Human Cell (2021) 34:1282–1284
https://doi.org/10.1007/s13577-021-00552-w

LETTER TO THE EDITOR

Smoking habits correlate with the defense against SARS-CoV-2 infection in the Indian population

Bishwaranjan Purohit[1] · Aditya K. Panda[2]

Received: 7 May 2021 / Accepted: 14 May 2021 / Published online: 17 May 2021

Smoking has a detrimental effect on the human health system, raising the risk of cancer, coronary, respiratory, and reproductive diseases [1]. However, the role of smoking in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection has been contradictory. A recent report from the South Korean population revealed protection of smoking habit (both current smokers and ex-smokers) against SARS-CoV-2 infection [2]. A total of 4167 COVID-19 patients and 20,937 healthy controls, data were obtained from National Health Insurance Services (NHIS) and Korea Centers for Disease Control and Prevention (KCDC), respectively, were included in the study [2]. In line with these observations, earlier two independent studies from France also showed a lower prevalence of smokers among SARS-CoV-2 infected cases than healthy controls [3, 4]. Interestingly, a meta-analysis of 13 published reports in Chinese cohorts also concluded the protective role of smoking against COVID-19 infections [5]. In contrast, independent reports from Italy and China failed to demonstrate any association between SARS-CoV-2 infection and smoking habit [6]. These observations from different populations tempted us to investigate the possible link between smoking habits and the SARS-CoV-2 infection rate in the Indian population.

The SARS-CoV-2 infection rate was obtained from the official site of the Government of India (https://www.mohfw.gov.in/ accessed on 26th April 2021). The population of all Indian states and union territories was obtained from the 2011 census data (https://censusindia.gov.in/2011-common/censusdata2011.html), and the SARS-CoV-2 infection rate per million of the population was estimated. The smoking habit of Indian subjects in different states and union territories was noted from the Global Adult Tobacco Survey fact sheet India 2016–2017 (https://www.who.int/tobacco/surveillance/survey/gats/GATS_India_2016-17_FactSheet.pdf), that ranges from 3.8 to 34.4%. SARS-CoV-2 infection rate/millions and the smoking percentage in the respective states and union territories are mentioned in Table 1.

The spearman rank correlation analysis between SARS-CoV-2 infection rate and smoking percentage of the Indian States and union territories revealed a significant inverse correlation between these two variables (Spearman $r = -0.46$, $p = 0.007$), indicating a protective nature of smoking habit against SARS-CoV-2 infection corroborating with the earlier observations [2-5]. Although the precise mechanism by which smoking habit defends subjects against SARS-CoV-2 infection is unknown, the role of squamous cell metaplasia (SQM) and angiotensin-converting enzyme-2 (ACE2) receptor expression have been linked to the protection. The SQM is most frequent among smokers and is characterized by alteration in the cell surface, reduction in ciliated cells, and increased mucus cells [7, 8], which possibly hampered the binding and entry of the SARS-CoV-2 virus as compared to the normal cells. The spike protein of SARS-CoV-2 requires ACE2 of host cells to infect a cell. Numerous studies have linked smoking and nicotine to decreased ACE2 expression [9, 10], suggesting that lower ACE2 levels in smokers can inhibit virus entry into host cells and provide defense against SARS-CoV-2 infection.

The present analysis has several limitations, and those need to be presented. First, the current report is a secondary data correlation study among the prevalence of SARS-CoV-2 infection in Indian states and union territories and the percentage of individuals having smoking habits. A case controls study will be more appropriate to explore the association of smoking and protection against SARS-CoV-2 infections. Second, as the smoking data for Andaman and Nicobar, Dadra and Nagar Haveli, Ladakh, and Lakshadweep were not available, these four union territories of India were not considered for the present correlation analysis.

✉ Aditya K. Panda
adityarmrc@gmail.com; akpanda@khallikoteuniversity.ac.in

[1] C-209, DHPL Sahoo Residency, Near Mancheswar Railway Station, Gadakana, Bhubaneswar 751017, India

[2] Department of Bioscience and Bioinformatics, Khallikote University, Konisi, Berhampur, Odisha 761008, India

Table 1 Percentage of smoking habit and COVID-19 data in Indian states and union territories

States/union territoreis	Cases/million	Death/million	Smoking percentage
Andaman and Nicobar	14,885	173	Data not available
Andhra Pradesh	20,928	156	14.2
Arunachal Pradesh	12,724	42	22.7
Assam	7612	38	13.3
Bihar	13,877	21	5.1
Chandigarh	36,659	412	9.4
Chhattisgarh	25,538	286	5.5
Dadra and Nagar Haveli	11,210	7	Data not available
Delhi	61,217	849	11.3
Goa	53,119	697	4.2
Gujarat	8207	105	7.7
Haryana	16,737	149	19.7
Himachal Pradesh	12,747	195	14.2
Jammu and Kashmir	13,105	175	20.8
Jharkhand	6116	60	11.1
Karnataka	21,920	236	8.8
Kerala	42,078	153	9.3
Ladakh	48,697	503	Data not available
Lakshadweep	32,975	16	Data not available
Madhya Pradesh	6875	71	10.2
Maharashtra	44,450	576	3.8
Manipur	10,652	135	20.9
Meghalaya	5391	54	31.6
Mizoram	4931	12	34.4
Nagaland	6663	50	13.2
Odisha	9707	47	7
Puducherry	42,693	599	7.2
Punjab	12,222	304	7.3
Rajasthan	7505	53	13.2
Sikkim	11,966	226	10.9
Tamil Nadu	14,997	188	10.5
Telengana	11,416	58	8.3
Tripura	9425	107	27.7
Uttar Pradesh	5438	56	13.5
Uttarakhand	15,050	213	18.1
West Bengal	8151	120	16.7

SARS-CoV-2 infection data were obtained from the Government of India website (accessed on 21st April 2021). Smoking percentage data was acquired from the Global Adult Tobacco Survey fact sheet 2017

Third, the rate and duration of smoking were not considered in the investigation as data were not available. Fourth, confounding factors for SARS-CoV-2 infections such as age, gender, hypertension, obesity, kidney disease etc., were not considered in the current analysis.

Based on the present study results and observations of earlier reports, it can be concluded that the smoking habit of subjects possibly offers protection against SARS-CoV-2 infection in the Indian population. This result, however, should be viewed cautiously and should not be used to promote smoking. Further, case–control studies are further required to confirm our findings. In addition, the role of nicotine in disease modulation or its use in the treatment strategy of SARS-CoV-2 infection could be investigated in the future.

Funding No specific funding was received to report.

Declarations

Conflict of Interest The authors declare that there is no conflict of interest.

References

1. Onor IO, Stirling DL, Williams SR, et al. Clinical effects of cigarette smoking: epidemiologic impact and review of pharmacotherapy options. Int J Environ Res Public Health. 2017;14:1147.
2. Lee SC, Son KJ, Kim DW, et al. Smoking and the risk of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. Nicotine Tob Res. 2021.
3. Fontanet A, Tondeur L, Madec Y, et al. Cluster of COVID-19 in northern France: a retrospective closed cohort study. medRxiv. 2020:2020.04.18.20071134.
4. Miyara M, Tubach F, Pourcher V, Morelot-Panzini C, Pernet J, Haroche J. Low rate of daily active tobacco smoking in patients with symptomatic COVID-19. Qeios Published online May. 2020; 9.
5. Farsalinos K, Barbouni A, Niaura R. Systematic review of the prevalence of current smoking among hospitalized COVID-19 patients in China: could nicotine be a therapeutic option? Intern Emerg Med. 2020;15:845–52.
6. Rossato M, Russo L, Mazzocut S, Di Vincenzo A, Fioretto P, Vettor R. Current smoking is not associated with COVID-19. Eur Respir J. 2020; 55.
7. Trump BF, McDowell EM, Glavin F, et al. The respiratory epithelium. III. Histogenesis of epidermoid metaplasia and carcinoma in situ in the human. J Natl Cancer Inst. 1978; 61:563–75.
8. Auerbach O, Forman JB, Gere JB, et al. Changes in the bronchial epithelium in relation to smoking and cancer of the lung; a report of progress. N Engl J Med. 1957;256:97–104.
9. Oakes JM, Fuchs RM, Gardner JD, Lazartigues E, Yue X. Nicotine and the renin-angiotensin system. Am J Physiol Regul Integr Comp Physiol. 2018;315:R895-r906.
10. Yue X, Basting TM, Flanagan TW, et al. Nicotine downregulates the compensatory angiotensin-converting enzyme 2/angiotensin type 2 receptor of the renin-angiotensin system. Ann Am Thorac Soc. 2018;15:S126–7.