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ASSOCIATION BETWEEN SELF-PERCEIVED XEROSTOMIA AND HALITOSIS WITH MASK MOUTH SYNDROME IN SERVICE SECTOR WORKERS - A CROSS-SECTIONAL STUDY

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ABSTRACT:

Background:

Mask Mouth syndrome usually occurs when the nose and mouth are covered by a face mask for a prolonged duration of time (>6–8 hours), causing dryness in the mouth and halitosis. Service sector workers are among the most frequently exposed to the social environment during an outbreak and they are bound to use face masks for prolonged periods without adequate breaks.

Methodology:

The cross-sectional study included 400 service sector workers belonging to various departments like the health and traffic department using masks for prolonged periods in various parts of Tamil Nadu. Data was collected from them using a Google form about their mask usage, perceived Xerostomia, halitosis, and awareness about mask mouth syndrome. Self-perceived xerostomia was recorded using the Thomson Inventory scale. Descriptive analysis was performed and the Chi-square test was performed. (p value<0.05)

Results:

Xerostomia was prevalent among 286(71.5%) participants and 337(84.2%) of them perceived halitosis. These factors were associated with the lack of awareness about mask mouth syndrome and the type of mask used (p-value <0.005) and not with the duration of mask used. (p-value =0.150)

Conclusion:

The study emphasizes that mask mouth syndrome causes a potential impact on service sector workers using masks for prolonged periods. They are to be made aware of the effects of this syndrome and educated to practice good oral hygiene, stay hydrated, take short mask breaks whenever possible, and seek dental care.

Keywords: Mask mouth syndrome, service sector workers, mask, xerostomia, halitosis.

INTRODUCTION

Although respiratory infections are nothing new, they are nevertheless a serious concern today. Respiratory viruses still pose a threat to humans today, causing everything from seasonal flu to catastrophic epidemics.(Sim, Moey, & Tan, 2014) There are both pharmacological and nonpharmaceutical treatments for respiratory infections. Pharmaceuticals like vaccinations and antiviral drugs are quite efficient in curing respiratory diseases. A novel pathogen epidemic, particularly in its early phases, cannot be adequately controlled by vaccinations and antiviral drugs since they require time to produce and are in short supply.(MacIntyre & Chughtai, 2020)

On the other hand, personal protective equipment can help in both disease prevention in the general population as well as the early containment of a new epidemic. These equipment are relatively inexpensive and it is a non-invasive way to lower respiratory infection mortality and morbidity. In this regard, facemasks are useful for preventing the spread of infectious diseases, particularly when it comes to avoiding droplet transmission. For instance, surgical masks and N95 masks are each 68% and 91% efficient at preventing the spread of SARS, respectively. (Jefferson et al., 2023) Facemasks are less successful at preventing the transmission of airborne illnesses outside of the hospital environment, partly because they are misused and users don't follow instructions. (MacIntyre et al., 2009) and (Purushothaman, Priyanga, & Vaidhyswaran, 2021) While mask-wearing is crucial for preventing the spread of infection, it has given rise to a phenomenon known as mask-mouth syndrome, which encompasses various oral health issues.

Of all such issues, self-perceived xerostomia (dry mouth) and halitosis (bad breath) have emerged as common concerns among the public.(Khedulkar & Multani, n.d.)Wearing facemasks causes an increased chance of mouth breathing leading to surface dehydration and reduced salivary flow rate which in turn causes xerostomia. (Bhattacharya, 2022; Orellana et al., 2006) The decreased salivary flow associated with mask-wearing can disrupt the oral environment, leading to dysbiosis and subsequent halitosis.(Delanghe et al., 2021; Wyszynska et al., 2022) In the context of mask-mouth syndrome, the combination of reduced saliva flow, reduced periodontal health, and prolonged mask-wearing can create an environment conducive to halitosis.(Scully & Greenman, 2008)

Service sector workers like health and traffic workers are required to wear masks for prolonged periods. They are relatively more susceptible to mask mouth syndrome due to their job duties often involving continuous mask usage and limited opportunities for mask-free breaks. Priya et al., (Priya, Vaishali, Rajasekaran, Balaji, & Navin, 2022) did a cross-sectional study on the effects of prolonged use of facemasks on ENT professionals which showed that 80.65% of them believed that there are side effects like nasal itching, difficulty in breathing, and dryness of nose and mouth due to wearing masks. A study done in India by Achanta et al.,(Achanta, Sasidharan, Majji, & Uppala, n.d.) among

the general population it was found that 62.3% of them experienced difficulty in breathing, 37.9% complained of dry mouth, halitosis (34.7%), and bleeding gums (2%).

Batta et al (Batta, Kumar, & Sharma, 2022) did a narrative review describing the benefits and disadvantages of wearing masks which stated that using masks has benefits in the side of controlling infections and disadvantages in the side of causing disrupted breath patterns and dehydration. Wearing a mask can create difficulties in articulating speech clearly, leading to increased mouth breathing or altered breathing patterns and increased moisture accumulation. (Batta et al., 2022) Service sector workers who experience xerostomia may also face social and professional consequences due to halitosis, affecting their confidence and interactions with colleagues and clientele.

While the association between xerostomia and halitosis is well-established in various contexts, such as certain medications, systemic diseases, and poor oral hygiene, its specific relationship within the context of the mask-mouth syndrome among those who frequently use face masks for work and their subjective experience remains relatively unexplored.(Kisielinski et al., 2021) Understanding the association between self-perceived xerostomia and halitosis with mask mouth syndrome among such users is crucial for developing targeted interventions and preventive strategies to address these oral health issues in the service sector people.

MATERIALS AND METHODS

This cross-sectional study was conducted for 2 months and involved mask-wearing service sector employees from the health and transportation sectors after receiving ethical approval (No.0232/IHEC/October 2021). Initially, a pilot study was conducted on 25 such workers based on inclusion and exclusion criteria and test-retest reliability was found to be acceptable (Cronbach alpha = 0.77). A structured questionnaire with 27 closed-ended questions was developed and circulated via Google Forms and responses were collected. The questionnaire includes Socio-demographic factors, mask usage, self-perceived xerostomia using the Thomson Inventory scale of Xerostomia(Thomson, Chalmers, Spencer, & Williams, 1999), self-perceived Halitosis, and knowledge and awareness about mask mouth syndrome and methods of preventing it.

Service sector workers who are continuing work-life actively during the COVID-19 pandemic were included. Those on leave or vacation, working remotely, or working part-time were excluded. The participants were informed about the nature of the study and a brief outline of the study was provided in the introduction part of the Google form and their willingness to participate in the study is confirmed as they agreed to participate in the study. The sample size was calculated using the formula $N = \frac{z^2 \times P \times (1-P)}{e^2}$ where P is the true proportion of self-perceived halitosis among the Saudi population = 0.338 (AlSadhan, 2016), e is the margin of error (0.03) and z is 1.645 at 90%

confidence intervals. The resultant sample size = 379 (rounded off to 380) and to decrease non-responsive error, the sample size was further raised by 5% and rounded up to 400.

Collected data were transferred and tabulated in Windows Microsoft Excel (Version 2211). The Statistical Package of Social Science (SPSS Version 24; IBM Chicago Inc., USA; 2016) was used for statistical analysis. A descriptive analysis was performed. The Chi-square test was used to determine the statistical significance of categorical data expressed as frequency and percentage. For the analysis, the significance level was set at $p \leq 0.05$.

RESULTS:

Among 400 study participants, a large number of the study participants (n= 165: 41.3%) belong to 18- 30 years of age. More than half of the study participants (n= 222: 55.5%) were females. And 65: 16.2% use tobacco in any one form, and 98: 25.5% of them consume alcohol. 166 (41.5%) of them use surgical masks whereas 16(4%) use surgical masks over cloth masks. (Table 1). Nearly half of them (n=204: 51%) use masks for more than 5 hours per day. (Graph 1)

Nearly three fourth of the study participants (n=286: 71.5%) perceive xerostomia on regular mask usage (Table 2) 84.2% of the study participants perceive that they have bad breath on wearing the mask (Table 3), 67% of them notice a bad taste in their mouth on wearing a mask. Among the study participants, 19.75% were aware that mask mouth syndrome can be prevented by good oral hygiene practices, and 18.5% of them were aware that it can be prevented by quitting the habit of smoking and alcohol. More than three-fourths of the study participant using cloth masks (77.10%) had felt dryness in their mouth with a statistical significance of $p = 0.016$. Of the N95 mask users, 17.9% did not perceive halitosis which shows significance (p -value = 0.047). (Graph 2) Nearly 80% of the study participants who were not aware of mask mouth syndrome had felt dryness of their mouth and halitosis which shows a statistical significance of p -value = 0.0001. (Table 4)

DISCUSSION

Service sector workers may experience self-perceived xerostomia (dry mouth) and halitosis (bad breath) as a result of what's colloquially known as "mask mouth syndrome." The combination of reduced airflow and moisture retention within the mask can lead to decreased saliva production and a buildup of bacteria in the oral cavity, contributing to feelings of dryness and unpleasant breath.(Li et al., 2005 and Priya et al., 2022) These effects may be particularly pronounced in service tertiary workers who interact closely with customers and colleagues throughout the day, highlighting the need for strategies to alleviate discomfort and maintain oral hygiene in mask-wearing environments. A systematic review suggested that N-95 masks are more effective in controlling respiratory infections than surgical masks. (Smith et al., 2016)

Three-fourths of the study participants belong to the age group 18-30 (74.5%) which is similar to that of Muzzamil et al (2023) study where the mean age of the participants was 27.31 and the majority of them used disposable face masks (60.5%) which is also similar to the present study(41.5%).

In the current study, 71.2% of the participants experienced xerostomia on wearing masks similarly 83.06% of ENT professionals experienced xerostomia(Priya et al., 2022) and 62.3% of the general population in Achanta S et al study(2021) felt the same. About 84.2% of service sector workers perceived halitosis on wearing masks whereas only 13.87% of the general population felt the same in the Faria SFS et al(2022) study and 34.7% of them in another (Achanta et al. 2021.) study. The rationale is that employees in the service industry are required to wear facemasks with high levels of protection at all times to stop the spread of infections in public areas. These discomforts also commonly force people to constantly adjust their masks, which may raise the chance of contamination of the hands and face and thus increase the chance of infection.(Purushothaman et al., 2021)To control the halitosis, 22.5% of the participants have started using mouthwashes and 19% of them have begun using chewing gums whereas in Mubayrik et al study(2017) 77% of university students use these personal methods to overcome halitosis.

In the current study, there was a significant association between xerostomia, halitosis, and tobacco usage similar to that of Hasan G.A et al(2014) study which indicated that bad oral habits contribute to the perception of one's oral health. According to Lee L.Y.K et al(2021) study, adults dispose of masks less properly than younger age groups because they are not as educated about infection control. Similar to mask mouth syndrome related to the oral cavity, Mask-induced Exhaustion syndrome associated with the respiratory system occurs in mask users leading to O₂ drop and fatigue.(Kisielinski et al., 2021)The usage of tight-fitting masks with too many layers of filters causes more discomfort and illness among healthcare and service sector workers which are preventable by taking simple measures like taking periodic breaks from wearing masks when feasible, effective oral hygiene, staying adequately hydrated(Priya et al., 2022), and seeking dental care promptly.

The study's participants' levels of xerostomia and halitosis were evaluated using the questionnaire. It is advised that more innovative research be done to quantify mask mouth syndrome objectively, examine it clinically, and develop preventative strategies.

TABLES**Table 1: Distribution of study participants based on demographics, mask usage, and disposal method**

Variables		Frequency (n%)	Total N%
Age	18-30 years	298(74.5%)	400(100%)
	31-40 years	52(13.0%)	
	41-50 years	34(8.5%)	
	51-60 years	16(4%)	
Sex	Male	222(55.5%)	400(100%)
	Female	178(44.5%)	
Service Sector	Health sector	277(69.3%)	400(100%)
	Transportation sector	123(30.7%)	
Tobacco usage history	Non-tobacco users	383(95.8%)	400(100%)
	Tobacco users	17(4.3%)	
Alcohol consumption history	Non-alcoholics	375(93.8%)	400(100%)
	Alcoholics	25(6.3%)	
Type of mask used	Cloth mask	35(8.8%)	400(100%)
	Surgical mask	166(41.5%)	
	N 95 mask	151(37.8%)	
	Surgical mask over cloth mask	16(4%)	
	Surgical mask over N95 Mask	32(8%)	
Mask usage time	Less than 1 hour	24(6%)	400(100%)
	1-3 hour	85(21.3%)	
	4-5 hours	87(21.8%)	
	More than 5 hours	204(51%)	
	Once it becomes dirty	97(24.3%)	
	Once it is torn	23(5.8%)	
	When it smells bad	33(8.3%)	
	After single use	214(53.5%)	

Table 2: Distribution of study participants based on the xerostomia level using the Thomson Inventory scale

Xerostomia level	Yes N (%)	Sometim es N (%)	No N (%)	Total N (%)
Do you feel the dryness of mouth on wearing the mask	286 (71.5%)	43 (10.8%)	71 (17.8%)	400 (100%)
Do you have any difficulty eating dry foods after wearing a mask	261 (65.3%)	18 (4.5%)	121 (30.3%)	400 (100%)
Do you wake up at night to drink water	164 (41%)	102 (25.5%)	134 (33.5%)	400 (100%)
Do you feel the dryness of your mouth while eating a meal after wearing a mask for an extended period	160 (40%)	85 (21.25%)	155 (38.7%)	400 (100%)
Do you sip liquids to aid in swallowing food	134 (33.5%)	104 (26%)	162 (40.5%)	400 (100%)
Do you feel the dryness of the face, eyes, or nose on wearing the mask	129 (32.3%)	77 (19.3%)	194 (48.5%)	400 (100%)

Table 3: Distribution of study participants based on halitosis level

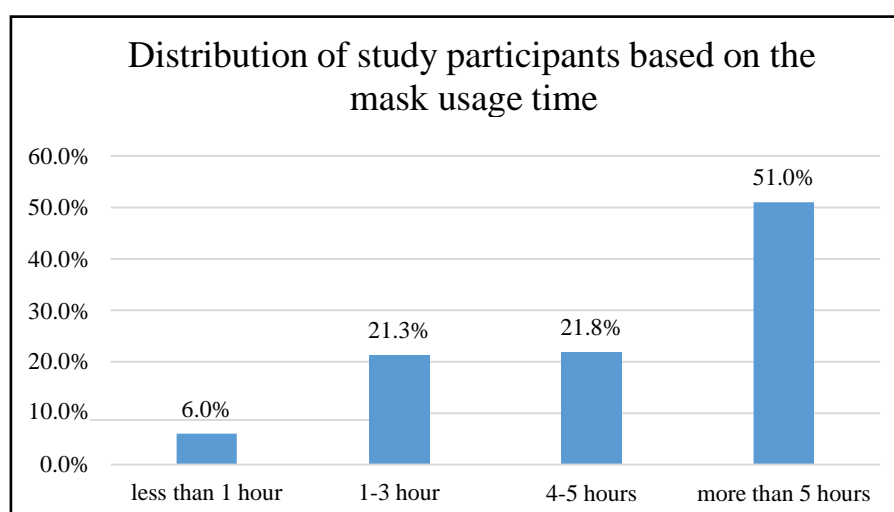
Halitosis level	Yes N (%)	No N (%)	Total N (%)
Would you say you have bad breath on wearing mask?	337 (84.2%)	63 (15.8%)	400 (100%)
Has any family member/friend ever told you have bad breath?	103 (25.8%)	297 (74.3%)	400 (100%)
Do your gums bleed during toothbrushing	338 (84.5%)	62 (15.5%)	400 (100%)
Do you notice any bad taste in your mouth on wearing the mask	268 (67%)	132 (33%)	400 (100%)
Have you started using mouthwashes to reduce bad breath	80 (20%)	320 (80%)	400 (100%)
Have you increased the frequency of toothbrushing/using mouthwashes to reduce bad breath	90 (22.5%)	310 (77.5%)	400 (100%)
Have you started using chewing gums/mints due to bad breath	76 (19%)	324 (81%)	400 (100%)
Have you sought dental professional help to reduce dryness of mouth and bad breath	40 (10%)	360 (90%)	400 (100%)

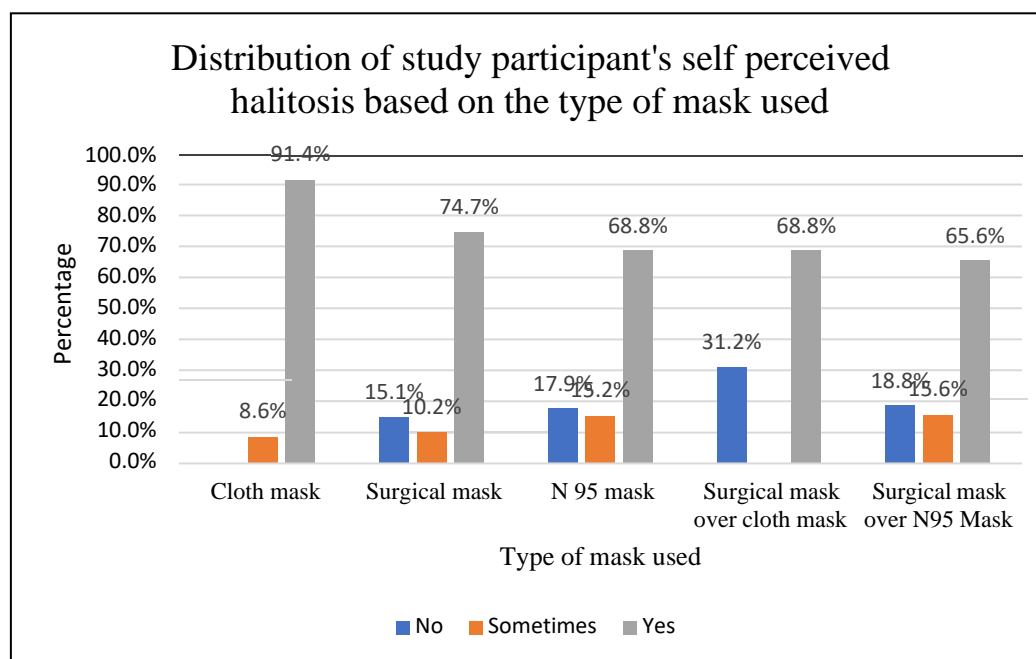
Table 5: Association between perceived xerostomia and perceived halitosis with mask usage and awareness about mask mouth syndrome.

Dependent Variables	Independent variables	χ^2 test value	p-Value*
Self-perceived Xerostomia	Type of mask used	18.877	0.016*
Self-perceived Xerostomia	Duration of mask usage	4.265	0.641
Self-perceived Xerostomia	Tobacco usage	6.351	0.042*
Self-perceived Xerostomia	Alcohol consumption	1.100	0.577
Self-perceived Xerostomia	Awareness about mask mouth syndrome	53.534	0.000*
Self-perceived Halitosis	Type of mask used	15.719	0.047*
Self-perceived Halitosis	Tobacco usage	13.949	0.001*
Self-perceived Halitosis	Alcohol consumption	7.490	0.024*
Self-perceived Halitosis	Duration of mask usage	9.437	0.150
Self-perceived Halitosis	Awareness about mask mouth syndrome	121.324	0.000*

Chi-Square test

* Significant

GRAPHS**Graph 1: Distribution of study participants based on their mask usage time**



Graph 2: Distribution of study participants self-perceived halitosis based on the type of mask used

CONCLUSION:

Mask-wearing negatively influences oral health, as seen by the clear association between self-perceived xerostomia and halitosis in mask-mouth syndrome among workers in the service industry. This affects not just dental health but also the general well-being and interpersonal relationships of service sector workers. By informing participants about their mask-wearing habits, the types of masks that are available, and the measures that may be taken, this study aided people who were unaware of the cause of symptoms in changing their opinions.

RECOMMENDATIONS:

Nonetheless, the study's findings offer valuable insights and serve as a foundational reference for future research in changing the design of masks and finding alternate options for preventing airborne infections. It's also essential for service sector workers to understand the potential consequences of mask mouth syndrome and to take proactive steps to preserve their oral health.

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