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Impact of COVID-19 pandemic on patterns of cigarette, hookah and marijuana consumption among undergraduate students of University of Sarajevo Bosnia and Herzegovina: a repeated cross-sectional study

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Key words: COVID-19, cigarettes, hookah, marijuana, tobacco products, students, survey
Parole chiave: COVID-19, sigarette, narghilé, marijuana, derivati del tabacco, studenti, indagini

Abstract

Aim. *The aim of the study was to assess the impact of COVID-19 pandemic on patterns of cigarette, hookah and marijuana consumption among undergraduate students of Bosnia and Herzegovina.*
Methods. *The first part of the double cross-sectional study was conducted among undergraduate students of the University of Sarajevo from 22nd to 26th January 2020, prior to the first COVID-19 case in the country (study period 1), and the second part from March 25th to August 26th 2021, during the third wave of COVID-19 outbreak (study period 2).*
Results. *The majority of the 1,230 respondents were women (N_1 70.9%, N_2 70.1%), pursuing medical sciences (N_1 60.0%, N_2 55.0%), in their 3rd year of study (N_1 26.3%, N_2 26.7%), and living in urban environment (N_1 84.9%, N_2 86.4%). Similar proportion of cigarette smokers (N_1 38.5%, N_2 39.2%), and smaller, similar portions of hookah smokers (N_1 19.3%, N_2 21.1%) were classified in both study periods, while the smallest portion of marijuana smokers (N_2 8.0%) was classified during COVID-19. Similar number of cigarettes per day, types of cigarettes consumed and consumption frequency in the last 30 days, with the similar independent predictors of cigarette consumption (being woman and living in rural environment associated with decreased risk, and age older than 22 associated with increased risk) were identified both before and during COVID-19 pandemic. Compared to before COVID-19 pandemic, increased trends in intentions (73.6% vs. 81.2%) and attempts (51.9% vs. 75.1%) to smoking cessation among cigarette smokers, but decreased determination not to smoke in the coming year among cigarette non-smokers (N_1 72.2%, N_2 51.6%) and decreased awareness of smoking harmfulness among both cigarette smokers (N_1 68.0%, N_2 46.5%) and especially cigarette non-smokers (N_1 60.9%, N_2 22.9%) were seen during COVID-19 pandemic. Also, risky behavior among hookah smokers was evident during COVID-19 pandemic.*

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Conclusions. *COVID-19 pandemic seemed to positively affect intentions and attempts to smoking cessation among cigarette smokers while negatively affecting attitudes towards cigarette smoking among cigarette non-smokers.*

Introduction

Consumption of tobacco products (cigarettes, hookah, etc.) is present around the world with an emphasis on lower and middle-income countries such as Bosnia and Herzegovina (B&H) (1). In addition to higher morbidity and mortality rates among smokers and people exposed to tobacco smoke (2), caused mostly by cardiovascular and respiratory illnesses (3-5), tobacco smoking now represents an important factor in COVID-19 transmission (6). Smoking facilitates the contact between contaminated materials and mucous membranes in the mouth, increasing the likelihood of hand-to-mouth transmission. In addition, exhaled smoke, coughing and sneezing produce aerosols containing COVID-19 particles that are likely to contaminate surrounding surfaces (6). Due to long retention of SARS-CoV-2 particles in the form of micro-aerosols and droplets, these surfaces can stay contaminated from a few hours to 2–3 days (7). This way non-smokers can get passively infected even if human distancing is practiced (6). Moreover, smoking in groups, especially hookah, also called shisha consumption, involves close physical and salivary fluid contact as means of transmitting the virus (6).

Different global programs have supported smoking cessation and awareness about the effects of tobacco smoking through the years, but these efforts intensified during the COVID-19 pandemic. Smoking cessation was recognized as one of the vital measures for stopping the viral spread because smoking itself violated isolation and hygiene measures as critical management strategies (6). Despite these recommendations, some countries reported an increase in tobacco product consumption as a result of strict epidemiological measures, such as lockdown, to contain the spread of COVID-19 (8). B&H has sustained different epidemiological measures in the form of curfew and closing of all nonessential services during the winter months. However, strict measures seemed to inevitably cause stress and anxiety that may be associated with higher smoking prevalence.

Besides tobacco smoking, marijuana smoking also referred to as cannabis, is a global health concern (9). It is the most commonly used federally illegal drug in the United States, with an estimated 48.2 million people who used it in 2019 (10). It is a psychoactive plant that contains more than 500 components with the two most frequently used: *tetrahydrocannabinol* (THC, an indicator of cannabis potency) and *cannabidiol* (CBD). Although its regular use leads to health problems, addiction and mental disorders (9), the ongoing pandemic was associated with increased cannabis consumption mainly because of social isolation, changes in daily routines and boredom (11, 12). With its anxiolytic property, mainly attributed to CBD, marijuana has also been used in alleviating anxiety (9).

The data regarding cigarettes, hookah and marijuana consumptions among young people during the COVID-19 pandemic are scarce. Therefore, we intended to carry out a continuation of our study conducted prior to the onset of the COVID-19 pandemic (13), in order to evaluate the COVID-19 pandemic-related changes in the pattern of cigarette and hookah consumption among undergraduate students of the University of Sarajevo, B&H. In addition, because B&H still lack legal procedures for cannabis commerce, we also

aimed to explore the consumption of marijuana products among the same population during the COVID-19 pandemic.

Methods

Study design and setting

This follow-up study was done in the form of a repeated cross-sectional study among undergraduate students of the University of Sarajevo, B&H. The first cross-sectional study was conducted from 22nd to 26th of January 2020, prior to the appearance of the first COVID-19 case in the country [study period 1, (13)], and the second one from 25th of March to 26th of August 2021, during the third wave of COVID-19 outbreak in the country (study period 2).

Undergraduate students of the University of Sarajevo, B&H, were enrolled. When compared to the entire population, our study sample had a comparable gender and year of study distribution, and the minimum sample size computed for our population was 379 students (z=379, 314–466 95% CI, E=5%). All respondents were informed about the study aims, the voluntary involvement, the request to sign an online informed consent and to follow the instructions on how to complete the questionnaire. Exclusion criteria were (i) being under 18 years, (ii) not being a student at the University of Sarajevo, and (iii) not being a B&H resident. The study was validated in advance and approved by University Bioethical Committee and Sector for Education (0101-555).

Questionnaire

An anonymous online questionnaire based on a National Youth Tobacco Survey (NYTS) (13, 14) was used in study period 1, and another anonymous online questionnaire based on both NYTS *and* Marijuana Effect Expectancy Questionnaire (MEEQ) was used in study period 2. Both questionnaires were adapted to local characteristics, translated into local languages and distributed via online university Facebook® and Microsoft Teams® groups through student representatives.

The questionnaire used in study period 2 consisted of five sections, as follows: (i) demographic characteristics of the sample i.e. gender, age, study field, year of study, living environment; (ii) place of residence, attitudes and exposure to cigarette smoking; (iii) hookah consumption; (iiii) other tobacco product consumption, i.e. cigars, cigarillos, pipe tobacco, chewing tobacco; (iiiii) marijuana consumption and attitudes accompanying it (part of the questionnaire used in the study period 2 only). According to the Center for Disease Control and Prevention (CDC), a current smoker was considered a person who smoked at least 100 cigarettes in his lifetime and who currently smokes cigarettes (15). Because one hookah smoking session is comparable to the intake of 100 cigarettes, as indicated by the World Health Organization "TobReg Advisory Note" (16), a hookah smoker was defined as someone who smoked one or more hookahs each month. Marijuana smoker is yet not defined in the literature.

Data analysis

Descriptive statistics were used to summarize the data. Categorical variables were presented by frequencies and percentages, while numerical variables were presented by mean±standard deviation for data with normal distribution, and median (25th, 75th percentile) for data that were not normally distributed. To identify independent determinants of cigarette and hookah consumption before and during the COVID-19 pandemic, and of marijuana consumption during the COVID-19, binary logistic regression models were tested. Each logistic regression model tested variables sex, age, living environment, field of study, and year of study. Data were statistically analyzed using the Statistical Package for the Social Sciences

(SPSS) version 23.0, with the level of significance set at P<0.05.

Results

The study included 1,282 respondents in total, with a similar participation rate in both study periods [N_1=637 (3.7%), N_2=645 (4.2%)]. After eliminating respondents who met exclusion criteria, the final numbers of respondents were N_1=605 and N_2=625, predominantly women [N_1=429 (70.9%), N_2=438 (70.1%)], pursuing medical sciences [N_1=363 (60.0%), N_2=344 (55.0%)], in their 3rd year of study [N_1=159 (26.3%), N_2=167 (26.7%)], coming from Canton Sarajevo [N_1=224 (37.0%), N_2=333 (53.3%)] and living in an urban environment [N_1=514 (84.9%), N_2=540 (86.4%)].

The median age of the respondents before the COVID-19 pandemic was 22.0 (20.0; 23.0) with an age range 18–37 years, and the mean age of the respondents during COVID-19 pandemic was 21.9±1.8 with an age range 19–30 years. The mean BMI of the respondents during COVID-19 pandemic was 23.1±3.4, ranging 15.8–57.8, while the data regarding BMI before COVID-19 pandemic were not collected. Demographic characteristics of the respondents before and during COVID-19 pandemic are presented in Table 1.

Patterns of cigarette consumption before and during COVID-19 pandemic

Out of 1,230 respondents, N_1=235 (38.5%) were current cigarette smokers before COVID-19 pandemic, and N_2=245 (39.2%) were current smokers during the COVID-19 pandemic. Demographic characteristics of cigarette smokers before and during COVID-19 pandemic are presented in Table 1.

Both before and during COVID-19 pandemic cigarette smokers typically smoked 1–10 cigarettes per day [N_1=152 (64.7%), N_2=188 (76.7%)] and preferred regular [N_1=87 (37.0%), N_2=151 (61.6%)] or light flavored cigarettes [N_1=101 (42.9%), N=90 (36.7%)]. Only a small portion of smokers [N_1=23 (9.8%), N_2=16 (6.5%)] reported smoking menthol cigarettes. Consumption frequency among cigarette smokers in the last 30 days was similar before and during COVID-19 pandemic (Table 2).

The majority of cigarette smokers [N_1=173 (73.6%), N_2=199 (81.2%)] considered smoking cessation both before and during the COVID-19 pandemic, and more than a half [N_1=122 (51.9%), N_2=144 (58.7%)] reported that they wanted to permanently stop smoking. Also, more than a half of cigarette smokers [N_1=122 (51.9%), N_2=184 (75.1%)] tried quitting 1–5 times over the last year, most commonly [N_1=120 (51.1%), N_2=113 (46.1%)] with an abstinence period longer than 30 days. Cigarette smokers reported also the period of cigarette craving to last from 3 to 24 hours [N_1=78 (33.2%), N_2=108 (44.0%)], and moderate to severe difficulty to abstain from smoking in smoking prohibited areas [N_1=74 (31.5%), N_2=91 (37.1%)]. Only a small portion of cigarette smokers [N_1=18 (7.6%), N_2=16 (6.5%)] used additional help such as consulting, working groups, nicotine gums, etc. to ultimately stop smoking.

Being a woman (OR_1=0.539, 95% CI 0.368–0.790, P=0.002; OR_2=0.571, 95% CI 0.400–0.814, P=0.002), and living in a rural environment (OR_1=0.335, 95% CI 0.191–0.585, P<0.001; OR_2=0.556, 95% CI 0.332–0.933, P=0.026) were associated with a decreased risk for cigarette consumption, while older age (22+ years) (OR_1=1.287, 95% CI 1.122–1.476, P<0.001; OR_2=1.218, 95% CI 1.111–1.336, P<0.001) increased the risk for cigarette smoking both before and during COVID-19 pandemic. Independent predictors associated with cigarette smoking before and during COVID-19 pandemic are presented in Table 3.

Attitudes towards cigarette smoking

Table 1 - Demographic characteristics of respondents categorized as cigarette smokers/non-smokers and hookah smokers/non-smokers before and during the COVID-19 pandemic, and marijuana smokers/non-smokers during the COVID-19 pandemic [data presented as absolute numbers and percentages or as mean±standard deviation or as median (25^{th}, 75^{th} percentile)]

Characteristics		Before COVID-19 pandemic				During COVID-19 pandemic					
		Cigarette smoker (N=235)	Cigarette non-smoker (N=370)	Hookah smoker (N=117)	Hookah non-smoker (N=488)	Cigarette smoker (N=245)	Cigarette non-smoker (N=380)	Hookah smoker (N=132)	Hookah non-smoker (N=493)	Marijuana smoker (N=50)	Marijuana non-smoker (N=575)
Sex	Female	149 (63.4)	280 (75.7)	74 (63.2)	355 (72.7)	155 (63.3)	283 (74.5)	86 (65.1)	352 (71.4)	22 (44.0)	416 (72.3)
	Male	86 (36.6)	90 (24.3)	43 (36.8)	133 (27.3)	90 (36.7)	97 (25.5)	46 (34.9)	141 (28.6)	28 (56.0)	159 (27.7)
Age (years)		22.0 (21.0, 23.0)	22.0 (20.0, 23.0)	21.0 (20.0, 23.0)	22.0 (21.0, 23.0)	22.32±1.86	21.68±1.76	21.72±1.55	21.99±1.89	22.58±1.80	21.87±1.82
Study field	Medical sciences	140 (59.6)	223 (60.3)	68 (58.1)	295 (60.4)	127 (51.8)	217 (57.1)	74 (56.1)	270 (54.8)	29 (58.0)	315 (54.9)
	Technical sciences	55 (23.4)	87 (23.5)	22 (18.8)	120 (24.6)	70 (28.6)	111 (29.2)	41 (31.0)	140 (28.4)	8 (16.0)	173 (30.1)
	Social sciences	40 (17.0)	60 (16.2)	27 (23.1)	73 (15.0)	48 (19.6)	52 (13.7)	17 (12.9)	83 (16.8)	13 (26.0)	87 (15.0)
Year of study	1^{st}	39 (16.6)	76 (20.5)	34 (29.0)	81 (16.6)	41 (16.7)	78 (20.5)	43 (32.5)	76 (15.4)	8 (16.0)	111 (19.3)
	2^{nd}	49 (20.8)	64 (17.3)	21 (17.9)	92 (18.8)	51 (20.8)	66 (17.3)	23 (17.4)	94 (19.1)	10 (20.0)	107 (18.6)
	3^{rd}	58 (24.7)	101 (27.3)	23 (19.6)	136 (27.9)	58 (23.7)	109 (28.6)	26 (19.7)	141 (28.6)	11 (22.0)	156 (27.1)
	4^{nd}*	45 (19.1)	64 (17.3)	13 (11.1)	96 (19.7)	47 (19.2)	62 (16.3)	17 (12.9)	92 (18.7)	14 (28.0)	95 (16.5)
	5^{nd}*	32 (13.6)	50 (13.5)	15 (12.8)	67 (13.7)	33 (13.4)	48 (12.6)	10 (7.5)	71 (14.4)	4 (8.0)	77 (13.5)
	6^{nd}*	12 (5.2)	15 (4.1)	11 (9.6)	16 (3.3)	15 (6.2)	17 (4.7)	13 (10.0)	19 (3.8)	3 (6.0)	29 (5.0)
Environment	Urban	214 (91.0)	300 (81.0)	105 (89.7)	409 (83.8)	222 (90.6)	318 (83.7)	107 (81.1)	433 (87.8)	49 (98.0)	491 (85.4)
	Rural	21 (9.0)	70 (19.0)	12 (10.3)	79 (16.2)	23 (9.4)	62 (16.3)	25 (18.9)	60 (12.2)	1 (2.0)	84 (14.6)

* The fourth year of study at the University of Sarajevo is integrated not only in the studies of medicine, dentistry, veterinary medicine, and pharmacy, but also in several social and technological sciences studies such as law and natural sciences and mathematics. Only medical sciences, such as the medicine, dentistry, veterinary medicine, and pharmacy, have a fifth and sixth year of study.

Table 2 - Cigarette, hookah and other tobacco products (cigars, cigarillos, pipe tobacco and chewing tobacco) consumption frequency in the last 30 days (data presented as absolute numbers and percentages)

Tobacco product	Before COVID-19 pandemic			During COVID-19 pandemic		
	0–10 days over last 30 days	11–29 days over last 30 days	All 30 days	0–10 days over last 30 days	11–29 days over last 30 days	All 30 days
Cigarette	53 (22.5)	81 (34.6)	101 (42.9)	66 (26.9%)	76 (31.0)	103 (42.1)
Hookah	58 (49.6)	55 (47.0)	4 (3.4)	105 (79.5)	21 (15.9)	6 (4.6)
Cigar	12 (80.0)	1 (6.7)	2 (13.3)	15 (93.7)	0 (0.0)	1 (6.3)
Pipe	2 (50.0)	2 (50.0)	0 (0.0)	0 (0.0)	2 (66.6)	1 (33.4)
Chewing tobacco	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (100.0)	0 (0.0)
Marijuana	No data			41 (82.0)	5 (10.0)	4 (8.0)

Table 3 - Independent predictors for cigarettes and hookah consumption before and during the COVID-19 pandemic identified by binary logistic regression

Variable	Odds ratio	95% CI	P value	Variable	Odds ratio	95% CI	P value
Independent predictors for cigarettes consumption among students before COVID-19 pandemic				**Independent predictors for cigarettes consumption among students during COVID-19 pandemic**			
Woman	0.539	0.368–0.790	0.002	Woman	0.571	0.400–0.814	0.002
Rural environment	0.335	0.191–0.585	<0.001	Rural environment	0.556	0.332–0.933	0.026
Older age (22+ years)	1.287	1.122–1.476	<0.001	Older age (22+ years)	1.218	1.111–1.336	<0.001
Younger year of study (1st and 2nd)	0.805	0.667–0.972	0.024	*The model was not statistically significant X^2=10.636, P=0.155; it explained 7.0% (Nagelkerke R2) and correctly classified 61.0% of cases.*			
The model was not statistically significant X^2=5.566, P=0.696; it explained 9.8% (Nagelkerke R2) and correctly classified 65.1% of cases.							
Independent predictors for hookah consumption among students before COVID-19 pandemic				**Independent predictors for hookah consumption among students during COVID-19 pandemic**			
Female	0.595	0.380–0.930	0.023	Not identified			
Younger age (18–21 years)	0.832	0.743–0.932	0.001				
Medical sciences (yes vs no)	0.567	0.328–0.978	0.041				
Technical sciences (yes vs no)	0.683	0.366–1.273	0.230				
The model was not statistically significant X^2=3.960, P=0.861; it explained 4.9% (Nagelkerke R2) and correctly classified 80.4% of cases.							

among cigarette smokers and cigarette non-smokers both before and during COVID-19 pandemic are presented in Table 4. The proportion of cigarette non-smokers who definitely intend not to smoke in the coming year decreased by about 20% during COVID-19 pandemic compared to before it [N_1=267 (72.2%), N_2=259 (51.6%)]. The

Table 4 - Attitudes towards cigarette smoking among responders categorized as cigarette smokers/non-smokers before and during COVID-19 pandemic (data presented as absolute numbers and percentages)

		Before COVID-19 pandemic		During COVID-19 pandemic	
		Cigarette smokers (N=235)	Cigarett non-smokers (N=370)	Cigarette smokers (N=245)	Cigarette non-smokers (N=380)
Do you intend to smoke in the coming year?	Definitely yes	86 (36.6)	10 (2.7)	88 (35.9)	6 (1.5)
	Probably yes	90 (38.3)	32 (8.6)	110 (44.9)	45 (18.3)
	Probably not	30 (12.7)	61 (16.5)	33 (13.5)	70 (28.6)
	Definitely not	29 (12.4)	267 (72.2)	14 (5.7)	259 (51.6)
Would you smoke if you were offered a cigarette by a friend?	Definitely yes	101 (42.9)	15 (4.0)	133 (54.3)	16 (4.2)
	Probably yes	79 (33.6)	37 (10.0)	69 (28.1)	54 (14.2)
	Probably not	20 (8.5)	58 (15.7)	21 (8.6)	52 (13.7)
	Definitely not	35 (15.0)	260 (70.3)	22 (9.0)	258 (67.9)
Do you think that people who smoke tend to have more friends?	Definitely yes	16 (6.8)	14 (3.8)	7 (2.8)	12 (3.1)
	Probably yes	33 (14.0)	63 (17.0)	40 (16.3)	47 (12.3)
	Probably not	76 (32.3)	81 (21.9)	88 (35.9)	98 (25.8)
	Definitely not	110 (46.9)	212 (57.3)	110 (45.0)	223 (58.8)
Do you think it's okay to smoke one or more packs of cigarettes every day?	Definitely yes	17 (7.2)	3 (0.8)	85 (34.7)	186 (48.9)
	Probably yes	30 (12.8)	13 (3.5)	60 (24.5)	45 (11.8)
	Probably not	45 (19.1)	28 (7.5)	44 (17.9)	20 (5.2)
	Definitely not	143 (60.9)	326 (88.2)	56 (22.9)	129 (34.1)
Do you believe that smoking a pack of cigarettes every day is harmful to one's health?	Definitely yes	188 (80.0)	344 (92.9)	186 (75.9)	345 (90.7)
	Probably yes	18 (7.6)	14 (3.7)	50 (20.4)	25 (5.2)
	Probably not	15 (6.3)	7 (1.9)	1 (0.4)	4 (1.0)
	Definitely not	14 (6.1)	5 (1.5)	8 (3.3)	6 (3.1)
Do you believe that cigarette smoke is harmful to your health?	Definitely yes	160 (68.0)	294 (79.4)	114 (46.5)	257 (67.6)
	Probably yes	55 (23.4)	55 (14.8)	97 (39.6)	112 (29.5)
	Probably not	13 (5.5)	10 (2.7)	22 (8.9)	9 (2.3)
	Definitely not	7 (3.1)	11 (3.1)	12 (5.0)	2 (0.6)

portion of both cigarette smokers [N_1=143 (60.9%), N_2=56 (22.9%)] and cigarette non-smokers [N_1=326 (88.2%), N_2=129 (34.1%)] who think it's definitely wrong to smoke one or more packs of cigarettes every day decreased by about 40% and 55% during COVID-19 pandemic compared to before it, respectively. Also, a smaller decrease in the proportion of both cigarette smokers [N_1=160 (68.0%), N_2=114 (46.5%)] and cigarette non-smokers [N_1=294 (79.4%), N_2=257 (67.6%)] who believe that cigarette smoke is definitely harmful to their health is documented during COVID-19 pandemic compared to before it.

Patterns of hookah consumption before and during COVID-19 pandemic

Although more than two thirds of respondents [N_1=457 (75.5%), N_2=488 (78.0%)] reported consuming hookah at least once in their lifetime, only around one fifth of respondents [N_1=117 (19.3%), N_2=132 (21.1%)] were classified as hookah smokers in both study periods. The most common age when responders tried hookah for the first time was 15 or 16 years [N_1=58 (49.6%), N_2=59 (44.7%)]. Demographic characteristics of hookah smokers before and during COVID-19 pandemic are presented in Table 1.

Compared to before COVID-19 pandemic, the portion of hookah smokers who smoked hookah rarely (0–10 days over the last 30 days) increased during pandemic by about 30% [N_1=58 (49.6%), N_2=105 (79.5%)], i.e. on the cost of the proportion of those who smoked hookah more frequently (11–29 days over the last 30 days) [N_1=55 (47.0%), N_2=21 (15.9%)] (Table 2). When smoking hookah during COVID-19 pandemic, N_2=40 (30.3%) hookah smokers reported sharing the same pipe attachment, and N_2=72 (54.5%) would smoke hookah after someone who coughs, sneezes, has a fever, or other COVID-19 associated symptoms. During COVID-19 pandemic almost half of all the respondents (N_2=296, 47.4%) were regularly exposed to hookah smoke as passive smokers, and a quarter of them had a living partner (N_2=78, 12.5%) who smoked hookah at home.

Being a woman (OR=0.595, 95% CI 0.380–0.930, P=0.023), younger age (18–21 years) (OR=0.832, 95% CI 0.743–0.932, P=0.001) and a medical science student (OR=0.567, 95% CI 0.328–0.978, P=0.041) were associated with decreased risk for consuming hookah before the COVID-19 pandemic, while no independent predictor was identified for consuming hookah during the COVID-19 pandemic (Table 3).

Patterns of marijuana consumption during the COVID-19 pandemic

Although more than one third of respondents (N_2=225, 36.0%) reported consuming marijuana at least once in their lifetime, only a small portion (N_2=50, 8.0%) was classified as marijuana users during the COVID-19 pandemic. Demographic characteristics of marijuana users during the COVID-19 pandemic are presented in Table 1. Marijuana was most commonly N_2=41 (82%) consumed 0–10 days over the last 30 days. The frequency of consumption of marijuana and other tobacco products in the last 30 days are presented in Table 2. Respondents N_2=26 (52.0%) consumed marijuana most commonly regardless of the occasion, less commonly N_2=19 (38.0%) only on special occasions, and rarely N_2=5 (10.0%) as a learning stimulus. One third of marijuana smokers (N_2=17, 34.0%) also consumed other marijuana products such as marijuana cookies, brownies, or cannabis oil. The most common ways of obtaining marijuana were face-to-face (N_2=47, 94.0%), from a close friend (N_2=46, 92.0%), or from a local dealer (N_2=40, 80.0%). When marijuana was consumed, the majority of users reported feeling relaxed (N_2=47, 94.0%), less anxious (N_2=43, 86.0%), a change in their personality (N_2=39, 78.0%), happy and satisfied (N_2=34, 68.0%), and confident in social interactions (N_2=31, 62.0%).

No independent predictor for marijuana usage during the COVID-19 pandemic was identified.

Discussion

Our study showed that COVID-19 pandemic seemed to positively affect cigarette smokers' intentions and attempts to smoking cessation, but negatively affecting cigarette non-smokers' attitudes towards cigarette smoking with their decreased determination not to smoke in the coming year and decreased awareness of its harmfulness to the human health. In addition, although the bigger portion of hookah smokers smoked hookah less frequently during COVID-19 pandemic compared to before it, at least one third of them expressed risky behavior related to COVID-19 transmission.

Otherwise, similar portions of cigarette smokers i.e. more than one third, similar number of cigarettes per day, types of cigarettes consumed, and consumption frequency in the last 30 days, with the similar independent predictors of cigarette consumption (being a woman and living in a rural environment associated with a decreased

risk, and an age older than 22 associated with increased risk) were identified both before and during COVID-19 pandemic. Also, the similar portion of respondents i.e. around one fifth, were classified as hookah smokers in both study periods, and only a small portion of respondents (8.0%) were classified as marijuana smokers during COVID-19.

Tobacco product smoking is considered to be a dangerous health hazard, especially during the COVID-19 pandemic when it is marked as a potent way of transmitting the SARS-CoV-2. In fact, the link between tobacco smoking and Sars-Cov-2 infection seems to be bidirectional where the stress, insecurity, boredom, and anxiety induced by the strict epidemiological measures (i.e. lockdown) seem to be associated with an increase in tobacco smoking and relapse from abstinence (17), and, at the same time, smoking seems to facilitate the transmission of Sars-CoV-2.

Despite the recommendations for smoking cessation, or even banned sales of tobacco products during COVID-19 lockdown times (17), some countries reported an increase in tobacco products consumption as a result of strict epidemiological measures (8). A marginal increase in the number of smoked cigarettes per day, and an increased odd of smoking for younger participants were shown during the lockdown (18). The most commonly reported reasons for increased consumption of cigarettes during the COVID-19 pandemic were loss of a daily structure, reward after a hard-working day, loneliness, and conviviality (19). Also, prolonged quarantine was shown to affect addictive disorders as it increases the symptoms of post-traumatic stress disorder and depression (20, 21). Even though smoking is a way of relieving stress for cigarette smokers, it may eventually generate or aggravate negative emotional states leading to an increase in overall stress level (22-24).

On the other hand, the period of self-isolation and lockdown measures can be considered an opportunity to quit cigarette smoking, especially in front of the acknowledged facilitating role of smoking in virus transmission. Our study showed that the COVID-19 pandemic has led to an increase in the proportion of cigarette smokers with intentions and attempts to smoking cessation, with more than a half of them who tried quitting 1–5 times over the last year. However, only 6.5% of them considered additional help to ultimately stop smoking. Another study showed that very few individuals reduced cigarette use (25), and only a minority of people reached smoking cessation during the COVID-19 lockdown measures (17).

Global programs considering smoking cessation mostly focus on the prevention of non-infective respiratory, cardiovascular, and cancer-related illnesses. The WHO has released guidelines for preventing abuse of addictive substances taking into account all the adverse effects COVID-19 pandemic can have on addictions globally (17). However, according to some authors, not enough attention has been given to the transmission of the novel SARS-CoV-2 via smoking (26, 27). Moreover, although without any known mechanism to support it, information about a lower number of cigarette smokers compared to cigarette non-smokers among hospitalized patients with COVID-19 was spread in an early pandemic period resulting in the hypothesis that the intake of nicotine or other cigarette components may reduce the likelihood of developing COVID-19 disease (28, 29). However, next to studies on traditional tobacco products (6, 7), a study on electronic cigarette (e-cigarette) use showed that the ongoing youth e-cigarette epidemic also contributed to the COVID-19 pandemic (30). Both dual (cigarette and e-cigarette) and e-cigarette use can be associated with getting infected with COVID-19 for multiple reasons, such as increased exposure to nicotine and other chemicals that impair lung function, or spreading virus particles

by touching one's mouth with contaminated hands and sharing devices (30). Our findings of decreased determination not to smoke in the coming year among cigarette non-smokers, and decreased awareness of its harmfulness among both cigarette smokers and especially non-smokers during COVID-19 pandemic compared to before it, could be, at least partly, explained by the initial spread of a speculation that cigarette smokers were less likely to develop COVID-19 disease. Also, despite the efforts made in the field of education and tobacco control in the earlier years, young people in B&H, including students, seem to smoke cigarettes as a means of general stress relief, suggesting the limited knowledge on tobacco harmfulness. Sustaining control of tobacco consumption is even more important during the pandemic in order to prevent smoking-mediated transmission of the coronavirus.

Hookah smoking has recently been determined to be a worldwide public health risk (31), with the highest prevalence in Eastern Mediterranean and European countries, and higher among youth than adults (32). Compared to cigarette smoking, hookah smoking, usually smoked for the first time at the age of 15 or 16 years, remained less popular among our students both before and during COVID-19 pandemic. Hookah smoking appeared to be less popular than cigarette smoking in other Western nations as well, and it was argued that it was significantly tied to the country's heritage (33). According to our data from before the COVID-19 pandemic, hookah was less likely to be smoked among younger ages (18–21 years). An earlier study among high school students in Saudi Arabia revealed a prevalence of shisha smoking of 65.9% among men (34). Being a woman was also a negative predictor of hookah consumption before COVID-19 pandemic in our study. The change in pattern of hookah consumption seen in our study, with the bigger portion of hookah smokers who smoked hookah less frequently during COVID-19 pandemic compared to before it, could be attributed to the closure of numbers of hookah bars during the mandatory non-essential service lockdown measures during the COVID-19 pandemic.

Taking into consideration a public health education perspective, the biggest obstacle to the implementation of hookah cessation programs is the belief that the negative health impact is lower or non-existent in comparison to other forms of tobacco products (35, 36). However, given the public health risks it poses for COVID-19 transmission, some countries had placed restrictions on hookah use (37-39). Egypt and the United Arab Emirates recently banned hookah use (37). In Canada, hookah use is illegal in restaurants, bars and enclosed workplaces (38, 40). The proportion of hookah smokers who expressed risky behavior during COVID-19 pandemic was surprisingly high in our study, i.e. one third of smokers reported sharing the same pipe attachment, and one half reported willingness to smoke hookah after someone with COVID-19 associated symptoms. Although international healthcare guidelines strongly advise against this risky habit (39), more effort should be made to inform students regarding the harmful effects of the newly acquired habits as well as to appeal to governmental agencies for regulations.

Compared to cigarette and hookah smoking, only a small proportion of respondents (8.0%) were classified as marijuana smokers during COVID-19. An earlier study from B&H showed marijuana consumers to be likely from urban areas, 15 to 17 years old, and with no difference regarding sex (41). Our study during the COVID-19 pandemic confirmed marijuana consumers to be mostly from urban areas, but mostly males. Similar to smoking, the most commonly reported reasons for the global increase in the use of marijuana were boredom and anxiety (18). This is expected, 55% marijuana users smoke cigarettes as well. A study from Belgium

reported no change in cannabis consumption during the social isolation, and the authors discussed that this might have reflected the zero-net effect of increased need and its reduced availability during the lockdown (19).

Although it used standardized questionnaires distributed to the same pool of undergraduate students in both study periods, this study had numerous limitations. First, the cross-sectional research design restricted our ability to infer causality. Second, the study period 1 was described by data from the historical cohort from January 2020 (13), and there was a small increase in the participation rate in the study period 2 (4.2% vs 3.7%) that could be attributed to strict lockdown and other epidemiological measures at the time of the sampling, making students more prone to fill out the questionnaires, as well as to a longer available period of the second survey. Third, due to respect for anonymity and confidentiality of participants in both study periods, we could not track the individual participants who took part in both study periods and thus could not perform statistical comparisons in related samples of respondents. Fourth, the covariates analyzed (gender, environment, age, year of study, type of study) could not permit to fully understand the impact of COVID-19 pandemics on smoking patterns, even more since respondents could apparently have changed in the second study period. Therefore, the found differences in ORs could be linked not only to smoking habits and related risk factors, but also to the choice to participate in the study or to refuse participation. Other study limitations included a lack of questions that could have subjectively assessed how did the pandemic affect the smoking patterns and the online sampling method which confined the study to students with internet access.

In conclusion, although the proportion of cigarette smokers has not changed during the COVID-19 pandemic compared to before it, it seemed to positively affect intentions and attempts to smoking cessation among cigarette smokers. However, despite the acknowledged role that smoking could have on COVID-19 transmission, the attitudes towards cigarette smoking, including the determination not to smoke among cigarette non-smokers and awareness of smoking harmfulness among both cigarette smokers and especially cigarette non-smokers, were negatively affected.

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Riassunto

Impatto della pandemia di COVID-19 sul modello di utilizzo di sigarette, narghilé e marijuana da parte degli studenti dell'Università di Sarajevo, Bosnia & Herzegovina: ripetizione di uno studio trasversale

Obiettivi. Scopo del presente studio è stato di definire l'impatto della pandemia di COVID-19 sulle modalità di consumo di sigarette e marijuana, nonché d'uso del narghilè, da parte degli studenti dei primi anni d'Università in Bosnia ed Herzegovina.

Metodi. La fase 1 del doppio studio trasversale è stata effettuata tra gli studenti dell'Università di Sarajevo dal 22 al 26 Gennaio 2020, prima che si verificasse il primo caso di COVID-19 in Bosnia-Herzegovina (periodo di studio N 1), mentre la fase 2 è stata effettuata dal 25 Marzo al 26 Agosto 2021, durante la terza ondata della pandemia di COVID-19 (periodo di studio N 2).

Risultati. La maggioranza dei 1,230 soggetti che hanno partecipato era rappresentata da donne (N_1 70,9%, N_2 70,1%), iscritte a Medicina (N_1 60,0%, N_2 55,0%), nel 3° anno di studi (N_1 26,3%, N_2 26,7%), residenti in ambito urbano (N_1 84,9%, N_2 86,4%). Simili proporzioni di fumatori (N_1 38,5%, N_2 39,2%), e simili, ma più piccole proporzioni di fumatori di narghilè (N_1 19,3%, N_2 21,1%), sono state identificate in entrambi i periodi di studio, mentre la proporzione più piccola di fumatori di marijuana (N_2 8,0%) è stata identificata durante la pandemia. Numeri simili di sigarette/dì, tipi di sigarette consumate e frequenza di consumo negli ultimi 30 giorni con simili, indipendenti predittori del consumo di sigarette (essere donna e vivere in ambiente rurale associati con una riduzione dei rischi, ed età superiore a 22 anni, associata invece ad un incremento del rischio) sono stati identificati sia prima che durante la pandemia da COVID-19.

Rispetto a prima della pandemia di COVID-19, durante la pandemia si è osservata una tendenza all'aumento delle intenzioni (73,6% vs 81,2%) e dei tentativi (51,9% vs 75,1%) di smettere di fumare tra i fumatori di sigarette, ma ad una riduzione nell'intenzione di non iniziare a fumare tra i non fumatori di sigarette (N_1 72,2%, N_2 51,6%), e una ridotta coscienza del fatto che il fumo è dannoso sia tra i fumatori (N_1 68,0%, N_2 46,5%) che – ancor più – tra i non fumatori (N_1 60,9%, N_2 22,9%). In aggiunta, un comportamento a rischio è risultato evidente tra i fumatori di narghilè durante il periodo pandemico.

Conclusioni. La pandemia di COVID-19 appare influenzare positivamente le intenzioni e i tentativi di smettere di fumare da parte dei fumatori di sigarette, ed influenzare invece in senso contrario gli atteggiamenti verso il fumare sigarette da parte dei non fumatori.

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