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Ana Paula Coelho Figueira Freire

Bruna A.S. Medina

Marceli R. Leite

Tainá O. Lopes

Ester T. Santos

See next page for additional authors

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Authors

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Consumption, nicotine dependence and motivation for smoke cessation during early stages of COVID-19 pandemic in Brazil: A cross-sectional study

Ana P. C. F. Freire^{1,2}, Bruna A. S. Medina², Marcell R. Leite³, Tainá O. Lopes², Ester T. Santos², Milena M. Ferreira², Bruna S. A. Silva⁴, Margaret A. Cavalcante⁵, Francis L. Pacagnelli²

ABSTRACT

INTRODUCTION The COVID-19 pandemic may have changed smoking habits. For the smoking population, information regarding smoking habits and the pandemic could potentially aid COVID-19 prevention and control measures. Our study aimed to analyze the effects of the COVID-19 pandemic on tobacco consumption, nicotine dependence levels, and motivation for smoking cessation. We also collected information from smokers regarding their awareness of the consequences of tobacco use and the increased risks smokers have for severe complications from COVID-19.

METHODS In the survey for this observational cross-sectional study, 122 smokers responded to an online form. The participants provided general data about their smoking history, their smoking habits in the months of April and May 2020, and the effect of the pandemic on their smoking habits. They also completed a Fagerström test and were measured by the Wisconsin Smoking Withdrawal Scale.

RESULTS When compared to pre-pandemic levels, the majority of smokers reported increased tobacco consumption of between 1 and 10 cigarettes per day (37.7%). Their motivation to quit smoking (59.8%) and desire to smoke (53.2%) were unchanged by the pandemic. Most participants demonstrated an awareness of the increased risks smokers have for severe COVID-19-related complications ($p < 0.001$). We identified the following correlations: cigarettes/day before pandemic and motivation for smoking cessation ($r = 0.19$; $p = 0.030$), cigarettes/day and nicotine dependence level ($r = 0.61$; $p < 0.001$), and load consumption and nicotine dependence level ($r = 0.69$; $p < 0.001$). No significant correlations were observed between load consumption and motivation to quit ($r = 0.13$; $p = 0.120$).

CONCLUSIONS Most smokers are well aware of their increased risks for severe COVID-19-related complications. In the early stages of the COVID-19 pandemic in Brazil, most smokers reported increased cigarette consumption. In addition, motivation to quit and desire to smoke were unchanged for the majority of smokers.

AFFILIATION

1 Department of Health Sciences, Central Washington University, Ellensburg, United States

2 Physiotherapy Department, University of Western Presidente Prudente (UNOESTE), São Paulo, Brazil

3 Medicine Department, University of Western Guarujá (UNOESTE), São Paulo, Brazil

4 Exercise and Immunometabolism Research Group, Program in Movement Sciences, Department of Physical Education, Universidade Estadual Paulista (UNESP), Presidente Prudente, São Paulo, Brazil

5 Medicine Department, University of Western Presidente Prudente (UNOESTE), São Paulo, Brazil

CORRESPONDENCE TO

Ana P. C. F. Freire. Central Washington University, Department of Health Sciences, 400 E University Way, Ellensburg, Washington 98926, United States.

E-mail: anapcfff@hotmail.com

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INTRODUCTION

Viral diseases are continuously emerging and represent a serious public health problem. In December 2019, Chinese authorities identified a new coronavirus, SARS-CoV-2, which quickly triggered a pandemic, named coronavirus disease 2019 (COVID-19)^{1,2}.

COVID-19 is characterized as a highly infectious disease³. Severe complications from COVID-19 can include pneumonia and acute respiratory syndrome^{1,2}. Despite the extraordinary rapid response from the scientific community to combat COVID-19, information is limited regarding the impact of comorbidities and lifestyle on prognosis and risk of complications; such information is crucial for the investigation of COVID-19 characteristics and treatment. At the end of 2020, an estimated 15% of the Brazilian population had contracted COVID-19, slightly more than 30 million individuals³.

Smoking significantly damages the respiratory system and lung tissues; thus, smoking may negatively impact COVID-19 prognosis⁴. In addition, smoking negatively affects the immune system response, increasing vulnerability to infectious diseases^{5,6}. In recent years, smoking prevalence in Brazil has been declining by an average of 3.99% per year, from 15.7% in 2006 to 9.8% in 2019⁷.

When compared to non-smokers with COVID-19, studies have shown that smokers and ex-smokers with COVID-19 more frequently require visits to intensive care units and use of mechanical ventilation⁸⁻¹⁰. Data have also shown that smokers and ex-smokers are 1.4 times more likely to have severe COVID-19 symptoms than non-smokers⁸.

Social isolation and lockdown measures have impacted the routine of the entire population¹¹. Smoking habits can be directly affected by pandemic-related factors, such as financial crisis, changes in work dynamic, fears of contamination, and worsening of depression and anxiety¹²⁻¹⁴.

For the creation of specific pandemic-oriented strategies to help smokers quit, more studies need to analyze smoking behavior and nicotine dependence in pandemic periods. Such information is especially critical for the COVID-19 pandemic due to the association between smoking and severe COVID-19 complications. This study has clinical relevance for public policies and the creation of smoking cessation campaigns and treatments.

Our primary aim was to analyze tobacco consumption, nicotine dependence levels, and motivation for smoking cessation during the COVID-19 pandemic. We also observed that smokers reportedly knew about the risks associated with smoking and COVID-19.

METHODS

Study design

We used an observational cross-sectional survey. Smokers were recruited through advertising on social media, television, and newspapers. Participants responded to questions using online forms (Google Forms).

Between April and May 2020, patients completed an evaluation that included general data, comorbidities, and a complete history of smoking habits. We used the Fagerström test for nicotine dependence and the Wisconsin scale to measure levels of nicotine withdrawal symptoms.

After initial evaluations, participants answered questions developed by the authors about levels of prior knowledge regarding smoking and COVID-19 complications. In the final stage of the survey, participants answered questions on how the pandemic had affected their consumption of tobacco and tobacco derivatives.

In June and July 2020 (30 to 45 days later), participants were invited again to answer the same questionnaires. However, due to a low response rate (only 28%) and high likelihood of attrition bias, these data were not included in the analysis. Nevertheless, the full dataset (including the answers from June and July) of this study is available at Mendeley Data and Digital Commons Data (<https://data.mendeley.com/datasets/z9m39n9gbb/2>)

Initial evaluation

We performed an initial evaluation that included data collection for name, age, date of birth, sex, address, marital status, weight, height, ethnicity, use of drugs, and daily consumption of alcoholic beverages and cigarettes. Concomitant pathologies were reported. The Fagerström test was applied to evaluate nicotine dependence levels¹⁵. This test consists of six questions: 1) 'How soon after waking do you smoke your first cigarette?'; 2) 'Do you find it difficult to refrain from smoking in places where it is forbidden?'; 3) 'Which cigarette would you hate to give up?'; 4) 'How many cigarettes a day do you smoke?'; 5) 'Do you smoke more frequently in the morning?'; and 6) 'Do you smoke even if you are sick in bed most of the day?'. The score ranges between 0 and 10, the higher the score the stronger the smoking dependence¹⁵.

Finally, we also asked participants to rate their motivation to quit smoking during the pandemic

on a scale from 0 to 5 (0=not motivated at all, to 5=extremely motivated to quit smoking).

Wisconsin Smoking Withdrawal Scale (WSWS)

The WSWS is a previous validated scale and contains 28 questions divided into seven domains. Scores range from 0 to 4 points for each question. The scale evaluates the main symptoms of nicotine withdrawal syndrome and includes domains of anger, anxiety, sadness, concentration, hunger, somatic symptoms, sleep, and craving. The items are scored on a 5-point scale, with 0 indicating strongly disagree and 4 indicating strongly agree. The maximum score is 112 points. The higher the score obtained on the scale, the greater the nicotine dependence¹⁶.

Questionnaires on previous knowledge and the effect of the pandemic on smoking

These questionnaires were developed by the authors of this study. They were applied electronically via Google Forms. The COVID-19 prior knowledge questionnaire assessed the participants' knowledge of general COVID-19 information, and the elevated risks smokers have for severe COVID-19 complications. The questionnaire is composed of eight questions with answers corresponding to a 5-point scale of pre-established possibilities of the Likert type. We asked participants: 1) If they considered COVID as a serious disease, 2) If preventive measures should be taken to combat COVID-19; 3) If smokers are more likely to

have severe symptoms of COVID-19; 4) If smokers with COVID-19 are more likely to need respirators and intensive care; 5) If the severity of COVID-19 may be greater in smokers; 6) If smokers have a worse body defence system than non-smokers; 7) If COVID-19 can cause severe complications; and 8) If they know the main symptoms of COVID-19. In the final stage of the survey, participants answered a questionnaire with eight multiple-choice questions about how the pandemic period had affected their smoking habits and tobacco consumption. We included questions regarding previous diagnosis of COVID-19, changes in routine and how much the pandemic affected their cigarette consumption.

Inclusion criteria

We used adult smokers, both male and female, who had been smoking for a least 1 year. Participants included tobacco smokers and users of tobacco derivatives (e.g. rope/straw cigarettes, cigars, and hookahs). They had no reports of previously diagnosed severe psychiatric comorbidities, such as schizophrenia or bipolarity. The participants were all literate and cognitively able to answer all survey questions.

Statistical analysis

We used SPSS (version 17.0) software. The following descriptive statistical measures were used: frequencies, percentages, measures of central tendency and dispersion. Chi-squared tests were performed to compare the frequency of responses

Table 1. Previous knowledge of smokers about COVID-19 and smoking complications, Brazil 2020 (N=122)

Questions	Strongly disagree		Disagree		Neutral		Agree		Strongly agree		p*
	n	%	n	%	n	%	n	%	n	%	
COVID-19 is a serious disease	1	0.8	2	1.6	6	4.9	28	22.9	85	69.6	<0.001
Preventive measures should be taken to combat COVID-19	3	2.4	2	1.6	5	4.1	28	22.9	84	68.8	<0.001
Smokers are more likely to have severe symptoms of COVID-19	2	1.6	5	4.1	19	15.5	53	43.4	43	35.2	<0.001
Smokers are more likely to need respirators and intensive care	2	1.6	5	4.1	13	10.6	47	38.5	55	45.0	<0.001
The severity of COVID-19 may be greater in smokers	2	1.6	9	7.3	18	14.7	50	40.9	43	35.2	<0.001
Smokers have a worse body defence system than non-smokers	4	3.2	5	4.1	19	15.5	56	45.9	38	31.1	<0.001
COVID-19 can cause severe complications	1	0.8	1	0.8	3	2.4	45	36.8	72	59.0	<0.001
I know the main symptoms of COVID-19	1	2.0	2	1.6	5	4.1	49	40.1	65	53.2	<0.001

*Chi-squared test comparing proportions of responses in each category.

Table 2. Analysis of consumption, motivation for cessation, and craving, Brazil, April–May 2020 (N=122)

	n	%	p*
Diagnosis of COVID-19			
Yes	0	0.0	
No	122	100	
Suspected COVID-19			
Yes	6	4.9	
No	116	95.0	
Routine altered by the pandemic			
Routine unchanged	6	4.9	0.001
Minimally	19	15.5	
Partially	42	34.4	
Completely	55	45.0	
Following prevention recommendations			
Not following recommendations	2	1.6	
Following a few of the recommendations	13	10.6	<0.001
Following most of the recommendations	52	42.6	
Following all the recommendations	55	45.0	
Consumption of cigarettes and derivatives in the pandemic			
Reduced the number of cigarettes	25	20.4	0.165
Continued to smoke the same number of cigarettes	43	35.2	
Increased by 1 to 10 cigarettes a day, in addition to the usual	46	37.7	
Increased by more than 10 cigarettes a day, in addition to the usual	8	6.5	
Desire (craving) to smoke in the pandemic			
Remains the same when compared to before the pandemic	65	53.2	
A little more desire compared to before the pandemic	30	24.5	<0.001
Considerably more desire compared to before the pandemic	19	15.5	
Extremely more desire compared to before the pandemic	8	6.5	
Motivation to quit smoking in the pandemic			
Motivation remains the same	73	59.8	
A little more motivated	29	23.7	<0.001
Considerably more motivated	14	11.4	
Extremely more motivated	6	4.9	
Feel more anxious, irritable, or depressed during the pandemic			
Feelings remain the same	44	36.0	
Feeling a little more anxious, irritable, or depressed	38	31.1	0.961
Feeling considerably more anxious, irritable, or depressed	19	15.5	
Feeling extremely more anxious, irritable, or depressed	21	17.2	

*Chi-squared test comparing proportions of responses in each category.

in categorical data. Continuous data were analyzed with the Wilcoxon test according to data distribution (cigarette/day before pandemic and April–May consumption). Correlation analyses were performed by Spearman or Pearson tests according to data distribution. We used a 5% significance level.

RESULTS

We evaluated 122 smokers. The demographic and smoking characteristics of the sample are presented in Supplementary file Table 1. There was a predominance of individuals who had a higher level of education ($p<0.001$), low dependence level on the Fagerström scale ($p<0.001$), and conventional cigarette smoking ($p<0.001$).

Table 1 presents the levels of prior knowledge about the elevated risks smokers have for severe COVID-19 complications. In all questions, the majority of participants reportedly knew about the elevated risks and agreed that the risks were true ($p<0.001$). We also noted that the daily consumption of cigarettes between January (questioned retrospectively in the first evaluation) and March did not change significantly ($p=0.723$).

Table 2 presents the categorical analyses of consumption, motivation to quit, and craving. The majority of smokers reported that, during the pandemic, they increased their consumption by between 1 and 10 cigarettes a day (37.7%) and maintained the same motivation (59.8%) and desire to smoke (53.2%). We observed significantly positive correlations between years of smoking and both motivation for smoking cessation ($r=0.32$; $p<0.003$) and nicotine dependence level ($r=0.44$; $p<0.001$). We also identified a significantly positive correlation between cigarette consumption (cigarettes/day) and both motivation for smoking cessation ($r=0.19$; $p=0.030$) and nicotine dependence level ($r=0.61$; $p<0.001$). These results show that individuals who smoked more were more motivated to quit and more dependent on nicotine. No significant correlations were observed between consumption and motivation to quit ($r=0.13$; $p=0.129$). However, a significant correlation was observed between load consumption and nicotine dependence level ($r=0.69$; $p<0.001$).

DISCUSSION

The main findings of our study are that smokers with the longest histories of smoking and highest levels of tobacco consumption were the most motivated

to quit and presented the highest levels of nicotine dependence. During the early stages of the pandemic, 20.4% of participants reported that they had reduced tobacco consumption, 35.2% had maintained the same level of consumption, and 44.2% had increased their consumption. We also observed that, during the early stages of the pandemic, motivation for smoking cessation was unaffected for the majority of smokers: 59.8% of participants reported their desire to quit was unchanged by the pandemic. We also identified that.

Increasing tobacco consumption during a pandemic may be a remedy for boredom in lockdown periods or a response to stress from the possibility of job loss, financial difficulties, insecurities, and fear of contracting a potentially fatal disease¹⁷. Stress and anxiety have been shown to augment tobacco use¹⁸. Pandemic-related social isolation, concerns, and uncertainties may thus explain our findings that the early stages of the pandemic led to increased levels of tobacco consumption and did not motivate smokers to quit.

According to Prochaska and DiClemente¹⁸, campaign strategies on the awareness of the harms of tobacco and benefits of cessation are necessary to motivate smokers to take action by quitting. In such cases, the subject is influenced to choose a strategy to change their addictive behaviors¹⁸.

On the other hand, 35.2% of smokers in our study reported that their tobacco consumption had not changed, and 20.4% reported reduced tobacco consumption. Knowledge about the risks involving tobacco consumption and COVID-19-related complications may have led to these outcomes. The ease of access to information and wide dissemination by the media about the high incidence of respiratory complications from COVID-19 may have directly influenced some smokers not to increase tobacco consumption or reduce consumption during the early stages of the pandemic. Self-awareness of the damages of smoking, especially in a pandemic period, may have also increased motivation for smoking cessation among smokers with the highest tobacco consumption levels and longest histories of smoking.

As shown in the literature, the effects of the COVID-19 pandemic on tobacco and tobacco derivative consumption are still divergent; this is possibly due to differences in sample sizes and the diversity of methods applied to evaluate consumption. A study conducted in 2020 by

Klemperer et al.¹² evaluated 366 smokers; they observed that tobacco and electronic cigarette consumption remained unchanged for 41.4% and 46.0% of smokers, respectively, which corroborates the results of our study. The authors also identified weak correlations between the perceived risk of COVID-19 complications due to cigarette use and the motivation to quit smoking; the risk of perceived damage was not associated with a change in use¹². Klemperer et al.¹² also showed study participants had an average concern regarding COVID-19 of 7.9 (SD=2.7) for their own health and 8.4 (SD=2.4) for the health of others (0=not at all, 10=extremely). The authors reported similar and positively correlated concerns ($r=0.69$; $p<0.001$) that the use of cigarettes and electronic cigarettes increased the risk of damage from COVID-19; these findings corroborate the findings of our study that showed participants were well aware of the increased risks smokers have for severe COVID-19 complications. The authors also reported that the pandemic did not motivate 48.2% of cigarette smokers and 48.2% of electronic cigarette smokers to quit¹²; these results are similar to the findings of our study.

In contrast, a study by Stanton et al.¹¹ reported that most smokers increased tobacco consumption during the early stages of the pandemic. They reported a positive change (reduction of consumption) in 16.3% ($n=28$) of smokers, no change in 38.4% ($n=59$), and a negative change (increase in consumption) in 49.9% ($n=85$)¹¹.

Previous studies, including systematic reviews, have compared the effects of COVID-19 in smokers and non-smokers; most of these studies demonstrate that smokers have worse outcomes in hospitalization, use of intensive care, manifestation of severe symptoms, and mortality^{19,20}. Smoking cessation can decrease susceptibility to coronaviruses. Reducing chronic exposure to smoke consequently decreases pulmonary levels of ACE2, which is the main receptor used by coronavirus 2 in severe acute respiratory syndrome (SARS-CoV-2) to enter the mucosa of the host and cause an active infection. This is a unique mechanism of the virus¹⁷.

Some smokers likely used periods of social isolation and lockdown as an opportunity to quit smoking; this is reflected by our data that show various smokers reduced or did not change tobacco

consumption in the early pandemic period. However, the success rate of cessation without specialized support is low¹⁵; thus, we recommend the expansion of access to intensive treatment approaches during pandemic periods. Remote strategies and the use of technology to treat nicotine addiction may be good approaches during pandemics and require further investigation²¹.

In our assessment of the prior knowledge of smokers about their elevated risks to develop severe COVID-19 complications, we noted that most participants were reportedly aware of the involved risks. These results might be related to the fact that 61.5% of the surveyed individuals had a college degree. Almost all previous studies evaluating Brazilian smokers were conducted with individuals with low education level. For example, a Brazilian survey conducted in 2005 with more than 7900 smokers showed that 34.3% of smokers had not completed primary education and only 7.3% of smokers had a college degree²². However, educational levels in Brazil have changed considerably since 2005. A study by Maia et al.⁷ analyzed cigarette smoking trends from 2006 to 2019 among Brazilian adults. The authors showed that the percentage of smokers with a low level of formal education (0 to 8 years of schooling) decreased from 45.5% (2006) to 28.8% (2019). However, the percentage of smokers with ≥ 12 years of formal education increased from 21.2% (2006) to 32.8% (2019)⁷. Although the epidemiological profiles of smokers in Brazil have changed greatly, the sample used in our study has a higher educational level than in samples of similar surveys^{7,22}.

These differences might be attributed to the fact that the present survey was only available online; many previous studies contacted individuals by phone^{7,22}. The socioeconomically underprivileged population in Brazil has significantly less access to the internet than higher income groups. Poverty is also intrinsically connected to low educational level²³.

Regarding the distribution between male and female smokers and age of smokers (predominately young adults), we observed similarities between our study and previous larger studies. Nevertheless, generalizations of our results for the Brazilian population should be made with caution, especially

considering the high level of education of participants in our survey. Studies with larger populations are needed to better understand the effects of pandemics on the smoking habits of Brazilians.

Limitations

The results of our study have important clinical relevance; however, the limitations of our study need consideration. For example, the cross-sectional design of our study does not reveal cause-effect relations. Although we tried to perform a longitudinal follow-up, the low response rate (only 28%) 45 days after the first evaluation did not allow us to analyze these data due to potential attrition bias. Additionally, our total sample of 122 participants is small. We also had one retrospective question regarding smoking consumption on January 2020, therefore these data should be interpreted with caution since it may be subjected to recall bias.

Nonetheless, our results add important clinical information to the literature concerning the consumption pattern of smokers in the early stages of the COVID-19 pandemic and an understanding of factors that may influence this process. These findings can assist and guide policies that promote motivation for cessation and ease of access to specialized programs for nicotine addiction treatment. In addition, our results reinforce the importance of incentives, remote treatment programs, and technology to increase the rates of permanent smoking cessation.

CONCLUSIONS

Most smokers were well aware of the health risks associated with smoking and COVID-19. Additionally, a majority of smokers reportedly increased tobacco consumption during the early stages of the COVID-19 pandemic in Brazil. However, motivation to quit and desire to smoke were not modified during this period in the surveyed population.

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CONFLICTS OF INTEREST

The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none was reported.

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ETHICAL APPROVAL AND INFORMED CONSENT

This study was approved by the Institutional Research Ethics Committee (Protocol: 30652220.2.0000.5515). Participants provided informed consent.

DATA AVAILABILITY

The data supporting this research are available from the Mendeley Data and Digital Commons Data at <https://data.mendeley.com/datasets/z9m39n9gbb/2>

AUTHORS' CONTRIBUTIONS

Study design: APCFF, BASM, TOL, ETS, MMF and FLP. Data analysis: APCFF. Drafting the manuscript: APCFF, MRL, BSAS and FLP. Literature search and data collection: BASM, MRL, TOL, ETS and MMF. All authors reviewed and approved the final version of the manuscript.

PROVENANCE AND PEER REVIEW

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