

ATTITUDES AND KNOWLEDGE OF MEDICAL STUDENTS CONCERNING PREVENTION AND PHARMACOTHERAPY OF COVID-19 INFECTION IN SERBIA

STAVOVI I INFORMISANOST MEĐU STUDENTIMA MEDICINE O PREVENCIJI I FARMAKOTERAPIJI COVID-19 INFEKCIJE U SRBIJI

Milica Ivanišević¹, Branislava Medić Brkić², Vedrana Pavlović³

¹ Univerzitet u Beogradu, Medicinski fakultet, Beograd, Srbija

² Univerzitet u Beogradu, Medicinski fakultet, Institut za farmakologiju, kliničku farmakologiju i toksikologiju, Beograd, Srbija

³ Univerzitet u Beogradu, Medicinski fakultet, Institut za medicinsku statistiku i informatiku, Beograd, Srbija

Correspondence: ivanisevicmilica4@gmail.com

Abstract

Introduction: COVID-19 infection represents a worldwide health issue. To prevent the infection, it is necessary to possess adequate knowledge regarding the virus itself, transmission routes, clinical forms of disease and prevention measures. Also, it is crucial to stay informed about protocols and pharmacotherapeutic options in the treatment of patients infected with the SARS-CoV-2 virus.

Aim: This study aimed to investigate knowledge and attitudes about prevention and pharmacotherapy of COVID-19 infection among students of the Faculty of Medicine, University of Belgrade as well as compare differences between 1st, 3rd and 6th year students.

Material and methods: A cross-sectional study was conducted among 479 students of all six years of study. The questionnaire was distributed online and it was available between November 30 and December 20, 2021. Results were obtained and analyzed in statistical software SPSS 22.0 (IBM Corp. IBM SPSS Statistics for Windows. Armonk, NY: IBM Cor; 2017).

Results: Most of the students that took the part in the survey were females (72%) and the majority of our participants were vaccinated against COVID-19 infection at the time of the survey (92.7%). The vaccination rate in 1st year students was 78.8%, in 3rd year 97.3% and 97.4% in 6th year students. Different than the 6th year students, 1st year students tend to believe that vaccine is the most efficient preventive measure (medium value \pm standard deviation; 1.2 ± 0.1 vs 0.7 ± 0.1 ; $p < 0.001$). The results showed that there is a significant difference in knowledge about pharmacotherapy of this infection between students at the beginning of the studies and older peers ($p < 0.001$).

Conclusion: Students showed progress in understanding pharmacotherapy during their studies in the Faculty of Medicine, meaning that courses they take in Pharmacology and Toxicology and clinical experience improve their knowledge and skills when it comes to therapeutic approaches.

Keywords:

COVID-19,
medical students,
pharmacotherapy,
questionnaire

Sažetak

Uvod: Pandemija COVID-19 predstavlja svetski zdravstveni problem. Da bi se infekcija virusom prevenirala neophodno je posedovati adekvatno znanje o virusu, njegovom širenju, kliničkim oblicima bolesti i neophodnim merama prevencije. Takođe je važno biti informisan i o protokolima i farmakoterapijskim mogućnostima prilikom zbrinjavanja pacijenata sa COVID-19 infekcijom.

Cilj: Cilj ove studije je bio da se istraže znanja i stavovi studenata Medicinskog fakulteta Univerziteta u Beogradu vezanih za prevenciju i farmakoterapiju ove infekcije, kao i da se uporede razlike među studentima prve, treće i šeste godine studija.

Materijal i metode: Studija preseka je sprovedena među 479 studenata na svim godinama studija. Anketa je izvršena putem interneta i bila je dostupna od 30. novembra do 20. decembra 2021. godine. Rezultati su prikupljeni i analizirani u statističkom softveru SPSS 22.0 (IBM Corp. IBM SPSS Statistics for Windows. Armonk, NY: IBM Cor; 2017).

Rezultati: Većina učesnika je bila ženskog pola (72%) i vakcinisana u vreme izvođenja studije (92,7%). Procenat vakcinisanih studenata na prvoj godini iznosio je 78,8%, na trećoj 97,3%, a na šestoj godini 97,4%. Za razliku od studenata šeste godine, studenti prve godine teže stavu da je vakcinacija najefikasnija preventivna mera (aritmetička sredina \pm standardna devijacija; $1,2 \pm 0,1$; $0,7 \pm 0,1$; $p < 0,001$). Pored toga, rezultati prikazuju da studenti treće i šeste godine imaju značajno kvalitetnije znanje na polju farmakoterapije ove infekcije ($p < 0,001$).

Zaključak: Studenti tokom studija na Medicinskom fakultetu pokazuju značajan progres u razumevanju farmakoterapije, što ukazuje na to da predmet Farmakologija sa toksikologijom i kliničko iskustvo koje dobiju značajno unapređuju njihovo znanje i veštine.

Ključne reči:

COVID-19,
studenti medicine,
farmakoterapija,
anketa

Introduction

New emerging infectious diseases are a modern-day health issue that is present worldwide. In late 2019, China was struck by the eruption of a, then yet unknown, virus now named SARS-CoV-2 (1). This virus belongs to the family of *Coronaviridae* and it causes life-threatening respiratory disease and multiorgan dysfunction. Fighting against this pandemic is complicated for several reasons. One of the therapeutical problems is the fact that there is a wide spectrum of clinical forms, from asymptomatic cases to severe acute respiratory syndrome (2). It is known that asymptomatic transmission of this virus is possible and quite often present in the population (3). Looking from the side of epidemiology, asymptomatic cases are those that represent a significant threat to public health (4). Those patients usually remain unaware that they could endanger other people, which makes the virus spreading much more possible. This kind of transmission is extremely concerning and hard to control.

Besides this, another concerning characteristic of this virus is its ways of transmitting. There were many studies that tried to find out all possible ways of transmission, and scientists came to the conclusion that this virus could be spread, not only via respiratory droplets, as it was previously believed, but it could also be airborne (5-7). Furthermore, infection is not so often, but still possible by indirect transmission via contaminated objects (8). This makes it clear that controlling epidemic and pandemic in general, caused by this virus, is tremendously complicated.

In order to end this health threatening situation, it is very important to develop sufficient strategies for prevention of infection and its therapy. This is necessary not

only for those strategies to be known by health workers, but it is also crucial to educate young generations and the population in general. Students of medicine, as future medical doctors, have a great influence on people that surround them. Their knowledge could help in spreading the awareness of how important is to apply different measures in order to maintain the health and end the pandemic. In addition, medical students were included during the pandemic in sharing information that is of great importance, as well in the vaccination process. Beside this, it is shown that people that have more accurate information and more knowledge about this disease and pandemic have bigger tendencies to take all preventive measures (9). This leads to the conclusion that educating people about SARS-CoV-2 infection could be a good base for suppressing the transmission and ending of pandemic.

The curriculum of our Faculty has two courses related to Pharmacology during studies. First contact with this content is on the third year of studies in the course of Pharmacology and Toxicology. Second course is on the sixth and last year of studies named - Clinical Pharmacology.

The aim of this study was to examine the attitudes and knowledge of medical students regarding prevention and pharmacotherapy of this infectious disease and to compare the knowledge of the 1st, 3rd and 6th year students.

Material and methods

Study design

A cross-sectional study at the University of Belgrade, Faculty of Medicine, was conducted among 479 students

on all six years of studies. Due to the pandemic, researchers were faced with online education and less options for face-to-face survey. Therefore, the best option in order to rise visibility of the survey among students was to distribute the questionnaire online. The questionnaire was available online, by social networks (closed Facebook groups, WhatsApp) (10, 11). Students were motivated to forward the survey link to their peers in order to increase the response rate. The survey was generated using the Google platform, Google Form tool.

Questionnaire

Medical students completed an anonymous questionnaire entitled "Attitudes and knowledge of medical students concerning prevention and pharmacotherapy of COVID-19 infection in Serbia" (12). The questionnaire was developed at the Department of Pharmacology, Clinical Pharmacology and Toxicology, Faculty of Medicine, University of Belgrade.

Access to the questionnaire was possible between November 30 and December 20, 2021. The survey had three sections which contained demographic, multiple-choice, 5-point Likert scale and binary questions.

The first one was consisted of general data (such as gender, age, the average study score, grade obtained in Pharmacology etc.), as well as questions regarding vaccination process in the country. Furthermore, students were asked about their vaccination status in prevention of COVID-19 and the reasons why they were not vaccinated, if that was the case.

The second section was consisted of the 5-point Likert scale multiple-choice questions, to measure the agreement with the statement from "strongly disagree" (1) to "strongly agree" (5) where students gave information about their attitudes regarding COVID-19 infection and how they inform themselves about this pandemic.

In the third and the last section, their knowledge about this infection, transmission routes and pharmacotherapeutic options was surveyed. After collecting all the necessary data, the survey was closed and we proceeded with statistical analysis.

The survey was available to students of all years. Response rate in the 2nd, 4th and 5th year was small (less than 10%). In the results section, statistical analysis of all obtained data will be presented, while the comparative statistics will be focused only on the answers gained from 1st, 3rd and 6th year students. There are two reasons for such a decision. The first reason lays in insufficient response rate in other years of study. The second reason is the fact that researchers wanted to examine whether there is a difference in knowledge and attitudes of students at the beginning of the Faculty of Medicine (1st year), in the middle (3rd) and in the end (6th) of studies. Also, 3rd and 6th year students have classes in the field of pharmacotherapy (Basic Pharmacology in third and Clinical Pharmacology in final year of study), therefore the effect of these courses on their knowledge regarding COVID-19 infection and pharmacotherapeutic approach was analyzed.

Statistical analysis

The primary obtained data was analyzed using descriptive statistics. Measures of central tendency (the mean value - \bar{x} , the median value - med), measures of variability (standard deviation - SD) and structural indicators were used in percentages. In order to compare participants, Pearson's chi-square test or Fisher's exact test for categorical data and ANOVA for numerical data were used. Analysis was done on the level of significance (alpha level) 0.05. All data that were inputted online were collected.

Results

Demographic characteristics, vaccination rate and success during studies

Out of 479 total responses gained through the questionnaire, 343 responses were from students that study in 1st, 3rd and 6th year of studies. The questionnaire was completed by a total of 118 out of 555 students of the 1st year (21.3%), 110 out of 438 students of the 3rd year (25.1%) and 115 out of 523 students of the 6th year (21.9%). Results of the survey show that the preponderance of our examinees were females, 345 out of 479 (72%). Average age of participants was 21.8 ± 2.6 (table 1).

Table 1. Age of participants.

Age	\bar{x}	sd	med	min	max
Male	21.8	3.0	22	18	34
Female	21.8	2.5	22	18	35
Total	21.8	2.6	22	18	35

\bar{x} - the mean value; med - the median value; sd - standard deviation.

Among all students that participated in this survey, 92.7% of them were fully vaccinated (two doses of some of the available vaccines in our country) in the time that questionnaire was available online. First-year respondents had vaccination rate of 78.8%, while the other two groups had higher number of vaccinated students at the time of conducting the survey (3rd year respondents had 97.3%, 6th year respondents 97.4%).

Average grade during the studies of medicine was 8.7 ± 0.8 and average grade in Pharmacology and toxicology was 8.7 ± 1.2 out of 10 (keeping in mind that students on the first year of studies do not have nor average grade during the studies nor the grade in this particular course).

COVID-19 information and attitudes about preventive measures

In this part of survey, the respondents were asked which sources of information they found most important, and the majority of students indicated the scientific publications as most relevant (figure 1).

Students were asked to express how meaningful

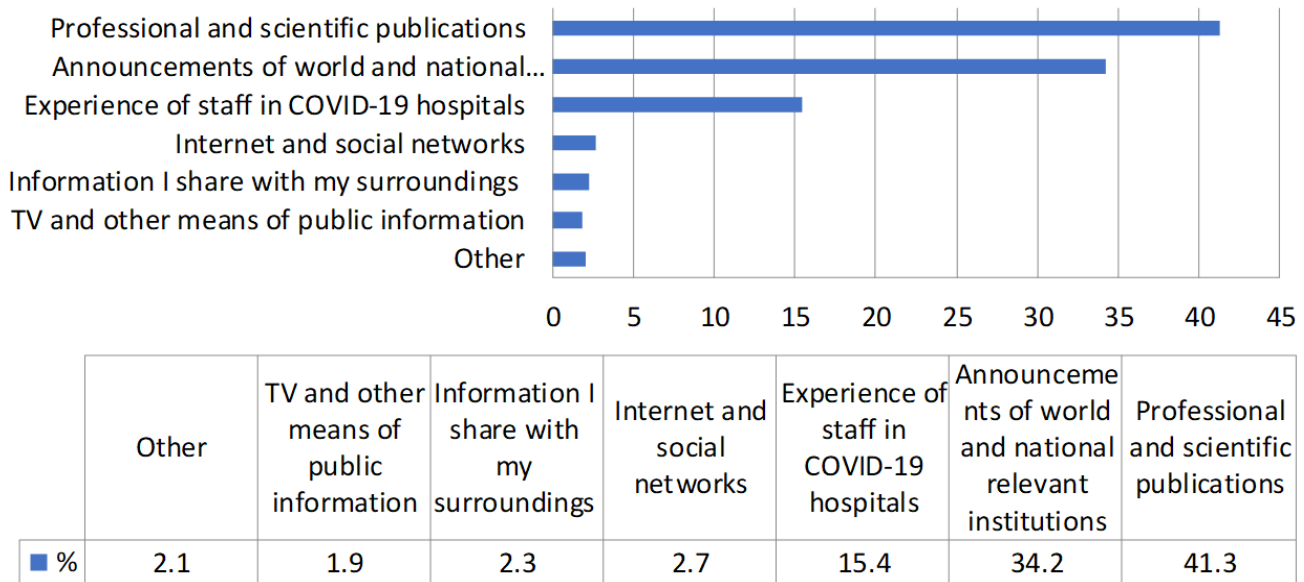


Figure 1. Which sources of information students find most important.

Table 2. Students' assessment of importance of preventive measures and comparison.

	\bar{x}	sd	med	min	max
Grade your health status:	4.5	0.7	5.0	2.0	5.0
How important do you think it is crucial for students of medicine to be aware of possibilities of prevention and pharmacotherapy of COVID-19 infection:	4.7	0.6	5.0	1.0	5.0
How would you grade your own knowledge about possibilities of prevention and pharmacotherapy of COVID-19 infection?	3.7	0.8	4.0	1.0	5.0
How much do you keep to the newest recommendation about the pharmacotherapy of COVID-19 infection?	3.3	1.1	3.0	1.0	5.0
How much do you think students of medicine in Belgrade adhere to preventive epidemiological measures?	3.5	1.0	4.0	1.0	5.0
Do you think that prophylactic usage of supplements can decrease the risk of getting a COVID-19 infection?	2.8	1.0	3.0	1.0	5.0
	1 st year ($\bar{x} \pm SD$)	3 rd year ($\bar{x} \pm SD$)	6 th year ($\bar{x} \pm SD$)	P	
Grade your health status, mean \pm sd	4.6 \pm 0.7	4.4 \pm 0.7	4.4 \pm 0.7	1 st vs 3 rd 0.089 1 st vs 6 th 0.126 3 rd vs 6 th 0.854	
How important do you think it is crucial for students of medicine to be aware of possibilities of prevention and pharmacotherapy of COVID-19 infection, mean \pm sd	4.6 \pm 0.7	4.7 \pm 0.5	4.7 \pm 0.5	1 st vs 3 rd 0.223 1 st vs 6 th 0.085 3 rd vs 6 th 0.630	
How would you grade your own knowledge about possibilities of prevention and pharmacotherapy of COVID-19 infection, mean \pm sd	3.7 \pm 1.0	3.6 \pm 0.8	3.8 \pm 0.8	1 st vs 3 rd 0.955 1 st vs 6 th 0.122 3 rd vs 6 th 0.115	
How much do you keep to the newest recommendation about the pharmacotherapy of COVID-19 infection, mean \pm sd	3.0 \pm 1.1	3.4 \pm 1.1	3.4 \pm 1.0	1 st vs 3 rd 0.008* 1 st vs 6 th 0.005* 3 rd vs 6 th 0.911	
How much do you think students of medicine in Belgrade adhere to preventive epidemiological measures, mean \pm sd	3.8 \pm 1.0	3.4 \pm 1.0	3.5 \pm 0.9	1 st vs 3 rd 0.004* 1 st vs 6 th 0.020* 3 rd vs 6 th 0.547	
Do you think that prophylactic usage of supplements can decrease the risk of getting a COVID-19 infection, mean \pm sd	3.1 \pm 1.0	2.7 \pm 1.0	2.6 \pm 1.0	1 st vs 3 rd 0.014* 1 st vs 6 th <0.001* 3 rd vs 6 th 0.227	

\bar{x} - the mean value; med - the median value; sd - standard deviation.

they find adherence to measures; how much they are informed about new measures and how important do they find supplements as form of prophylaxis of COVID-19 infection. They graded their opinion according to 5-point Likert scale (table 2). Additionally, students of 1st, 3rd and 6th year were compared and gained results that show that there is significant difference between them (table 2). These results showed that students of 3rd and 6th year keep track of new recommendations more than youngest colleagues (arithmetic mean ± standard deviation; 1st year - 3.0 ± 1.1 vs 3rd year - 3.4 ± 1.1, p < 0.05; 1st year - 3.0 ± 1.1 vs 6th year - 3.4 ± 1.0, p < 0.05).

Furthermore, 1st year students tend to believe that other peers of the Faculty of Medicine in Belgrade adhere significantly to preventive measures, which is not the case with older ones (1st year - 3.8 ± 1.0 vs 3rd year - 3.4 ± 1.0, p < 0.005; 1st year - 3.8 ± 1.0 vs 6th year - 3.5 ± 0.9, p < 0.05). Moreover, first year students have an opinion that supplements are important for the prophylaxis contrary to older peers (1st year - 3.1 ± 1.0 vs 3rd year - 2.7 ± 1.0, p < 0.01; 1st year - 3.1 ± 1.0 vs 6th year - 2.6 ± 0.9, p < 0.001).

Knowledge about COVID-19 infection and pharmacotherapy

In the last set of questions, the knowledge of medical students regarding COVID-19 infection was examined. Among 479 students that filled the questionnaire, 214 (44.7%) of them gave incorrect answer regarding routes of transmission routes of COVID-19 infection regardless of their year of study (p > 0.05) (table 3). The numerical data showed in table 4 and table 5 refers to number of students that answered positively on listed statements.

On the other hand, 96% of students in total are well informed about different clinical forms of this infection and they are aware that COVID-19 positive people do not have to express any kind of symptoms. Moreover, 94.8% gave the correct answer that pharmacotherapeutic approach is dependent on clinical form. There was no statistical

Table 3. Students' knowledge about COVID-19 infection and pharmacotherapy.

	n	%
COVID-19 infection is transmitted exclusively by droplets.	214	44.7
COVID-19 positive people always have some of characteristic symptoms.	19	4.0
Pharmacological therapy of COVID-19 infection is conducted depending on form of disease.	454	94.8
Pharmacological therapy of COVID-19 infection necessarily includes some antibiotics.	147	30.7
Pharmacological therapy of COVID-19 infection necessarily includes some antiviral drugs.	138	28.8
Pharmacological therapy of COVID-19 infection necessarily includes some corticosteroid drugs.	63	13.2
Anticoagulant therapy in COVID-19 infection can include low molecular weight heparin.	403	84.1
Application of biological therapy in COVID-19 infection is recommended in progression of process on lungs and/or progression of inflammation markers amid previously applied therapy.	368	76.8

significance in these responses among the observed groups of students (p > 0.05).

Beside this, there is no significant difference in knowledge regarding epidemiological characteristics of this virus and its routes of transmission between students of examined years (p > 0.05).

On the other hand, results showed that there is a significant difference in knowledge regarding therapeutic protocols between students. Students of the 1st year had significantly more incorrect answers regarding the application of antibiotics, antiviral drugs as well as corticosteroid drugs in the treatment of COVID-19 infection, while students that have previously taken the course of Pharmacology (6th year students) and those that attended this course during the survey (3rd year students), in majority, gave correct answers on this topic (p < 0.05) (table 4).

Table 4. Comparison of knowledge between students on first, third and sixth year of studies.

	1 st year	3 rd year	6 th year	p
COVID-19 infection is transmitted exclusively by droplets, n (%)	49 (41.5)	59 (53.6)	50 (43.5)	0.148
COVID-19 positive people always have some of characteristic symptoms, n (%)	11 (9.3)	5 (4.5)	0 (0.0)	0.004*
Pharmacological therapy of COVID-19 infection is conducted depending on form of disease, n (%)	108 (91.5)	106 (96.4)	111 (96.5)	0.152
Pharmacological therapy of COVID-19 infection necessarily includes some antibiotics, n (%)	67 (56.8)	28 (25.5)	17 (14.8)	< 0.001*
Pharmacological therapy of COVID-19 infection necessarily includes some antiviral drugs, n (%)	53 (44.9)	37 (33.6)	14 (12.2)	< 0.001*
Pharmacological therapy of COVID-19 infection necessarily includes some corticosteroid drugs, n (%)	26 (22.0)	13 (11.8)	5 (4.3)	< 0.001*
Anticoagulant therapy in COVID-19 infection can include low molecular weight heparin, n (%)	92 (78.0)	91 (82.7)	98 (85.2)	0.343
Application of biological therapy in COVID-19 infection is recommended in progression of process on lungs and/or progression of inflammation markers amid previously applied therapy, n (%)	85 (72.0)	94 (85.5)	81 (70.4)	0.016*

Table 5. Comparison between years.

	1 st year (x̄ ± SD)	3 rd year (x̄ ± SD)	6 th year (x̄ ± SD)	P
I think COVID-19 infection is very serious and life-threatening, mean ± sd	1.0 ± 0.1	1.0 ± 0.1	0.8 ± 0.1	1 st vs 3 rd 0.679
				1 st vs 6 th 0.208
				3 rd vs 6 th 0.408
I think vaccine is one of the most efficient measures in preventing the COVID-19 infection, mean ± sd	1.2 ± 0.1	0.9 ± 0.1	0.7 ± 0.1	1 st vs 3 rd 0.001*
				1 st vs 6 th < 0.001*
				3 rd vs 6 th 0.213
I think the benefit of these vaccines is far more significant than potential side effects, mean ± sd	1.1 ± 0.1	0.9 ± 0.1	0.8 ± 0.1	1 st vs 3 rd 0.001
				1 st vs 6 th < 0.001*
				3 rd vs 6 th 0.121
I think it is necessary to introduce new drugs in order to improve prevention and therapy of COVID-19 infection in our country, mean ± sd	1.0 ± 0.1	0.9 ± 0.1	0.8 ± 0.1	1 st vs 3 rd 0.224
				1 st vs 6 th 0.031*
				3 rd vs 6 th 0.356

x̄ - the mean value; sd - standard deviation.

Regardless of the lowest rate of vaccination in 1st year participants, those students believe significantly more than both students of 3rd and 6th year, that vaccination is the most efficient preventive measure (1st year - 1.2 ± 0.1 vs 3rd year - 0.9 ± 0.1, p < 0.001; 1st year - 1.2 ± 0.1 vs 6th year - 0.7 ± 0.1, p < 0.001) (**table 5**).

Discussion

In the study, researchers managed to collect important data about knowledge and attitudes of medical students regarding prevention and pharmacotherapy of COVID-19 infection in Serbia. Female students were more interested to take part in this survey, similar to some previous studies conducted at the Faculty of Medicine, University of Belgrade (13).

Based on the results, students of medicine are well informed about relevant sources of accurate information and they in majority rely on WHO guidelines and similar institutions, as well as, scientific publications. Those results are consistent with the results gained in one Italian study, but contrary to them, students of the Faculty of Medicine in Belgrade gave significantly less meaning to learning from social networks (14).

Encouraging results of the vaccination rate which is far higher than in general population in Serbia showed that students of the Faculty of Medicine, University of Belgrade know that vaccination process represents the crucial step in suppressing the raging pandemic. Observing the high vaccination rate among participants and in another study (15), it is notable that students are now more likely to accept and believe in efficiency of this preventive measure compared to the period of time when the vaccines were in the phase of development (16, 17). Even though the vaccination rate is high among these students, surprisingly, results showed that the youngest peers are more likely to believe that vaccination is the most efficient preventive measure. In addition to that, they are also more convinced that their classmates have acceptable preventive behavior.

When asked about the topic of preventive behavior, the majority of participants agreed that it is highly necessary for students of medicine to be aware of all preventive measures. On the other hand, they are not quite convinced in general that peers tend to adhere to preventive measures, such as wearing the mask, keeping social distance, using disinfection methods etc. This leads to the justified concern on how much students are willing to withhold from certain everyday activities that promote the spread of this virus. These results do not stand in agreement with some previous studies (14, 18) and the explanation could lay in the fact that those studies were conducted earlier, when the pandemic could have been taken more seriously.

Analyzing the results of how students would grade themselves about how much they are familiar with pharmacotherapy, the conclusion is that students on the 1st year of studies are not aware that knowledge that they have on this topic is inaccurate. On the other hand, students that had contact with the course of Pharmacology and toxicology are very well informed about therapeutic options. This leads to the assumption that during the course that educate students about pharmacotherapeutic possibilities, students efficiently gain knowledge and make progress.

Contrary to pharmacy students, medical students were less likely to believe that taking supplements can be helpful in preventing and treating COVID-19 infection (19). Even though 94.8% of the participants answered correctly that treatment of COVID-19 positive patients depends on the clinical form of disease, 30.7% of them believed that therapy always contains antibiotics. The fact that more than 50% of first year respondents marked antibiotic therapy as necessary in COVID-19 infection is also noteworthy due to the worldwide concerning health issue - growing antibiotic resistance. In 2020, there was a study that investigated world-wide, how much antibiotics were used during the time of the pandemic. Results of that study showed that the majority of health workers followed local protocols for COVID-19 treatment, but the usage of the antibiotics was concerningly common, which raises the

concern if these drugs are used more than justified and how this can reflect on growing resistance (20). Positive side of the answers collected during the survey, is a fact that older students are aware that antibiotic therapy in this disease is not always necessary, especially students on the last year of studies, where only 14.8% of them think otherwise.

General knowledge about COVID-19 and its therapy was superior in those students that had some form of clinical education which stands in the agreement with previous studies that showed dependance of knowledge on years of age and education (21-23). This means that experience and more sufficient knowledge students gain through-out their education is exquisitely important and should not be neglected during this pandemic. Therefore, students should be encouraged to go for adequate preventive behavior and be included, as before the pandemic, in the clinical practice in order to gain valuable experience and develop their knowledge.

The study has potential limitations - response rates in the questionnaire were not bigger than 20% in each year of studies, therefore, this could have influenced the outcome of the results.

Conclusion

Generally, it could be said that medical students showed noteworthy progress during their studies in understanding pharmacotherapeutic approach in COVID-19 disease. This means that the teaching in this field of medicine and clinical practice during the later years of studies give opportunity to students to gain sufficient knowledge and understand everyday clinical practice. Students that are in the beginning of their studies have significantly poorer knowledge on the topic of pharmacotherapy in COVID-19. This could open a question whether is it necessary to include younger peers in more clinical practice and introduce them earlier with rational drug application. At last, results of this study are optimistic and they show that during six years of the Faculty of Medicine, students develop and become competent for their future profession.

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