



Alcohol Consumption and Smoking During Covid-19 Pandemic: Association with Sociodemographic, Behavioral, and Mental Health Characteristics

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Abstract

The Covid-19 pandemic is related to increased alcohol consumption and smoking. These behaviors may be related to several sociodemographic, behavioral and mental health factors. Thus, the aim of this study was to assess the association between alcohol consumption and cigarette smoking with sociodemographic, behavioral and mental health characteristics. This study used data from two population-based studies conducted in two cities from Southern Brazil amid the Covid-19 pandemic. Individuals aged 18 years or older were included and selected using a multistage sampling procedure. Alcohol consumption and smoking and changes in such consumption during the Covid-19 pandemic were evaluated. Sociodemographic, behavioral, pandemic-related, and mental health variables were also included. A hierarchical model was used to conduct the adjusted analyses, and Poisson regression with robust adjustment was used for variance. A total of 2170 individuals were studied. The prevalence of alcohol consumption and smoking were 9.3% and 14.2%, respectively. The rates of increase in alcohol consumption and smoking during the Covid-pandemic were about 20% and 30%, respectively. They were higher among those with depressive symptoms, feeling of sadness and self-reported stress. Those with poor diet quality had higher prevalence of alcohol consumption (PR: 1.82) and were 1.58 times more likely to smoke. The findings may help stakeholders in health and political systems to better understand the consequences of the Covid-19 pandemic and develop strategies to mitigate these consequences in Brazil and elsewhere.

Keywords COVID-19 · Alcohol drinking · Cigarette smoking · Pandemics

Introduction

Abusive alcohol consumption and tobacco smoking are common behaviors around the world. In 2017, alcohol per-capita consumption was 6.5 L per year and the prevalence of heavy drinking was 20% in the global population [1]. In the region of the Americas, in 2020, 69.8% of males and 44.3% of females were current drinkers, 38.1% and 9.4% of those, respectively, presented heavy drinking episodes [2]. Although there was a decline in cigarette smoking in the last years, its prevalence is still high with marked differences between males and females: 32.7% in men and 6.6% in women in 2019, accounting for 1.14 billion smokers worldwide [3]. Only in Brazil, the prevalence of cigarette smoking decreased from 15.2% (in 2006) to 9.4% in eight years (in 2014), while the prevalence of abusive alcohol consumption remained stable, even though there was an important increase of this behavior in women [4].

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The Covid-19 outbreak has left people in a vulnerable state, owing to the easy transmission of the virus, fast disease progression, measures applied to mitigate or eliminate the virus transmission and the need for life adaption [5–7]. Traumatic events and crisis have been previous linked to the use of alcohol and tobacco [8, 9], and the Covid-19 pandemic crisis may result in increased alcohol and tobacco consumption. A reported increase in the consumption of these substances amid the Covid-19 pandemic had already been found in the population of many countries [10–13]. In Brazil, a study evidenced, during the pandemic, prevalence of smoking of 12%, with 34% of the participants reporting to have increased their consumption of cigarettes per day; and prevalence of increase in alcohol consumption of 17.6% [14].

Stress, depression and anxiety are conditions associated with alcohol consumption and smoking during the SARS-CoV-2 outbreak [7, 13, 15, 16], as they act as triggers for consumption as a way of coping [7, 17, 18]. Furthermore, certain populations can be considered to be more vulnerable to this pattern: being middle-aged [11], male [19], unmarried [19]; having higher income [20] or higher level of education [10] are also associated with increased alcohol consumption and tobacco smoking amid the pandemic.

It should be noted that smokers are at a higher risk for Covid-19 severity and mortality [21], while alcohol consumption is biologically related to damage to the respiratory system and negative outcomes in respiratory infections. However, more studies are needed to explain this relationship with Covid-19 [22]. Furthermore, the use of these substances is connected with negative social and protective behaviors, and it is an inappropriate coping mechanism for social isolation, economic losses and changes in work and family during this moment [7, 8].

Considering the concern related to this scenario and the range of physiological, psychological and behavioral consequences of the Covid-19 pandemic in the short, medium and long-term, including increase in alcohol consumption and smoking habits, it is crucial to investigate and present evidence about the complex relationship between alcohol, smoking and the pandemic. Therefore, the objective of the present study was to assess the association between alcohol consumption and cigarette smoking with sociodemographic, behavioral and mental health characteristics in two population-based studies carried out during the Covid-19 pandemic in Southern Brazil.

Methods

Ethical Aspects, Setting, Study Sample and Data Collection

All participants who agreed to participate in the study provided informed verbal consent. The Mental Covid

study was approved by the Research Ethics Committee of the Federal University of Rio Grande, protocol number 4.055.737.

This cross-sectional study used data from two population-based studies conducted in two cities from Southern Brazil: *Criciúma* (*Santa Catarina* state), and *Rio Grande* (*Rio Grande do Sul* state). Criciúma has approximately 217,311 inhabitants, a Human Development Index (HDI) of 0.788, and population density of around 815.87 inhabitants per km². Rio Grande has 211,965 inhabitants, HDI of 0.744, and population density of 72.79 inhabitants per km² [23].

The study “Mental Covid: impact of Covid-19 on the mental health of the population” was conducted amid the Covid-19 outbreak between October 2020 and January 2021. Individuals aged 18 years or older who were living in the urban area of both cities were eligible to take part in the study. Subjects who were physically or cognitively unable to complete the survey were excluded from the sample.

The sampling process was conducted in two stages, based on data from the 2010 Brazilian Demographic Census [24]. First, primary units (census tracts) were randomly selected. Second, secondary units (households) were randomly chosen from the previously selected census tracts. The total number of households was sampled proportionally to sector size. In Criciúma, 60 census tracts out of 307 were sampled, resulting in 15,765 households; 607 of them were included in this study. In Rio Grande, 90 census tracts out of 327 were sampled, resulting in 29,734 households, 900 of which were randomly selected. All adults aged 18 years old or more living in the selected households were invited to participate.

Face-to-face interviews were conducted by trained personnel who worn personal protective equipment during the fieldwork in order to avoid SARS-CoV-2 infection. A single, precoded, and standardized questionnaire was used in data collection. Data collection was performed using tablets and the RedCap® software was used to store the data; each interview lasted 30 min on average.

Alcohol Consumption and Change in the Alcohol Consumption During the Covid-19 Pandemic

Alcohol consumption was assessed through the following question: “How many days a week do you usually drink any alcoholic beverage?”. The answer options were: “Never drink or less than once a week” and “One day or more than one day a week”. In the present study, alcohol consumption was dichotomized as “no” (never drink or less than once a week) and “yes” (one day or more than one day a week).

Changes in alcohol consumption during the Covid-19 pandemic were assessed by the question: “During the period of social distancing, did your alcohol consumption increase, decrease or remain the same?”.

Smoking and Change in Cigarette Consumption During the Covid-19 Pandemic

To assess cigarette smoking, the following question was used: “Do you currently smoke cigarettes?”. The answer options were no; yes, every day; yes, but not every day. In this study, cigarette smoking was dichotomized as “no” and “yes” (yes, every day; yes, but not every day).

To evaluate changes in cigarette smoking during the Covid-19 pandemic, the following question was used: “During the period of social distancing, did your cigarette consumption increase, decrease or remain the same?”.

Mental Health Variables

Depressive symptoms were assessed by the Patient Health Questionnaire (PHQ-9), which is used for screening major depressive episodes (MDE) and validated for the Brazilian population [25]. The PHQ-9 consists of nine questions considering a two-week recall period. Depressive symptoms were defined by the presence of five or more symptoms, with at least one being depressive mood and/or anhedonia. Suicidal ideation was assessed using the following question of PHQ-9: “In the last two weeks, how many days did you think about hurting yourself in any way or did you think that you would be better off dead?”. Those individuals who responded “never” were classified as not having suicidal ideation. To assess self-reported feeling of sadness we used the faces scale [26].

Perceived stress was evaluated through the perceived stress scale (PSS), previously validated for the Brazilian population [27]. It was originally developed as a 14-item scale that assessed the perception of stressful experiences over the previous month. The total score consisted of the sum of points, ranging from 0 to 56 points. The total score was categorized into quintiles, and those individuals in the highest quintile were classified as having the highest level of perceived stress.

Sociodemographic, Behavioral and Pandemic-Related Variables

Sociodemographic and behavioral variables were: sex (male, female), age group (collected in completed years and categorized as 18–29, 30–39, 40–49, 50–59, 60 or older), skin color (collected as white, black, brown, yellow, indigenous and dichotomized into white and others), schooling (elementary school, high school, university education), wealth index (categorized into tertiles), physical activity (< 150, 150 min per week or more), and diet quality (categorized into tertiles) [28].

Pandemic-related variables were: got unemployed (no, yes), started working at home (no, yes); adherence to social

distance (no, yes); infodemic (no, yes); contact with someone infected (no, yes); presence of Covid-19 symptoms (no, yes); and went to bars or restaurants (no, yes). To evaluate adherence to social distancing, the following question was used: “During the period of social distancing, when only essential services were open, did you leave home?”. Infodemic²⁹ was assessed using the question: “How many times a day do you search for or receive information about Covid-19?”; the answers options were: many times a day, a few times a day, few times a day, only once a day, and a few times a week. We considered as infodemic those individuals who answered “many times a day”.

Statistical Analyses

All analyses were performed in STATA version 12.1

Proportions and 95% confidence intervals (95% CI) were used to describe the characteristics of the sample as well as changes in alcohol and cigarette consumption during the Covid-19 pandemic. Crude analysis of association of alcohol consumption and cigarette smoking according to sociodemographic, behavioral, pandemic-related, and mental health variables were assessed using Fisher’s exact test with significance level of 5%.

To evaluate whether the significant associations that had been found were independent of possible confounding variables, adjusted Poisson regression was used with robust adjustment for variance, presenting the p-value corresponding to the Wald test for heterogeneity or linear trend³⁰. Regression results were reported as prevalence ratio (PR) and its corresponding 95% CI

To identify the possible confounders, we used a level hierarchical model of analysis [29]. Variables were selected using backward method considering each hierarchical level, and those variables with p-value < 0.20 remained in the final model.

Three different models of adjusted analysis were used. For the association of alcohol consumption and cigarette smoking according to the sociodemographic and behavioral characteristics, the possible confounding variables included were: sex, age, skin color, schooling, wealth index, physical activity, and diet quality. To analyze the association of alcohol consumption and cigarette smoking according to the pandemic-related variables, in addition to the sociodemographic and behavioral variables mentioned above, the following information was included: got unemployed, started working at home, adherence to social distance, infodemic, contact with someone infected, presence of Covid-19 symptoms, and went to bars or restaurants. To analyze the association of alcohol consumption and cigarette smoking according to mental health variables, the sociodemographic, behavioral, and pandemic-related variables mentioned above were included as possible confounders.

Sensitivity analyses were also performed for evaluating the association of changes in alcohol consumption and cigarette smoking (decreased, increased, remained similar) during Covid-19 pandemic according to sociodemographic, behavioral, pandemic-related, and mental health variables. For these analyses were included only the individuals who reported to consume alcohol and cigarette. Fisher's exact test was used for these analyses.

Results

A total of 2,170 individuals were included in our analyses (75% of response rate). Most of them were female (59.7%) and self-reported white skin color (83.9%), and one third of them were elderly (31.2%). One-fourth of participants had university education (25.6%) and were physically active (24.7%). The prevalence of depressive symptoms and suicidal ideation were 13% and 3.8%, respectively. Moreover, about 18% of the individuals reported being stressed in the last month (data not shown).

The prevalence of alcohol consumption was 9.3% (95% CI: 8.2; 10.6), with no differences among skin color, schooling, and wealth index variables. After adjustment for the possible confounders, men, younger, physically active individuals, as well as those with worse diet quality, were more likely to consume alcohol. Males were 295% (PR = 3.95; 95% CI: 3.03; 5.16) more likely to consume alcohol than females. The prevalence of alcohol consumption decreased with increasing age, while it increased with increasing schooling. The physically active individuals presented higher prevalence of alcohol consumption (PR = 1.72; 95% CI: 1.32; 2.25). In addition, the individuals with poor diet quality were 1.82 times (95% CI: 1.29; 2.57) more likely to consume alcohol (Table 1).

The prevalence of cigarette smoking was 14.2% (95% CI: 12.8; 15.8), with no differences among sex, age group, skin color and physical activity. Schooling, wealth index, and diet quality remained associated with cigarette smoking after adjustment for potential confounders. The less educated individuals were almost 2 times more likely to smoke cigarettes than the more educated ones ($p < 0.001$). Moreover, people with poor diet quality were 58% (PR = 1.58, 95% CI: 1.22; 2.04) more likely to smoke cigarettes when compared to the individuals with better diet quality (Table 1).

Table 2 shows the association between alcohol consumption and cigarette smoking with pandemic-related variables. Having had contact with someone infected and having been to bars or restaurants increased the probability of consuming alcohol by 65% (95% CI: 1.21; 2.25) and 87% (95% CI: 1.32; 2.64), respectively. The prevalence of cigarette smoking was 100% higher among those individuals who got unemployed

(PR: 2.01, 95% CI: 1.51; 2.68) after adjustment for potential confounders.

The analyses of association between alcohol consumption and cigarette smoking with mental health disorders showed that these disorders were not related to alcohol consumption. However, depression was associated with smoking: individuals with depressive symptoms were 45% (PR = 1.45, 95% CI: 1.08; 1.94) more likely to smoke when compared to those who were not depressed (Table 3).

Figure 1 shows changes in alcohol consumption and cigarette smoking during the Covid-19 pandemic. Around 18% (95% CI: 13.7; 23.5) of individuals reported having increased alcohol consumption while 19.8% (95% CI: 15.2; 25.3) of them reported having decreased consumption. Increasing in cigarette smoking was reported by 29.7% (95% CI: 24.4; 35.5) of the participants and 17.5% of them (95% CI: 13.3; 22.6) reported having decreased their consumption. Sensitivity analysis showed that the individuals who reported having increased their alcohol consumption during the Covid-19 pandemic were younger, more educated and with non-white skin colour. In addition, the increase in alcohol consumption was also higher in smokers, had depressive symptoms or felt sadness (Supplementary Tables 1 and 3). Increasing in cigarette smoking was higher among younger individuals, in those with higher level of stress, depressive symptoms and feelings of sadness (Supplementary Tables 4 and 6).

Discussion

The present study—which aimed to assess sociodemographic, behavioral and mental health characteristics associated with alcohol consumption and cigarette smoking in two population-based studies from Brazil—brings interesting results from the understanding of the consequences of the pandemic for public health. Although mental health disorders have not been associated with current alcohol consumption and cigarette smoking, higher prevalence of depressive symptoms, feeling of sadness and self-perceived stress were associated with increases in these behaviors amid the Covid-19 pandemic.

A recently published meta-analysis has shown that the Covid-19 pandemic increased mental health disorders worldwide, especially in healthcare workers [30]. In addition, alcohol consumption and cigarette smoking appear to be associated with these disorders [7, 13, 15, 16], as such behaviors are often seen as ways to relieve stress, depression and sadness [7, 31], and these conditions are commonly linked to the Covid-19 outbreak. The increase in mental health disorders and the use of alcohol and cigarette as ways of coping with these problems may help to understand why

Table 1 Crude and adjusted analyses of association between alcohol consumption and smoking during the Covid-19 pandemic with sociodemographic and behavioral characteristics of the individuals. Criciúma-SC and Rio Grande-RS, Brazil, 2021 (n = 2170)

Variables	Alcohol consumption				Smoking			
	Crude analysis ^a		Adjusted analysis ^b		Crude analysis ^a		Adjusted analysis ^b	
	%	p-value	PR (95% CI)	p-value	%	p-value	PR (95% CI)	p-value
Sex		<0.001		<0.001		0.133		0.169
Male	16.9		3.95 (3.03;5.16)		15.7		1.16 (0.94;1.43)	
Female	4.2		1.00		13.3		1.00	
Age group		<0.001		<0.001 ^c		0.149		0.644
18–29	14.0		2.59 (1.72;3.90)		14.2		1.16 (0.81;1.66)	
30–39	13.4		2.54 (1.70;3.80)		14.6		1.17 (0.84;1.63)	
40–49	11.9		2.25 (1.43;3.55)		14.4		1.20 (0.83;1.73)	
50–59	6.1		1.24 (0.74;2.07)		17.6		1.48 (1.09;2.02)	
≥ 60	5.2		1.00		12.0		1.00	
Skin color		0.989		0.554		0.078		0.050
White	9.4		1.00		13.6		1.00	
Other	9.2		0.89 (0.60;1.32)		17.3		1.27 (1.00;1.61)	
Schooling		0.001		0.114		<0.001		<0.001
Elementary	6.7		0.69 (0.43;1.10)		17.7		1.97 (1.42;2.74)	
High school	10.7		0.81 (0.56;1.16)		15.8		1.99 (1.38;2.87)	
University education	12.1		1.00		6.9		1.00	
Wealth index (tertile)		0.810		0.291		<0.001		<0.001 ^c
First (poor)	9.0		1.24 (0.83;1.86)		20.5		1.89 (1.38;2.60)	
Second	9.8		1.08 (0.75;1.57)		13.7		1.38 (1.00;1.90)	
Third (richer)	10.0		1.00		8.8		1.00	
Physical activity (per week)		<0.001		<0.001		0.002		0.191
< 150 min	7.5		1.00		15.6		1.00	
≥ 150 min	14.7		1.72 (1.32;2.25)		10.2		0.85 (0.66;1.09)	
Diet quality		<0.001		0.001 ^c		<0.001		0.001
Tertile 1 (better)	5.8		1.00		11.8		1.00	
Tertile 2	9.6		1.37 (0.90;2.10)		11.9		0.91 (0.69;1.21)	
Tertile 3 (poor)	14.0		1.82 (1.29;2.57)		19.7		1.58 (1.22;2.04)	

PR prevalence ratio

^aFisher's exact test

^bPoisson regression adjusted for variables of this table with p < 0.20

^cLinear trend

depressive symptoms, feeling of sadness and self-perceived stress were linked to increases in alcohol consumption and cigarette smoking in the present study.

Other observational investigations have also found similar results to the ones presented here. An online survey with more than 45 thousand Brazilian adults, performed amid the Covid-19 pandemic, showed that people who often or always felt sad or depressed presented a higher increase in cigarette smoking (PR = 2.2; 95% CI: 1.4;3.7; PR = 2.4; 95% CI: 1.4;4.0, respectively) [32]. Another online cross-sectional survey conducted in the United Kingdom with more than 30 thousand adults found that drinking more alcohol than

usual during the pandemic was related to stress and anxiety disorders [15].

Along with the association between mental health characteristics and increase in alcohol and cigarette consumption, another finding was that becoming unemployed during the pandemic was linked to higher prevalence of current cigarette smoking. It is an important result because Brazil has suffered with high rates of unemployment over the last few years, owing to its economic and political crisis, with younger individuals being the most affected ones [33]. As a result of several actions, e.g., warnings on cigarette packages and ban on cigarette advertisements in the media, Brazil has succeeded in combatting tobacco

Table 2 Crude and adjusted analyses of association between alcohol consumption and smoking with pandemic-related variables. Criciúma-SC and Rio Grande-RS, Brazil, 2021. (n = 2170)

Variables	Alcohol consumption				Smoking			
	Crude analysis ^a		Adjusted analysis ^b		Crude analysis ^a		Adjusted analysis ^b	
	%	p-value	PR (95% CI)	p-value	%	p-value	PR (95% CI)	p-value
Got unemployed		0.257		0.200		<0.001		<0.001
No	9.1		1.00		13.1		1.00	
Yes	11.9		1.31 (0.86;1.99)		28.8		2.01 (1.51;2.68)	
Started working from home		0.026		0.328		0.002		0.415
No	8.9		1.00		14.9		1.00	
Yes	14.3		1.24 (0.81;1.90)		6.6		0.76 (0.40;1.47)	
Adherence to social distancing		0.005		0.632		0.043		0.158
No	20.0		1.00		22.7		1.00	
Yes	9.3		0.89 (0.54;1.45)		14.0		0.72 (0.45;1.14)	
Infodemic		0.006		0.160		0.064		0.172
No	10.2		1.00		13.5		1.00	
Yes	6.1		0.72 (0.46;1.14)		17.0		1.22 (0.92;1.61)	
Fear of Covid-19		0.989		0.226		0.433		0.907
No	9.1		1.00		14.0		1.00	
Yes	9.0		1.25 (0.87;1.80)		15.5		0.98 (0.76;1.28)	
Contact with someone infected		<0.001		0.002		0.291		0.668
No	7.3		1.00		14.7		1.00	
Yes	15.2		1.65 (1.21;2.25)		12.8		0.94 (0.70;1.26)	
Presence of Covid symptoms		<0.001		0.053		0.559		0.742
No	7.8		1.00		13.9		1.00	
Yes	14.2		1.36 (1.00;1.85)		15.0		1.04 (0.82;1.31)	
Went to bars or restaurants		<0.001		0.001		0.751		0.445
No	7.8		1.00		14.3		1.00	
Yes	24.4		1.87 (1.32;2.64)		15.1		1.16 (0.79;1.71)	

PR prevalence ratio

^aFisher's exact test

^bPoisson regression adjusted for sociodemographic and behavioural (seen in Table 1) and for variables of this table with $p < 0.20$

use, with considerable decrease in the prevalence of this behavior when compared to other South American countries, for example, Argentina [4]. From 2006 to 2014, there was a drop of more than five percentage points in the prevalence of tobacco use [4]. However, the combination of high prevalence of unemployment and the consequences of the Covid-19 pandemic on people's health can mitigate the decrease in the prevalence of cigarette smoking found in Brazil, particularly in younger populations.

Additionally, it was also found that younger individuals (18 to 29 years old) presented a higher prevalence of alcohol consumption when compared to the older ones. Historically, economic crisis and respiratory outbreaks have been linked with increases in alcohol consumption [8], and research previous to the Covid-19 pandemic demonstrated that both alcohol and cigarette use were associated with losing one's job [34]. High rates of unemployment and higher prevalence of alcohol consumption in younger

adults can illustrate a post-pandemic scenario where finding a job can be even harder for those individuals who have already been the most affected by the labor market crisis in Brazil.

This whole range of consequences related to the Covid-19 pandemic can impact national public health policies, including the National Health Promotion Policy, which addresses several themes, including the fight against the use of cigarettes and excessive alcohol consumption, through social, legislative, environmental and economic actions [35]. These measures have been effective [36], but operationalization may be impaired by Covid-19 pandemic and the social and behavioral factors associated, as above mentioned.

Our study also showed that diet quality was linked with both tobacco and alcohol consumption. Those individuals with poor diet quality presented a higher prevalence of cigarette smoking and alcohol consumption. The social restrictions of the coronavirus outbreak have triggered

Table 3 Crude and adjusted analyses of association between alcohol consumption and smoking with mental health disorders. Criciúma-SC and Rio Grande-RS, Brazil, 2021. (n = 2170)

Variables	Alcohol consumption				Smoking			
	Crude analysis ^a		Adjusted analysis ^b		Crude analysis ^a		Adjusted analysis ^b	
	%	p-value	PR (95% CI)	p-value	%	p-value	PR (95% CI)	p-value
Depressive symptoms		0.741		0.947		0.002		0.013
No	9.4		1.00		13.4		1.00	
Yes	8.6		0.99 (0.66;1.48)		20.7		1.45 (1.08;1.94)	
Perceived stress		0.332		0.334		0.024		0.828
No	9.0		1.00		13.4		1.00	
Yes	10.7		1.16 (0.85;1.59)		18.0		1.03 (0.79;1.34)	
Feeling of sadness		0.314				0.133		0.217
No	9.6		1.00		13.4		1.00	
Yes	7.7				16.9		1.20 (0.90;1.60)	
Suicidal ideation		0.699		0.812		<0.001		0.055
No	9.4		1.00		13.7		1.00	
Yes	7.2		0.91 (0.40;2.04)		28.9		1.52 (0.99;2.34)	

PR prevalence ratio

^aFisher's exact test

^bPoisson regression adjusted for sociodemographic and behavioral (seen in Table 1) and pandemic-related variables (seen in Table 2) with $p < 0.20$

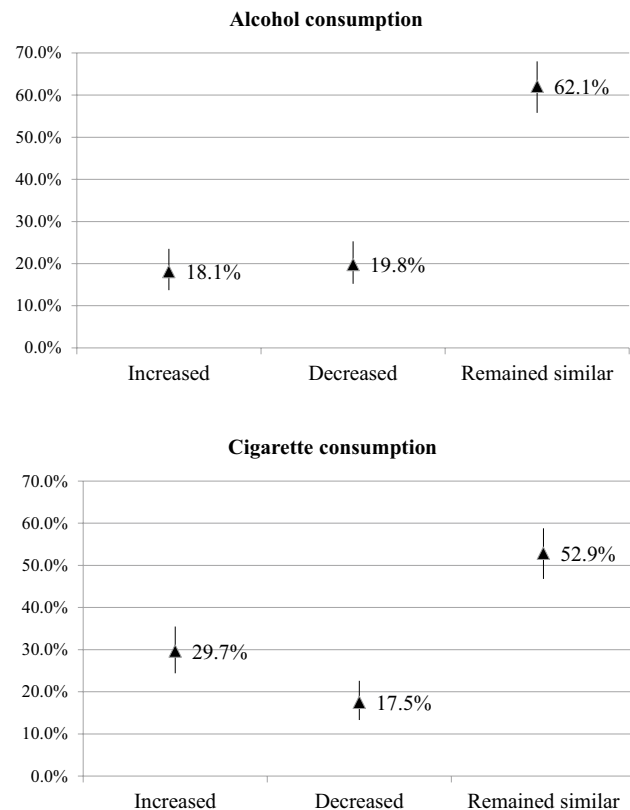


Fig. 1 Change in alcohol and cigarette consumption during the Covid-19 pandemic. Criciúma-SC and Rio Grande-RS, Brazil, 2021. (n = 243)

consequences for people's dietary intake habits, such as increase in the consumption of unhealthy foods and lack of adequate access to high-quality foods [37, 38, 38–40]. However, the relationship of diet quality with alcohol consumption and cigarette smoking can be bidirectional. If the lack of a high-quality diet might favor alcohol consumption and cigarette smoking, the opposite is also true. Cigarette smoking and alcohol consumption can be consequences of worry and stress about a food insecurity status. On the other hand, both behaviors can lead to inadequate dietary intake and difficulty in food acquisition as a result of a restricted financial source for it [41, 42].

It should also be noted that some socioeconomic and demographic characteristics were linked to alcohol consumption and cigarette smoking in the present study. Being male, younger and physically active were associated with a higher prevalence of alcohol consumption, while a higher prevalence of cigarette smoking was related to a lower wealth index and lower schooling. Other studies conducted amid the Covid-19 pandemic associated sociodemographic and behavioral characteristics with changes in alcohol consumption and cigarette smoking. In the United States, adults between 18 and 44 years old presented a higher prevalence of increase in alcohol consumption, and those with a higher income had a lower prevalence of cigarette smoking compared to less wealthy individuals [43]. In France, being between 18 and 34 years old was associated with increased alcohol and cigarette consumption [10], while in Brazil, individuals with lower educational levels

had a higher increase in the frequency of cigarette smoking [32].

The Covid-19 pandemic has affected the sociodemographic strata of the population differently. In addition, the impacts of the pandemic on behaviours and health vary around the world and according to the strategies adopted by different countries to mitigate or eliminate the virus [5, 44, 45]. In Brazil, the pandemic started in a context of political and economic crisis, which led the less favoured socioeconomic strata and the youngest individuals to be the most affected by the Covid-19 outbreak [33, 46].

Also noteworthy is the overall prevalence of depressive symptoms found in the present study, which was higher when compared to data for Brazil as a whole. According to data from the 2019 National Health Survey, the prevalence of depression in Brazilian adults was 10.2% (vs. 13.0% in the present study) [47]. A cohort study conducted during the Covid-19 pandemic in the Brazilian Southern region, the same region where *Criciúma* is located, evidenced a sharp increase in the prevalence of depressive symptoms. Severe depression symptoms before Covid-19 were reported by 3.9% of the population and increased to 29.1% amid the pandemic [48]. Historically, the South region presents one of the highest prevalence of depressive disorders in Brazil [49, 50], and the impacts of Covid-19 pandemic can further increase the population's mental health problems [44, 45].

This study has some methodological limitations. The cross-sectional design does not allow establishing causality in the associations; therefore, results must be interpreted with caution. Moreover, alcohol consumption and cigarette smoking, as well as the changes in these behaviours amid the Covid-19 pandemic, were self-reported, which may underestimate the prevalence found here. In addition, heavy drinking, an important aspect to health and behaviour outcomes, was not evaluated. The assessment of depressive symptoms, suicidal ideation, feeling of sadness and perceived stress was performed by screening tools that cannot be used as diagnostic. However, the PHQ-9, the PSS and faces scale are easy and quick to apply, and widely used in population-based studies [25–27, 50]. As strengths, this is a population-based study; for this reason, it is important to describe and evaluate health conditions and the epidemiological situation of the population. Furthermore, the interviews were conducted face-to-face, at participants' households, a distinction when compared to other surveys conducted amid the Covid-19 pandemic, which have mostly collected data using online platforms.

In conclusion, during the Covid-19 pandemic, around 20% and 30% of the individuals have reported increase in alcohol consumption and cigarette smoking, respectively, in both cities in Brazil. Consumption was higher among those with depressive symptoms, feeling of sadness and self-reported stress. In addition, both alcohol consumption

and cigarette smoking were more prevalent in individuals with poor diet quality. These results may help stakeholders in health and political systems to better understand the consequences of Covid-19 pandemic and build strategies to mitigate these consequences in Brazil and elsewhere.

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Data Availability The data that support the findings of this study are available from the corresponding author upon request.

Code Availability Note applicable.

Declarations

Conflict of interest The authors declare no competing interests.

Consent to Participate Informed verbal consent was received from each participant.

Consent for Publication Not applicable.

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