 were atypia histologically and 6 were palatal carcinomas Cytologically, only a few cases are diagnosed atypia or nonatypia Hard palate being a highly keratinized area in the oral cavity, is not sufficient to provide the evidence of exfoliation of atypical cells	As the study is only limited to palatal lesions, it cannot give generalised findings Cytological findings are inversely associated with keratinization and can result in information bias
Pindborg <i>et al.</i> (1971)	To identify the prevalence of RS and its influence upon the oral mucosa	Qualitative study using surveys	10,169 people (males and females) Aged 15 years and above	Villages of Srikakulam, Andhra Pradesh, India	74.2% of the total samples have the habit of smoking or chewing, out of which 43.8% smoke reversely and 3% combine other habits with RS Females are engaged more in RS than males with a ratio of 1.7:1 Peak prevalence among females and males are in the 55-64 and 45-54 age groups respectively Preleukoplakia (P), leukoplakia (L) and LNP were the lesions diagnosed and females have more prevalence Preleukoplakia Male=27.1% Female=31.3% Leukoplakia Male=38.9% Female=59.9% LNP Male=63.5% Female=130.7%	Palatal lesions were taken into account which fails to generalise these results to a wider aspect Information bias can take place as the intensity of the habits are not given and can affect the number and type of lesions
Hebert <i>et al.</i> (2002)	To test the effect of dietary nutrients on oral precancerous lesions in a reverse-smoking population in South India	Case control study	Out of 6007 tobacco users (males and females), 485 were cases and 487 were controls	19 villages in Srikakulam, Andhra Pradesh, India	RS was the commonest method of tobacco intake among cases (81.9%) and controls (73.5%). They have 5.19 times more chances to have precancerous lesions than chewers	Information bias can occur as the diet checklist was not standardised and this reduces the uniformity in nutrient intake Response bias can happen as most of the population in the study

Contd...

**Table 2: Contd...**

Author and Year	Research aim	Study design	Sample size	Study setting/ location	Key findings	Limitations
Gavarasana <i>et al.</i> (1989)	To identify the smoking habits and palatal mucosal changes among RS in an Indian village	Qualitative study	78 families with 324 samples of all age groups (males and females), 99 cases were smokers	East Godavari, Andhra Pradesh, India	<p>Zinc has the highest protective linear effect with 70.2% reduction of lesions in the interquartile range with OR=0.91, <math>P&lt;0.02</math>, followed by Calcium (33.6%), Fibre (29.6%), Riboflavin (22.1%), Iron (16.6%) and Copper (16%)</p> <p>Beta-Carotene and Ascorbic acid have nonlinear effects</p> <p>Out of 78 families, 9 families are NS</p> <p>Smokers out of 99 samples</p> <p>Males=18.21% (59)</p> <p>Females=12.35% (40)</p> <p>9.6% of female and 6.5% of male were RS</p> <p>Preleukoplakia (P), leukoplakia (L), SN and cancer were the palatal lesions seen in RS and regular smokers.</p> <p>Preleukoplakia: 2.26 times higher in RS (<math>P&lt;0.05</math>)</p> <p>Leukoplakia: 13.84 times higher in RS (<math>P&lt;0.01</math>)</p> <p>SN: 7.13 times higher in RS (<math>P&lt;0.01</math>)</p> <p>Cancer was only seen in 0.3% in RS</p>	<p>area are illiterate</p> <p>Only tobacco users were included in the study and it cannot have generalised findings</p> <p>Sample bias can take place as the sample population is small and hence cannot have generalised findings</p> <p>Response bias can happen as out of a large number of families invited, only few families have taken part in the study. Researchers also didn't make any selection criteria for the study</p>
Naveen- Kumar <i>et al.</i> (2016)	To study the different forms of tobacco use and associated oral mucosal lesions among the patients	Observational cross-sectional study	450 patients aged 18 years and above (313 males and 137 females) were divided into 3 groups RS group - 150 CS group - 150 ST group - 150	Vishnu dental college, Bhimavaram, Andhra Pradesh, India	<p>Females (137)</p> <p>RS=132</p> <p>CS=4</p> <p>ST=1</p> <p>Males (313)</p> <p>RS=18</p> <p>CS=143</p> <p>ST=149</p> <p>Different lesions associated with tobacco usage are Leukoplakia, Erythroplakia, Tobacco pouch keratosis, Quid induced lichenoid reaction, Smokers palate, Oral submucous Fibrosis, Tobacco associated melanosis, and Carcinoma</p> <p>These lesions were seen in 40.2% of RS, 40.64% of CS and 19.15% of ST</p>	<p>Information bias can take place as males and females are in different ratios, and so unable to generalise the findings</p> <p>Desirability bias can</p>

*Contd...*

Table 2: Contd...

Author and Year	Research aim	Study design	Sample size	Study setting/ location	Key findings	Limitations
Rajkumar <i>et al.</i> (2010)	To evaluate cytological changes and keratinisation pattern among reverse chutta smokers, and comparison with conventional chutta smokers and nonsmokers of coastal Andhra Pradesh	Pilot study	60 females aged between 45-65 years are divided into 3 groups Group A: 30 individuals with RCS habit for the past 20 years Group B: 20 individuals with CCS habit for the past 20 years Group C: 10 NS individuals	Coastal Andhra Pradesh, India	Leukoplakia, Tobacco associated melanosis, and Carcinoma were prevalent in all the 3 groups followed by other lesions seen in any one of the groups Pattern of keratinization among 3 groups are RCS: PK=36.6%, HK=11.3% CCS: PK=23.8%, HK=2.2% NS: PK=31.3%, HK=2.5% (PK - Parakeratinized cells, HK - Hyperparakeratotic cells) RCS: OK=29.7%, HPK=10.2% CCS: OK=68.2%, HPK=5.8% NS: OK=62.8%, HPK=3.4% (OK - cells HPK - cells) Other patterns include dyskeratotic cells and transition cells towards hyperparakeratosis and hyperorthokeratosis	occur when recording the habitual frequency of smoking as they are self-reported, and may affect the results of the study  Inability to generalise the findings of this study to the population Selection bias - Sample size was small and was restricted to small age groups Information bias as cytology cannot substitute biopsies, and only be used to diagnose high risk lesions. So any cancerous lesions can be differentially diagnosed as keratinization and affects the trustworthiness of the study
Harini <i>et al.</i> (2016)	To evaluate the psychosocial factors that influence an individual to undertake the habit of RS	Qualitative study using interview	128 habitual RS (121 females and 7 males)	Appughar and Pedhajaripeta areas of Visakhapatnam, Andhra Pradesh, India	Psychosocial factors which influence RS are learned from parents, peer pressure, and cold climatic conditions. Other reasons include friendship, advice by the family during pregnancy, and for bleeding gums 95.2% had no difficulties, 53.2% achieved satisfaction, 42.9% had other habits such as tea and alcohol	Selection bias - Sample size was small Information bias as the number of males and females were highly distinct and so findings cannot be generalised Desirability bias can take place as the answers were self-reported in the questionnaire

LNP: Leukokeratosis nicotina palate, OR: Odds ratio, SN: stomatitis nicotina, CS: Conventional smoking, ST: Smokeless tobacco, NS: Non-smoking, CCS: Conventional chutta smoking, RCS: Reverse chutta smoking, OK: Orthokeratinized, HPK: Hyperorthokeratotic, RS: Reverse smoking, PK: Parakeratinized, HK: Hyperparakeratotic

full-blown oral cancer, and the consequences vary depending on the kind of tobacco used.<sup>[11]</sup> Because of the proximity of heat and tobacco materials during smoking, the most noticeable abnormalities linked with reverse smoking recorded in the literature were detected on the palate and tongue.<sup>[6]</sup> When the tobacco habits are compared to the site of the lesion, the leukoplakia and preleukoplakia lesions were found exclusively on the palate.<sup>[12]</sup> Reverse smokers are more likely to develop precancerous palatal changes and squamous cell carcinoma of

the palate.<sup>[13]</sup> Hyperpigmentation, depigmentation, stomatitis nicotina, preleukoplakia, leukoplakia, erythroplakia, and palatal cancer are the most common oral mucosal lesions linked with reverse smoking.<sup>[6]</sup>

Hyperpigmentation of the palatal mucosa is described as well-defined diffuse or localized grayish black pigmentation caused by increased melanin synthesis by melanocytes. Elevated melanin deposition as a protective reaction to heat



and its antioxidant qualities against harmful chemicals created during tobacco combustion within the oral cavity causes this pigmentation, which was restricted to the hard palate and had regular edges.<sup>[14]</sup>

Melanin is a natural antioxidant generated by melanocytes that helps to scavenge the harmful chemicals released during tobacco combustion. Oral pigment alterations and depigmented regions are the signs of parts of the palatal mucosa that are clinically devoid of melanin pigmentation in heavy smokers. The severe toxic content over a period exceeds the levels of melanocytes to make melanin, robbing the depigmented regions of their melanin defence barrier, or the toxic impacts may induce melanocyte function loss.<sup>[14]</sup>

The toxins of tobacco smoke enter through the hypertrophied ductal openings of minor salivary glands, and the pseudostratified columnar epithelial linings of ducts undergo squamous metaplasia in response to chronic irritation caused by heat and chemicals released during reverse smoking, and this metaplastic squamous epithelium has a high malignant potential.<sup>[14]</sup>

Ulcerations, defined as a red region with a crater or excavation of varied degrees that was persistent, symptomatic, and seen in depigmented areas surrounded by hyperpigmentation, are malignant.<sup>[14]</sup>

### **Carcinoma and reverse smoking**

Oral cancer is linked to reversible smoking and other types of tobacco use.<sup>[4]</sup> The tongue, buccal mucosa, gingiva, lips, and floor of the mouth are the most frequent sites for cancer in the oral cavity, although the palate is less prevalent, except among reverse smokers, where it is the most common site.<sup>[15]</sup>

Reverse smoking has been linked to a variety of oral mucosal alterations, ranging from minor changes such as leukoedema, melanosis, and smoker's palate to more serious potentially malignant illnesses or lesions like leukoplakia and erythroplakia, which can eventually lead to oral cancer.<sup>[6]</sup>

The smoke generated by the chutta comes into close touch with the mouth mucosa in reverse smokers. This produced smoke has a high alkaline pH, which makes it easier for chemicals like nicotine alkaloid, reducing sugars, and nitrogen to be absorbed. Aside from that, it raises internal temperature by roughly 760°C and intraoral air temperature by up to 120°C. Temperature changes operate as co-carcinogens as well. When compared to traditional smokers, these modifications are responsible for an increased risk of oral cancer.<sup>[11]</sup>

### **Effect of keratinization on detection of epithelial atypia**

In the mouth, the palate is a highly keratinized region. Reverse smoking causes widespread hyperorthokeratosis of the palatal mucosa, which is frequently coupled with epithelial atypia.<sup>[16]</sup>

When comparing reverse smokers to traditional chutta smokers and nonsmokers, cytological research revealed a higher percentage of parakeratinization, hyper parakeratinization,

and dyskeratosis. The palatal mucosa of reverse chutta smokers has a parakeratosis and dyskeratosis pattern of keratinisation, indicating an enhanced proliferative potential of the epithelium, and thus cytological assessment of keratinization pattern can be employed in the early diagnosis of high-risk lesions.<sup>[13]</sup> At the same time, lesions in highly keratinized parts of the mouth obstruct the exfoliation of probable atypical cells that emerge from the epithelium's deeper layers. The degree of keratinization has an inverse relationship with the accuracy of cytological diagnosis. The highly keratinized surface of the hard palate, similar to atypias, may obstruct the free migration of cancer cells toward the outer surfaces, contributing to the high rate of false negative diagnosis. If there is a breach in the epithelium, such as an area of ulceration, the cytological smears are likely to identify cancer cells much more readily.<sup>[16]</sup>

### **Reverse smoking and psychosocial factors**

Human behavior is influenced and determined by a wide range of circumstances. Reverse smokers learned to smoke mostly from their mother and the people around them, primarily family and friends. Second, they are continuing the habit despite no physical advantages, and they have tried but failed to stop, implying that reverse smoking has a powerful psychological influence. Reverse smokers' lack of understanding of the harmful consequences of nicotine and tobacco-related products may explain why, when asked if they had seen any changes in their mouths as a result of reverse smoking, the most prevalent response was "no."<sup>[6]</sup>

The early age at which the habit is initiated, which causes the changes to look chronic and gradual; hence, the people may perceive them as normal. Furthermore, restricted access to health facilities and a lack of knowledge about dental health care might be linked to the social component that influences reverse smoking.<sup>[6]</sup>

## **DISCUSSION**

Sri Lanka, Venezuela, Sardinia, and Panama are among the countries where reverse smoking is common.<sup>[17]</sup> Reverse smoking is particularly popular in the districts of Vizianagaram, Srikakulam, and Visakhapatnam in the Indian state of Andhra Pradesh. There are no recent studies on its exact prevalence because, as a result of urbanization and higher literacy rates, such practises appear to be on the downslide. The clinical manifestations of mucosal alterations caused by reverse smoking are diverse. In comparison to traditional smokers, the clinical appearance of oral mucosa varies.

Because of the close proximity of heat and tobacco products during smoking, the most apparent alterations linked with reverse smoking recorded in the literature were detected on the palate and tongue. Hyperpigmentation, depigmentation, stomatitis nicotina, preleukoplakia, leukoplakia, erythroplakia, and palatal cancer are the most common oral mucosal lesions linked with reverse smoking.<sup>[12,17]</sup>



There are various theories as to why females in the coastal region of Andhra Pradesh prefer reverse smoking.<sup>[12]</sup> Initially, ladies began reverse smoking to conceal their smoking habits from their husbands and parents. Second, if they smoke in the traditional technique, the burnt end of the chutta becomes extinguished owing to strong winds and splashing of water during housework and fishing. Fisherwomen wanted to keep the hot ashes from falling on the fishing net and damaging it while weaving. There are a few taboos associated with this behaviour, such as smoking chutta in reverse to relieve tooth pain and hide halitosis, and forcing youngsters to smoke chutta in reverse to cure various diseases.

In a pilot study conducted in Andhra Pradesh, reverse chutta smokers had 36.6% parakeratinized cells and 11.3% hyperparakeratotic cells, compared to 23.8% and 2.2% of parakeratinized cells and hyperparakeratotic cells in conventional chutta smokers and 31.3% and 2.5% of parakeratinized cells and hyperparakeratotic cells in nonsmokers.<sup>[13]</sup>

When comparing reverse smokers to traditional chutta smokers and nonsmokers, cytological research revealed that reverse smokers had a higher percentage of parakeratinization, hyperparakeratinization, and dyskeratosis. Hence, this result could indicate high-risk lesions in the hard palate of reverse smokers. However, while cytology is not a substitute for biopsy, it may be useful to the clinician in identifying the hyperparakeratotic character of the lesion, which may signal potentially high-risk lesions in oral cancer control programs involving mass screening of the community.

However, previous studies have found that reverse smoking (i.e., with the lighter end inside the mouth), which is common among women in Andhra Pradesh's coastal region in east-central India, is strongly linked to oral, particularly palatal, precancerous lesions that can progress to carcinoma and exhibit epithelial atypia of the palate.<sup>[12,16]</sup> Whereas another study states that relative risk of developing oral cancer among those with precancerous lesions has been found to be extremely high, indicating that these lesions are part of the cancer causative pathway.<sup>[18]</sup>

The tongue, buccal mucosa, gingiva, lips, and floor of the mouth are the most common sites for cancer in the oral cavity, but the palate is less prevalent, except in reverse smokers, where it is the most common site.<sup>[15]</sup>

All of the participants in one study<sup>[6]</sup> who acquired habit of reverse smoking were from lower socioeconomic backgrounds, suggesting that there may be a link between their economic level and their smoking behaviours. These findings matched those of a study conducted by<sup>[19]</sup> which found that people with inadequate financial resources and little understanding of the detrimental consequences of tobacco are more likely to start smoking.

## CONCLUSION

Reverse smokers are more likely to develop precancerous palatal alterations and squamous cell carcinoma of the palate.

To make healthy choices, a strong focus on health promotion is required, which includes initiatives that emphasise the need of educating individuals about disease risks. It is necessary to run information campaigns aimed at high-risk groups in order to influence personal routines and behaviours. Individuals and communities must be empowered to define priorities, make decisions, and plan and implement solutions in order to improve their health.

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## Conflicts of interest

There are no conflicts of interest.

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