Pak. J. Chest Med. 2023;29(04)

Original Article

journal homepage: https:/www.pjcm.net/

Pakistan Journal of Chest Medicine

Official journal of Pakistan Chest Society

Adverse Effects of COVID-19 Vaccines Among Medical Students: A Study from Khyber Pakhtunkhwa

Safia Khanam[1], Uzma Hidayat[2], Sajjad Naseer[3], Munir Hussain[1]✉, Zia Ullah[4]

[1]Khyber Girls Medical College, Peshawar – Pakistan [2]Programmatic Management of Drug Resistant TB Unit, Lady Reading Hospital, Peshawar – Pakistan [3]Department of Pulmonology, Fazaia Medical College, Islamabad - Pakistan [4]Peshawar Medical College, Riphah International University, Islamabad - Pakistan

Corresponding Author:
Munir Hussain
Khyber Girls Medical College,
Peshawar – Pakistan
Email: sendtodrmunir@gmail.com

Article History:

Received:	Jan 03, 2023
Revised:	Mar 11, 2023
Accepted:	Apr 22, 2023
Available Online:	Dec 02, 2023

Author Contributions:
MU conceived idea, SK ZU drafted the study, SK UH SN collected data, MU SK did statistical analysis and interpretation of data, SN ZU did critical reviewed manuscript. All approved final version to be published.

Declaration of conflicting interests:
The authors declare that there is no conflict of interest.

How to cite this article:
Khanam S, Hidayat U, Naseer S, Hussain M, Ullah Z. Adverse Effects of COVID-19 Vaccines among Medical Students: A study from Khyber Pakhtunkhwa. Pak J Chest Med. 2023;29(04): 439-446.

A B S T R A C T

Background: Vaccinations protect against disease through a variety of ways, but the process of developing immunity might result ia side effects. Up till effective vaccines are widely distributed to the entire globe with fewer side effects, breakouts and disruptions to social and economic life are probably risks.

Objective: Objective of the present study was to investigate the prevalence and seriousness of COVID-19 vaccine-related side effects among the students of different medical colleges.

Methodology: The present study was of cross-sectional designed carried out at several Medical Colleges of Khyber Pakhtunkhwa. Between July 2022 and December 2022, data were gathered. Analysis was done on sociodemographic and clinical data, immunization schedules, and adverse effects.

Result: The study had 470 vaccine recipients in total. Ages of the respondents ranged from 18 to 25, with a mean age of 16.96 ± 6.3 years. Additionally, it was noted that 253 (53.8%) females and 217 (46.17%) males who had COVID-19 vaccinations. Only, 39.48% of those who received the COVID-19 vaccine reported experiencing any adverse reactions at all. Results showed that pain at the site of injection, swelling at the site of injection, fever and headache were the most frequent side effects of the vaccines among the study cases. Most people who received the Sputaik V vaccine (approximately 42.97%) and those who received the Cansino vaccine (about 14.25%) experienced side effects.

Conclusion: In conclusion, the vaccine displayed several common side effects, encompassing discomfort at the injection site, swelling or redness, fever, headache, nausea, diarrhea, cough, muscle pain, anxiety, and changes in sleep patterns, including difficulty sleeping or increased sleep duration. Importantly, there was a discernible correlation between the occurrence of adverse effects and individuals with a history of underlying health conditions. This underscores the significance of considering individual health backgrounds when assessing and managing vaccine-related reactions.

Keyword: COVID-19; Vaccine; Side Effects; Medical Students; Pakistan

Introduction

The global impact of COVID-19, caused by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), has led to an unparalleled crisis affecting societies, economies, and healthcare systems worldwide. Following its spread beyond China in March 2020, the World Health Organization (WHO) officially declared it a global pandemic.[1] Additional medical conditions have also been directly and indirectly caused by this healthcare issue, including epidemics of anxiety and depression as well as delays in the provision of vaccines and elective procedures. Approximately 163,312,429 confirmed cases and 3,386,825 recorded deaths worldwide as of May 2021.[2]

The world urgently needs vaccinations to address this crisis. A global cooperation has been established to solve the issue, and numerous groups are now engaged in the development of efficient vaccinations. The testing and development of vaccines have been accelerated in response to the urgency of the situation to stop the disease. Globally, numerous vaccines targeting SARSCoV-2 are currently undergoing different phases of preclinical and clinical development. The World Health Organization (WHO) has granted emergency approval for nineteen vaccines. Various countries are approving vaccines based on their individual standards and efficacy assessments. South Africa has authorized emergency use for six vaccines, while Pakistan and the UK have respectively approved five and three primary vaccines.[3,4] The FDA has offered a thorough definition of vaccination effectiveness that takes into account two essential elements. First and foremost, vaccines must be able to stop the spread of the virus from infected to vulnerable people. They should also be effective in slowing the disease's course and using resources for intensive care less frequently. Every vaccination that meets or exceeds the FDA's minimal effectiveness standard of 50% is authorized for use in emergency situations.

The success of vaccination programs depends on the safety of vaccinations, which is a global concern. Due to the widespread usage of COVID-19 vaccinations, worries regarding possible adverse effects have emerged. The dangers of serious adverse reactions brought on by vaccines, however, are less likely than those connected to the diseases themselves. Since the start of the COVID-19 pandemic, front-line healthcare workers have been at risk for infection, which has had an impact on their personal lives and family's health as well as placed a load on healthcare systems.[5]

Health students who deal with the public and are exposed to the virus have also been impacted by the pandemic. According to WHO estimations, between January 2020 and May 2021, COVID-19 caused 80 to 180 thousand deaths among medical personnel globally. Therefore, maintaining public health policies requires taking preventative steps against COVID-19 in this group.[6] Beginning on February 2, 2021, the Chinese government generously sent vaccines to Pakistan to start their vaccination program. For its immunization program, Pakistan has made four vaccinations available: Sinopharm (from China), Sputnik V (from Russia), CanSino, and Vaxzevria.[7] The Sinopharm vaccine is a complete virus vaccine that has been inactivated and created using vero cells. As the SARS-CoV-2 virus is replicated in these cells, it is then declared inactive by binding to the virus' genes by beta-propiolactone. An efficacy rate of 79.34% for this vaccine has been shown in phase III clinical studies carried out in a number of nations, including Argentina, Bahrain, Egypt, Morocco, Pakistan, Peru, and the United Arab Emirates (UAE).[8]The World Health Organization (WHO) granted the vaccine emergency use authorization following these clinical trials. The vaccination should be given in two doses with a 3–4 week gap between them, according to WHO recommendations. The information that is currently available on the vaccine's adverse effects points to very minor side effects like headache, fever, and soreness at the injection site.[9] Sputnik V underwent Phase III trials, similar to previous vaccinations, and these revealed a 91.6% efficacy rate. Similar to AstraZeneca, Sputnik V uses an adenovirus vector transport system, however it uses two Ad5 and Ad26 adenovirus vectors to let the gene for spike proteins express themselves.[10]60 nations, including China, India, and Pakistan, have approved the use of this vaccine for emergency situations. Pakistan reportedly requested 50,000 dosages from Russia. There have been reports of minor adverse effects like headaches and soreness at the injection site.[11]In addition, Sputnik V can be maintained at a temperature of 18°C and, in accordance with the recommendations made by the Pakistani Ministry of National Health Services, Regulations, and Coordination, must be delivered in two doses separated by 21 days.[12] The CansinoBio Company in China produces the CansinoBio vaccine. It injects genetic material from a coronavirus into the human body using a modified version of the common cold virus as a vector. This strategy strengthens the T cell response, which is important in battling the illness. This vaccine has undergone clinical testing in a number of nations, including Pakistan, Russia, Mexico, and Chile, showing a 90% effectiveness rate.Importantly, there have been no reported severe side effects from this vaccination.[13] In contrast, Vaxzevria uses a replication-deficient chimpanzee adenovirus to introduce SARS-CoV-2 proteins into the body and trigger immunological reactions. Following immunization, the body identifies these proteins and starts to mount defenses that stop the SARS-CoV-2 virus from entering. ChAdOx1 nCoV-19 vaccine/AZD1222 must be stored between 2°C and 8°C. This vaccine's efficacy was tested in numerous studies in South Africa and Brazil, with an overall efficacy of 70%. With this vaccine, mild systemic adverse effects such diarrhoea, fatigue, headache, cold,

and nausea have been recorded.[14,15]

In addition to these side effects, an uncommon condition known as thrombosis with thrombocytopenia syndrome (TTS), which combines thrombosis with thrombocytopenia, has also been documented. It's crucial to remember that these thrombotic events have only sporadically happened, despite the fact that the vaccine has been given out in millions of doses.[16] Several global regulatory bodies, such as the European Medicines Agency (EMA), the WHO Global Advisory Committee on Vaccine Safety (GVACS), and the UK Medicines and Healthcare Products Regulatory Agency (MHRA), have conducted assessments of early data and concluded that the advantages of the vaccine outweigh any potential risks.

Notably, preliminary findings suggest a higher frequency of thrombotic episodes reported by women compared to men. This observation may be linked to the use of contraceptives containing estrogen, a recognized risk factor for thrombosis.[17]

Since the beginning of the immunization campaign, vaccinations have been emphasized for students and healthcare professionals. In order to increase vaccination rates, create better public policies, and combat false information concerning COVID-19 vaccinations, it is crucial to comprehend how vaccines affect this population.

Objectives

The objective of this study is to outline the effectiveness, benefits, drawbacks, mechanism of action, and accessibility of prominent vaccines in Pakistan while confirming the prevalence and severity of COVID-19 vaccination side effects among medical students in the country.

Methodology

Numerous medical college students participated in this cross-sectional study. From July 2022 to December 2022, data were collected from different medical students. Regardless of the amount of doses or vaccinations used, vaccination against COVID-19 served as the inclusion criterion. 470 students in total participated in the study. The sociodemographic information (age, weight, height, gender, and race), the COVID-19 clinical history, and the COVID-19 immuni-zation schedule (Platform and dosages per vaccination) were all validated using a special form. After signing the informed consent form, the form was given. The study assessed and categorized adverse reactions into two main groups: local reactions (such as pain at the injection site, erythema, swelling, and induration) and systemic reactions (including headache, fatigue, myalgia, fever, pruritus, diarrhea, nausea, vomiting, abdominal pain, dizziness, loss of appetite, allergic or immediate hypersensitivity, thrombotic events, and others), along with cardiac changes like myocarditis or pericarditis. The analysis also covered adverse reactions subsequent to vaccination. Data presentation utilized both absolute and relative frequencies, and statistical analysis was conducted using SPSS (version 23) and R Core Team, with a significance threshold set at a p value less than 0.005 for associations (Chi-square test).

Results

There were 470 participants included in this study. Participants in the study ranged in age from 18 to 25, with a mean age of 32.96±7.7 years. There were 217 (46.17%) males and 253 (53.8%) females.38 individuals (8.08%) had a previous diagnosis of diabetes, 26 (5.53%) had hypertension, while 4 (0.85%) had a history of asthma and cardiovascular diseases have 3 (0.63%) and some have no history 399(84.89%). Approximately 35.10% (165/470) of the participants had recently tested positive for COVID-19 infection, whereas 145 (30.85) were now exhibiting COVID-19 symptoms, such as sore throat and flu-like symptoms. (Table 1). Majority of the studied cases received the Sputnik V vaccine (42.97%), followed by Sinopham (22.34%), Vaxzevria (AstraZeneca) (20.42%), and Cansino (14.25%) (Figure 1).

Various side effects were observed among the study participants in relation to different types of vaccines. These

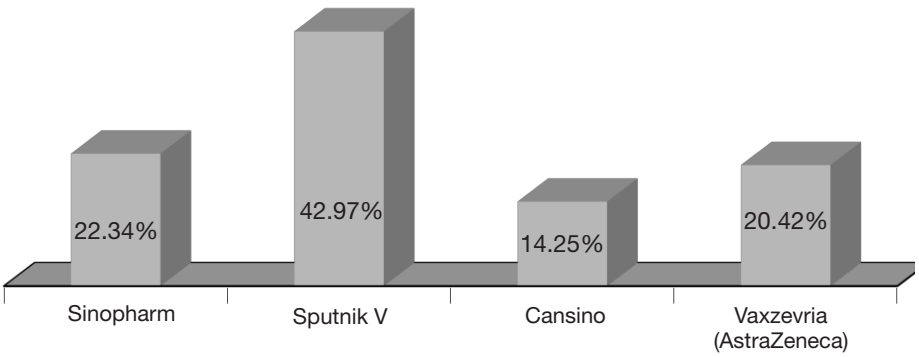

Figure 1. Distribution of COVID-19 vaccines among medical students

Table 1. Characteristics at baseline among the study cases (n=470).

Characteristics		Frequency (n)	Percentage (%)
Age in years (mean ± SD)		32.96 ± 7.7	
Age range		18 – 25	
Gender	Male	217	46.17%
	Female	253	53.8%
Comorbidities	Diabetes	38	8.08%
	Hypertension	26	5.53%
	Asthma	4	0.85%
	Cardiovascular diseases	3	0.63%
	Nil	399	84.89%
Experience COVID-19	Yes	165	35.10%
	No	305	64.89%
Symptoms	Yes	145	30.85%
	No	325	69.14%

included symptoms such as headache, pain at the site of injection, myalgia, fever, diarrhea, nausea, vomiting, lower abdominal pain, fatigue, dizziness, loss of appetite, and allergic or immediate hypersensitivity. Among study cases, 39.48% students show side effects while the remaining 60.52% students did not show any side effects (Figure 2). Among study cases the majority numbers of side effects occurred with the use of Sputnik V vaccine (42.97%), followed by Sinopham (22.34%), Vaxzevria (AstraZeneca) (20.42%), and Cansino (14.25%) (Table 2).

Discussion

In addition to causing a significant number of deaths, COVID-19 has also led to a global economic downturn. Until, effective vaccines are widely distributed to the

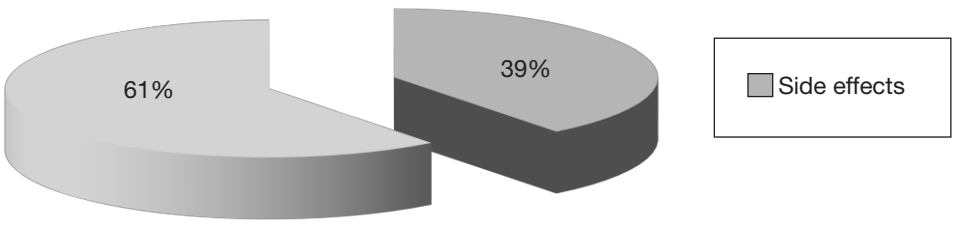

Figure 2. Frequency of side effects among COVID-19 vaccinated medical students.

Table 2a. COVID-19 vaccines associated adverse effects experienced by the study cases

Name of Vaccines	Symptoms	Frequency	Percentage
Sinopharm	Total	105	22.34%
	Pain at Injection site	83	55.33%
	Redness or swelling at the site of injection	72	48%
	Fever	88	58.66%
	Headache	52	34.66%
	Nausea	67	44.66%
	Diarrhea	44	29.33%
	Cough	78	52%
	Muscle pain	55	36.66%
	Anxiety	49	32.66%
	Less Sleep	22	14.66%
	more Sleep	12	8%
Sputnik V	Total	202	42.97%
	Pain at Injection site	151	74.75%
	Redness or swelling at the site of injection	109	53.96%
	Fever	120	59.40%
	Headache	97	48.01%
	Nausea	88	43.56%
	Cough	67	33.16%
	Muscle pain	88	43.56%
	Less Sleep	12	5.94%
	More sleep	7	3.46%

Table 2b. COVID-19 vaccines associated adverse effects experienced by the study cases

Name of Vaccines	Symptoms	Frequency	Percentage
Cansino	Total	67	14.25%
	Pain at the site of Injection	60	89.55%
	Redness or swelling at the site of injection	33	49.25%
	Fever	52	77.61%
	Nausea	13	44.66%
AstraZeneca	Total	96	20.42%
	Pain at the site of Injection	69	71.87%
	Redness or swelling at the site of injection	77	80.20%
	Fever	67	69.79%
	Nausea	53	55.20%
	Diarrhea	65	67.70%
	Muscle pain	88	43.56%
	Less Sleep	12	5.94%
	More sleep	7	3.46%

world's population, breakouts and disruptions to economic and social life are likely to happen[18].It is crucial to give safe and efficient COVID-19 vaccinations and foresee the adverse consequences in our population in order to combat the COVID-19 pandemic's terrible impacts on humanity. Vaccinations protect against disease through a variety of ways, but the process of developing immunity might result in side effects. Therefore, the purpose of this study was to ascertain the COVID-19 vaccination's acute side effects in medical students.

Less than half of the participants (39.48%) in the trial reported having at least one side effect from getting the COVID-19 vaccination. The reported side effects were typical and slight. Lethargy, fever, headaches, redness/ swelling at the injection site, and discomfort at the injection site were the most frequently reported side effects. The side effects lasted only 1-3 days on average, and none of the trial participants experienced any severe problems or needed to be hospitalized. These results are in alignment with research of a similar nature carried out in Saudi Arabia, India, and the Czech Republic.[19]

Sputnik V vaccine recipients (approximately 42.97%) experienced higher side effects than Sinopharm vaccine recipients. Contrarily, among individuals who received Cansino vaccinations from China, the occurrence of side effects was considerably lower (14.25%). The vaccine used in the immunization schedule may have different side effects, and the vaccine's manufacturer's leaflets list the probable side effects. For example, the inactivated vaccine CoronaVac, characterized as a purified and adsorbed on aluminum hydroxide inactivated virus vaccine, has the potential to induce the following side effects: headache,

fatigue, pain at the injection site, myalgia, fever, diarrhea, nausea, vomiting, lower abdominal pain, dizziness, loss of appetite, and allergic or immediate hypersensitivity.[20] The recombinant adenovirus vaccine, developed by the AstraZeneca laboratory as a viral vector vaccine, is associated with prevalent side effects. These commonly include headache, fatigue, myalgia, malaise, pyrexia, chills, arthralgia, nausea, and sensitivity or discomfort at the injection site. In contrast, the single messenger RNA of the Pfizer vaccine elicits symptoms such as weariness, headache, myalgia, chills, arthralgia, and fever.[21] In this study, 470 individuals were involved. Individuals in the study ranged in age from 23 to 55, with a mean age of 32.96±7.7 years. There were 253 women and 217 men (46.17% each). In addition, compared to men, women were more likely to report adverse reactions from vaccinations. This is a contradictory conclusion, with some studies claiming that males experience more side effects than females and others the opposite.[22]

38 (8.08%) of the participants had a history of diabetes, 26 (5.53%) had hypertension, 4 (0.85%) had a history of asthma, 3 (0.63%) had a history of cardiovascular disease, and some 399 (84.89%) had no history at all. Of the individuals, 35.10% (165/470) had recently tested positive for COVID-19 infection, whereas 145 (30.85%) were now exhibiting COVID-19 symptoms, such as sore throat/flulike symptoms.

The discovery of a successful vaccination has attracted significant funding from researchers around the world, and phase III clinical studies have produced overwh-elming favorable efficacy and safety results.[23] The general public's uncertainty about vaccinations' widespread adoption is a hurdle for the approved vaccines, nevertheless, as a result of their novelty. To build herd immunity, literature suggests that 82% of a country's population must receive vaccinations; nevertheless, scientists agree that, according to early studies, there is considerable vaccine hesitancy. The present study's lack of major adverse effects will aid in lowering vaccine reluctance. Numerous nations around the world, including France, Russia, and Poland, have reported in preliminary studies a high incidence of vaccine reluctance[24].

Reference

1. Castagnoli R, Votto M, Licari A, Brambilla I, Bruno R, Perlini S, Rovida F, Baldanti F, Marseglia GL. Severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) infection in children and adolescents: a systematic review. JAMA Ped. 2020;174(9):882-9.
2. Von Humboldt S, Low G, Leal I. Health service accessibility, mental health, and changes in behavior during the COVID-19 pandemic: a qualitative study of older adults. Int J Env Res Pub Health. 2022;19
3. Motamedi H, Ari MM, Dashtbin S, Fathollahi M, Hossainpour H, Alvandi A, Moradi J, Abiri R. An update review of globally reported SARS-CoV-2 vaccines in preclinical and clinical stages. Int Immun. 2021;96: 107763.
4. Ayenigbara IO, Adegboro JS, Ayenigbara GO, Adeleke OR, Olofintuyi OO. The challenges to a successful COVID-19 vaccination programme in Africa. Germs. 2021;11(3):427.
5. Adams JG, Walls RM. Supporting the health care workforce during the COVID-19 global epidemic. JAMA. 2020;323(15):1439-40.
6. Casey N. College made them feel equal. The virus exposed how unequal their lives are. The New York Times. 2020;4.
7. Suzuki M, Yang S. Political economy of vaccine diplomacy: explaining varying strategies of China, India, and Russia's COVID-19 vaccine diplomacy. Rev. Int. Political Econ. 2023;30(3):865-90.
8. Wambani J, Okoth P. Scope of SARS-CoV-2 variants, mutations, and vaccine technologies. Egypt J Intern Med. 2022 Dec;34(1):34.
9. El-Shitany NA, Harakeh S, Badr-Eldin SM, Bagher AM, Eid B, Almukadi H, Alghamdi BS, Alahmadi AA, Hassan NA, Sindi N, Alghamdi SA. Minor to moderate side effects of Pfizer-BioNTech COVID-19 vaccine among Saudi residents: a retrospective crosssectional study. Int J Gen Med. 2021 Apr 19:1389-401.
10. Calzetta L, Ritondo BL, Coppola A, Matera MG, Di Daniele N, Rogliani P. Factors influencing the efficacy of COVID-19 vaccines: a quantitative synthesis of phase III trials. Vaccines. 2021;9(4):341.
11. Bilawal Khaskheli M, Wang S, Hussain RY, Jahanzeb Butt M, Yan X, Majid S. Global law, policy, and governance for effective prevention and control of COVID-19: A comparative analysis of the law and policy of Pakistan, China, and Russia. Front Public Health. 2023 Jan 4;10:1035536.
12. Saleem Z, Godman B, Azhar F, Kalungia AC, Fadare J, Opanga S, Markovic-Pekovic V, Hoxha I, Saeed A, Al-Gethamy M, Haseeb A. Progress on the national action plan of Pakistan on antimicrobial resistance (AMR): A narrative review and the implications. Expert Rev Anti Infect Ther. 2022;20(1):71-93.
13. Abdulla ZA, Al-Bashir SM, Al-Salih NS, Aldamen AA, Abdulazeez MZ. A summary of the SARS-CoV-2 vaccines and technologies available or under development. Pathogens. 2021;10(7):788.
14. Chaudhary JK, Yadav R, Chaudhary PK, Maurya A, Kant N, Rugaie OA, Haokip HR, Yadav D, Roshan R,

Prasad R, Chatrath A. Insights into COVID-19 vaccine development based on immunogenic structural proteins of SARS-CoV-2, host immune responses, and herd immunity. Cells. 2021;10(11): 2949.

15. Angeli F, Spanevello A, Reboldi G, Visca D, Verdecchia P. SARS-CoV-2 vaccines: Lights and shadows. Eur J Intern Med. 2021;88:1-8.
16. Oliver SE, Shimabukuro TT. Johnson & Johnson/ Janssen COVID-19 vaccine and cerebral venous sinus thrombosis with thrombocytop-enia–update for clinicians on early detection and treatment.
17. Siddique S, Ahmed S. COVID-19 Vaccines in Pakistan: Efficacy, adverse effects and availability. Journal of Islamabad Medical & Dental College. 2021 Jun 29;10(2):125-30.
18. Maital S, Barzani E. The global economic impact of COVID-19: A summary of research. Samuel Neaman Institute for National Policy Research. 2020;2020:1-2.
19. Elbarbary NS, Dos Santos TJ, de Beaufort C, Agwu JC, Calliari LE, Scaramuzza AE. COVID-19 outbreak and pediatric diabetes: Perceptions of health care professionals worldwide. Pediatr Diabetes. 2020; 21(7):1083-92.
20. Al Kaabi N, Zhang Y, Xia S, Yang Y, Al Qahtani MM, Abdulrazzaq N, Al Nusair M, Hassany M, Jawad JS, Abdalla J, Hussein SE. Effect of 2 inactivated SARS-CoV-2 vaccines on symptomatic COVID-19 infection in adults: a randomized clinical trial. JAMA. 2021; 326(1):35-45.
21. Hatmal MM, Al-Hatamleh MA, Olaimat AN, Hatmal M, Alhaj-Qasem DM, Olaimat TM, Mohamud R. Side effects and perceptions following COVID-19 vaccination in Jordan: a randomized, cross-sectional study implementing machine learning for predicting severity of side effects. Vaccines. 2021;9(6):556.
22. Abramo G, D'Angelo CA, Mele I. Impact of Covid-19 on research output by gender across countries. Scientometrics. 2022;127(12):6811-26.
23. Dinga JN, Sinda LK, Titanji VP. Assessment of vaccine hesitancy to a COVID-19 vaccine in Cameroonian adults and its global implication. Vaccines. 2021;9(2): 175.
24. Sallam M. COVID-19 vaccine hesitancy worldwide: a concise systematic review of vaccine acceptance rates. Vaccines. 2021;9(2):160.