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Fear of COVID-19 among Healthcare Workers of a Tertiary Care Cardiac Facility Before- and After-Vaccination and Serology

Üçüncü Basamak Bir Kalp Merkezinin Sağlık Çalışanları Arasında Aşılama Öncesi ve Sonrası COVID-19 Korkusu ve Seroloji

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Abstract

Objective: This study aimed to assess the changes in the perceptions and practices during the coronavirus disease-2019 (COVID-19) era before and after vaccination and antibodies titer among the healthcare workers (HCWs) at a tertiary care cardiac center.

Materials and Methods: This descriptive study included HCWs working at a tertiary care cardiac center in Karachi, Pakistan. A predefined structured questionnaire was used to assess the sense of security, practice, and perception of the HCWs before vaccination, after vaccination, and after knowing the antibodies titer.

Results: Out of 151 HCWs, 70.2% (106) were male, and a majority, 65.6% (99), were ≤35 years old with an overall mean age of 34.92 ± 7.64 years. Nearly half of the individuals, (n=74; 49%), were doctors, 10 individuals (6.6%) were non-clinical staff, and reaming were nursing staff. The mean day since COVID-19 vaccination was 89.6 ± 40.07 before COVID-19 infection. Antibodies titer levels were >250 U/mL in 108 cases (71.5%) and ≤100 U/mL in 18 cases (11.8%). A significant increase in perception score was observed after serology with a mean of 61.04 ± 25.23 vs 53.86 ± 28.96; (p=0.008) compared to the post-vaccination perception score. A significant declining trend has been witnessed in mean practice scores, with a pre-vaccination mean of 69.93 ± 27.12, post-vaccination mean of 59.47 ± 30.61 (p<0.001). And post-serology mean of 55.1 ± 27.1 (p<0.001).

Conclusion: An increase in the sense of security and leniency in adherence to personal protective measures has been observed among HCWs after vaccination and after knowing the antibodies titer.

Keywords: COVID-19, healthcare workers, vaccination, serology, perception, practice

Öz

Amaç: Bu çalışmada, üçüncü basamak bir kalp merkezindeki sağlık çalışanları arasında koronavirüs hastalığı-2019 (COVID-19) döneminde aşılama öncesi ve sonrası algı ve uygulamalardaki değişikliklerinin ve antikor titrelerinin değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Bu tanımlayıcı çalışma, Pakistan, Karaçi'deki üçüncü basamak bir kalp merkezindeki sağlık çalışanlarını içermektedir. Sağlık çalışanlarının aşılamadan önce, aşılamadan sonra ve antikor titresini öğrendikten sonra güvenlik hissi, uygulama ve algılarını değerlendirmek için önceden tanımlanmış yapılandırılmış bir anket kullanılmıştır.

Bulgular: Yüz elli bir sağlık çalışanının %70.2 (n=106) erkek ve katılımcıların çoğunluğu, %65.6 (n=99) 35 yaşında ya da daha geç yaştaydı ve ortalama yaş 34.92 ± 7.64 yıl olarak saptandı. Neredeyse yarısı, (n=74; %49) hekim ve %6.6 (n=10) klinik dışı personel, geri kalan kişiler hasta

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bakım personeli görevindeydi. Önceki COVID-19 enfeksiyonu, doğası gereği 10 kişide (%6.6) ciddi, 1 kişide (%0.7) kritik olmak üzere 62 kişide (%41.1) rapor edilmiştir. COVID-19 aşılamasından bu yana geçen ortalama gün sayısı 89.6 ± 40.07 ve 11 kişide (%7.3) aşılama sonrası COVID-19 bildirildi. Antikor titre seviyeleri 108 kişide (%71.5) >250 U/mL ve 18 kişide ise (%11.9) ≤100 U/mL ve altında saptandı. Aşılama sonrası algı puanı ile karşılaştırıldığında algı skorunda seroloji sonrası ortalama 61.04 ± 25.23 ile 53.86 ± 28.96 arasında anlamlı bir artış gözlendi (p=0.008). Aşılama öncesi ortalama 69.93 ± 27.12, aşılama sonrası ortalama 59.47 ± 30.61 (p<0.001) ve seroloji sonrası 55.1 ± 27.1 olmak üzere (p<0.001) olan ortalama uygulama puanlarında önemli bir düşüş eğilimi görülmüştür.

Sonuç: Sağlık çalışanları arasında aşılamadan sonra ve antikor titresini öğrendikten sonra güvenlik hissi ve kişisel koruyucu önlemlere uyumda hoşgörünün arttığı gözlemlenmiştir.

Anahtar Kelimeler: COVID-19, sağlık çalışanları, aşılama, seroloji, algı, uygulama

Introduction

The SARS-Cov-2 virus spread in the whole world in a few months to become a global pandemic (1). It infected more than 175.676.457 people in 18 months, and caused more than 3.790.320 people to die (1). Its outbreak also changed lifestyles extensively by enforcing wearing masks and social distancing measures at a personal level and nationwide lockdowns limited the movement of people to prevent the spread of disease from one person to another (2). The impact has been significant in financial, political, and socio-psychological terms (3). It is more dangerous for underdeveloped and developing nations like Pakistan, which have weak economies and a deprived healthcare system (4). In particular, healthcare workers (HCWs) have been at high risk of getting contaminated because of closeness to COVID-19 infected individuals and face-to-face contact with them. Furthermore, disturbed lifestyles, long working hours, putting on personal protective equipment (PPE) for extended hours, constant dread of getting infected, traveling to offices in lockdown, and isolation from friends and families and less communication with them have had a considerable moral and psychosocial effect on them (5).

Vaccination brought a new hope in these dark hours of the COVID world. Many vaccines were developed to prevent COVID-19 infection by different countries, and now people are getting vaccinated worldwide (6). Developing countries like Pakistan are also trying to vaccinate people by providing different vaccines such as Sinopharm, Cansino Bio, SPUTNIK V, Sinovac, AstraZeneca, and Biontech vaccines (7). Data showed that available vaccines have an efficacy of 79 to 95%, with the prime intention of preventing severe disease, hospitalization and death (8,9). However, this may mean that there are 5 to 21% chances of getting infected with COVID severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) (10-12) despite vaccination. Vaccines produce immune response by producing antibodies IgM and IgG, which are detectable in blood after one to two weeks after symptom onset and after vaccination (13). The critical question is how long these antibodies persist in blood and how long they prevent reinfection. Similarly, the relationship between neutralizing antibodies and antigen-specific T-cells and chances of reinfection is yet to be identified (14). It is also observed that after vaccination, level of protection is decreased among health care workers because of the development of antibodies against COVID SARS-CoV-2. This study aims to evaluate the differences in behavioral attitudes and practices of HCWs regarding preventive measures after vaccination, both before and after assessing the levels of antibodies. This will also evaluate whether HCWs are getting infected with COVID-19 after vaccination and because of the decline in protective measures. This will help in continuing personal protective measures among health care workers after vaccination and knowing their antibody titers.

Materials and Methods

This descriptive study was conducted at the National Institute of Cardiovascular Diseases (NICVD) Karachi, Pakistan, between July 2021 and September 2021. The ethical review committee of the National Institute of Cardiovascular Diseases approved this study (approval number: ERC-65/2021), and written consent was obtained from all participants regarding their participation in the study and COVID-19 serology tests. This study included all the HCWs working at the hospital and fulfilling the inclusion and exclusion criteria. All the participants included in this study were healthcare professionals (doctors, nurses, paramedics, and frontend non-clinical staff) actively performing their duties during the COVID-19 era at a tertiary care cardiac hospital and fully vaccinated with recommended double dose of available vaccine (Sinopharm, Sinovac, or Cansino-Bio, etc.) at least six weeks prior to the start of this study. HCWs who had incomplete vaccination status, who were older than 60 years, who refused to participate in the study, or who refused for COVID-19 serology tests were excluded from the study.

The practice and perception of the HCWs were assessed using a self-administered predefined structured questionnaire in two phases. In phase one, HCW's practice and perception were assessed after getting vaccinated for COVID-19 compared to before vaccination. A blood sample was collected for the COVID-19 serology tests at the local laboratory. The assessment kit for antibodies titer was the same for all the participants, with a standard range

of 1.0. This qualitative assay detects both IgG and IgM as total antibodies targeted against nucleocapsid antigen by electrochemiluminescence immunoassay method. All assessments were performed on a fully automated cobas® 6000 analyzer using electrochemiluminescence technology and all the test were self-financed by the research investigators. In the second phase, serology report was delivered to the participants, and practice and perception were re-assessed after 30 days of delivery of the report.

Perception of HCWs was assessed using three questions regarding their sense of security at work, home, and outside home or work after vaccination and serology on a three-point rating scale, as "remains the same" assigned "0" points, "moderately secure" assigned "50" points, and "very secure" assigned "100" points. An aggregated pre-and post-serology perception score was computed as the average of responses to the three components, namely "sense of security at work," "sense of security at home," and "sense of security outside home or work."

The practice of HCWs was assessed based on the stated compliance level of the participant to the use of face mask and other personal protective measures under various scenarios. Routine use of a face mask type, i.e. N-95, KN-95, or surgical mask, while dealing with a COVID-19 suspected patient or while dealing with a COVID-19 positive patient was assessed.

Practice of HCWs regarding various personal protective measures was assessed on a point rating scale, as "not use" 1 point and "continuously" 5 points. Personal protective measures included using mask at work, using mask out of health care facility, regular hand washing, following social distancing recommendations, attending social gatherings during a pandemic, taking precautions after reaching home from the hospital, taking bath after reaching home, changing clothes after reaching home, hand washing after reaching home, and use of sanitizer at workplaces. A total practice score was computed by assigning a score of 100 points for the rating of "always" on each of the 10 personal protective measures and taking an average of all to compute a total score.

Along with practice and perception, participant related factors which were believed to have confounding effects, including gender, age, profession, type of vaccine, durations since vaccination, previous COVID-19 infection, COVID-19 infection after vaccination, antibodies titer level, and co-morbid conditions such as hypertension, diabetes, smoking, obesity, and chronic obstructive pulmonary disease/asthma, were also obtained.

Statistical Analysis

Collected data were analyzed with the help of statistical software IBM SPSS version 21. Descriptive summaries such as appropriate mean ± standard deviation or percentage (frequency) were computed. All the scoring variables were tested for the univariate normality with the help of a Normal QQ plot, which showed less point deviation from the reference line; hence parametric statistical testing approaches were used. Changes in the aggregated perception and practice score before- and after-vaccination and after serology were assessed by conducting parried sample t-test. Pre and post-categorical response variables were compared with the help of appropriate McNemar's test or chi-square test. The impact of various confounding factors on the aggregated perception and practice score was assessed by conducting repeated measured analysis of variance (ANOVA). A p-value ≤0.05 was taken as criterion for statistical significance throughout the data analysis.

Results

A total of 151 HCWs participated in this study. Of those, 106 individuals (70.2%) were male and a 99 (65.6%), were ≤35 years old, with overall mean age of 34.92 ± 7.64 years. Nearly 74 cases (49.0%) were physicians whereas 10 individuals (6.6%) were non-clinical staff and remaining cases were nursing staff. A previous history of COVID-19 infection was reported by 62 cases (41.1%) [10 cases (6.6%) had severe, 1 (0.7%) had critical disease]. The mean period following COVID-19 vaccination was 89.6 ± 40.1 and 11 (7.3%) participants reported post-vaccination COVID-19 infection. Antibodies titer levels were >250 U/mL in 108 (71.5%) and ≤100 U/mL in 18 cases (11.9%) (Table 1).

A significant increase in perception score was observed after serology, with a mean of 61.0 ± 25.2 vs. 53.9 ± 29.0; (p=0.008) compared to the post-vaccination perception score. Of the three components, perception of security at home significantly increased to 67.2 ± 30.6 after serology, compared to a post-vaccination score of 57.0 ± 32.2 (p=0.001). After vaccination and knowing the antibody titer, around quarter (20.5% and 25.2%, respectively) of the participants felt very secure at work (Table 2). No interaction effect was observed for most of the baseline characteristics as presented in Table 2.

A significant declining trend was observed in practice scores (pre-vaccination: 69.9 ± 27.1; post-vaccination: 59.5 ± 30.6; p<0.001; post-serology: 55.1 ± 27.1; p<0.001). Hand washing practice gradually declined from 73.5% (n=111) before vaccination to 68.2% (n=103) after vaccination, and 57% (n=86) after serology. Similar decline in other personal protective practices has been observed as presented in Table 3. The extreme fear of dealing with COVID-19 patients also declined from 32.5% (n=49) before vaccination to 9.3% (n=14) after vaccination and 9.9% (n=15) after serology.

No significant interaction effect of participants' baseline characteristics was observed as presented in Table 4.

Discussion

The tremendous success in getting the COVID-19 vaccine candidates from "bench to bedside" at a remarkable speed to meet the public health need is a testament to modern scientific technology. However, it is equally critical to ensure the vaccine is administered equitably to the entire population to achieve desired herd immunity (15). While all healthcare institutions rushed to provide the COVID-19 vaccines to their staff, the significant disparity was observed in the uptake of the vaccinations between the private and public institutions (15). A rapid systematic review by Li et al. (16) examined the behaviors of HCWs regarding COVID-19 vaccination. The percentage of HCWs who opted to be vaccinated against COVID-19 was different in various countries or regions of the same country, which was impacted by many elements. The major causes of vaccine hesitancy included the concerns regarding security, efficiency, and success due to the rapidity of its development/approval. The same concerns were revealed in related studies (17-19).

Table 1. Demographic and baseline characteristics of the study participants.

Characteristics	Total
Total (N)	151
Gender	
Male	106 (70.2%)
Female	45 (29.8%)
Age (years)	34.92 ± 7.64
≤35 years	99 (65.6%)
36 to 45 years	39 (25.8%)
>45 years	13 (8.6%)
Profession	
Physcian	74 (49%)
Nursing staff	67 (44.4%)
Non-clinical staff	10 (6.6%)
Type of vaccine	
Sinopharm	120 (79.5%)
Sinovac	30 (19.9%)
Cansino-Bio	1 (0.7%)
Days since vaccination (mean ± standard deviation)	89.6 ± 40.1
≤60 days	45 (29.8%)
61 to 90 days	25 (16.6%)
91 to 120 days	25 (16.6%)
>120 days	56 (37.1%)
Previous COVID-19 infection	62 (41.1%)
Non-severe	51 (33.8%)
Severe	10 (6.6%)
Critical	1 (0.7%)
Co-morbid conditions	
Hypertension	5 (3.3%)
Diabetes mellitus	2 (1.3%)
Smoking	8 (5.3%)
Obesity	19 (12.6%)
Chronic obstructive pulmonary disease/asthma	8 (5.3%)
Post vaccination COVID-19 infection	11 (7.3%)
Antibodies titer level (U/mL)	
≤100	18 (11.9%)
101 to 250	25 (16.6%)
>250	108 (71.5%)

COVID-19: Coronavirus disease-2019

The data from prior vaccination indicate that there might be a decline in obedience to precautionary behaviors (20,21). For example, after the Lyme disease vaccination rollout, a decline in the adoption of light color clothes and tick repellent was observed (20), and people started to interact with more people following the influenza vaccine's rollout (21). However, there is minimal scientific literature regarding behavior changes and adherence to the preventive measures after COVID-19 vaccination. In our study, as expected, leniency in adherence to personal protective measures has been observed among HCWs after vaccination and after knowing the antibodies titer. We observed a significantly declining trend in the mean practice scores. Such decline in practice can be partly attributed to the increase in the sense of security after vaccination and the decline in the overall burden of infection. We observed a significant increase in perception after knowing the antibody titer.

Our observation of a decline in personal protection behavior is similar to the finding of a study conducted by Zewude et al. (22), which evaluated the variations in the patterns of obedience in HCWs after having the first phase of the COVID-19 vaccine. According to this study, 78.9% of HCWs showed the intention to wear masks regularly. On the other hand, 30.5% of the HCWs revealed a decrease in the experience of wearing a mask following the first phase of the COVID-19 vaccine. While 88.6% of HCWs stated to wash hands after coming in contact with objects, 30.1% also reported a decrease in intent regarding washing hands following the first phase of the COVID-19 vaccine. Overall, a considerable decrease in compliance to the standard protective methods was observed due to the over-dependence on immunizing effectiveness of the first phase of the COVID-19 vaccine.

Another study by Yuan et al. (23) evaluated the consequences of the COVID-19 vaccine on precautionary behaviors and mental health in the standard population. Even after the propensity score matching method, a fair

Table 2. Perception of the respondents after COVID-19 vaccination and serology stratified by various baseline characteristics.

Characteristics	After vaccination	After serology	p-value
Total (N)	151	151	-
Feeling secure at work			
Remains the same	22 (14.6%)	12 (7.9%)	0.075
Moderately secure	98 (64.9%)	101 (66.9%)	
Very secure	31 (20.5%)	38 (25.2%)	
Score (mean ± standard deviation)	**53.0 ± 29.6**	**58.61 ± 27.5**	**0.052**
Feeling secure at home			
Remains the same	22 (14.6%)	8 (8.7%)	0.017
Moderately secure	86 (57.0%)	51 (55.4%)	
Very secure	43 (28.5%)	33 (35.9%)	
Score (mean ± standard deviation)	**57.0 ± 32.1**	**67.2 ± 30.6**	**0.001**
Feeling secure out of hospital or home			
Remains the same	28 (18.5%)	13 (14.1%)	0.293
Moderately secure	90 (59.6%)	65 (70.7%)	
Very secure	33 (21.9%)	14 (15.2%)	
Score (mean ± standard deviation)	**51.7 ± 31.8**	**57.3 ± 29.7**	**0.084**
Aggregated perception score (mean ± standard deviation)	**53.9 ± 29.0**	**61.0 ± 25.2**	**0.008**
Gender			
Male	55.2 ± 28.9	61.8 ± 24.6	t=0.011 f*t=0.744
Female	50.7 ± 29.3	59.3 ± 27.0	
Age (years)			
≤35 years	52.9 ± 28.1	60.1 ± 25.6	t=0.024 f*t=0.767
36 to 45 years	57.7 ± 30.8	62.8 ± 24.9	
>45 years	50 ± 31.2	62.8 ± 24.7	
Profession			
Physician	47.3 ± 23.4	50.2 ± 21.8	t=0.089 f*t=0.243
Nursing staff	60.2 ± 33.4	72.39 ± 23.8	
Non-clinical staff	60.0 ± 25.1	65.0 ± 25.4	
Type of vaccine			
Sinopharm	55.8 ± 27.0	59.2 ± 24.2	t=0.492 f*t=0.001
Sinovac	46.1 ± 35.7	70.6 ± 25.4	
Cansino-Bio	50 ± 0	-	
Days since vaccination			
≤60 days	49.3 ± 31.6	64.1 ± 24.9	t=0.072 f*t=0.098
61 to 90 days	62.7 ± 30.2	62.0 ± 26.1	
91 to 120 days	56.7 ± 23.1	54.0 ± 22.7	
>120 days	52.4 ± 28.3	61.3 ± 26.2	
Previous COVID-19 infection			
No	51.9 ± 29.2	62.2 ± 26.3	t=0.018 f*t=0.162
Yes	56.7 ± 28.5	59.4 ± 23.7	
Hypertension			
No	53.9 ± 28.8	61.3 ± 25.4	t=0.621 f*t=0.621
Yes	53.3 ± 36.1	53.3 ± 18.3	
Diabetes mellitus			
No	53.9 ± 29.2	61.2 ± 25.4	t=0.757 f*t=0.757
Yes	50 ± 0	50 ± 0	

Table 2. Continued

Characteristics	After vaccination	After serology	p-value
Smoking (mean ± standard deviation)			
No	54.2 ± 29.0	60.7 ± 25.3	t=0.036 f*t=0.307
Yes	47.9 ± 28.8	66.7 ± 25.2	
Obesity (mean ± standard deviation)			
No	55.3 ± 28.0	61.9 ± 25.4	t=0.028 f*t=0.550
Yes	43.9 ± 33.9	55.3 ± 23.6	
Chronic obstructive pulmonary disease/asthma (mean ± standard deviation)			
No	54.0 ± 29.4	61.2 ± 25.6	t=0.262 f*t=0.935
Yes	52.1 ± 20.8	58.3 ± 17.8	
Post vaccination COVID-19 infection (mean ± standard deviation)			
No	53.0 ± 29.3	60.5 ± 25.2	t=0.309 f*t=0.665
Yes	65.2 ± 21.7	68.2 ± 25.2	
Antibodies titer level (U/mL)			
≤100	49.1 ± 28.9	59.3 ± 18.3	t=0.018 f*t=0.837
101 to 250	55.3 ± 29.2	64.7 ± 27.0	
>250	54.3 ± 29.1	60.5 ± 25.9	

COVID-19: Coronavirus disease-2019, t: p-value for the main effect, f*t: p-value for the interaction effect

Table 3. Assessment of practice among healthcare workers before and after COVID-19 vaccination and after serology assessment.

Characteristics	Before vaccination	After vaccination		After serology	
		n (%)	*p-value	n (%)	*p-value
Total (N)	151	151	-	151	-
Type of mask used routinely n (%)					
N-95	44 (29.1%)	18 (11.9%)	<0.001	14 (9.3%)	<0.001
KN-95	38 (25.2%)	25 (16.6%)		29 (19.2%)	
Surgical mask	69 (45.7%)	108 (71.5%)		108 (71.5%)	
Type of mask used while seeing or dealing suspected patients n (%)					
N-95	74 (49.0%)	53 (35.1%)	<0.001	56 (37.1%)	0.010
KN-95	33 (21.9%)	38 (25.2%)		54 (35.8%)	
Surgical mask	44 (29.1%)	60 (39.7%)		41 (27.2%)	
Type of mask used while seeing or dealing PCR positive COVID-19 patients n (%)					
N-95	88 (58.3%)	78 (51.7%)	0.012	93 (61.6%)	0.098
KN-95	33 (21.9%)	31 (20.5%)		39 (25.8%)	
Surgical mask	30 (19.9%)	42 (27.8%)		19 (12.6%)	
Frequency of mask used in hospital n (%)					
Not use	-	-	0.023	-	0.001
Rarely	1 (0.7%)	1 (0.7%)		1 (0.7%)	
Often	9 (6.0%)	11 (7.3%)		2 (1.3%)	
Mostly	13 (8.6%)	24 (15.9%)		30 (19.9%)	
Always	128 (84.8%)	115 (76.2%)		118 (78.1%)	
Using mask out of health care facility n (%)					
Not used	2 (1.3%)	1 (0.7%)	0.006	-	-
Rarely	5 (3.3%)	9 (6.0%)		6 (4.0%)	
Often	7 (4.6%)	16 (10.6%)		25 (16.6%)	
Mostly	44 (29.1%)	45 (29.8%)		44 (29.1%)	
Always	93 (61.6%)	80 (53.0)		76 (50.3%)	

Table 3. Continued

Characteristics	Before vaccination	After vaccination		After serology	
		n (%)	*p-value	n (%)	*p-value
Regular hand washing					
Not used	-	-		-	
Rarely	1 (0.7%)	1 (0.7%)		7 (4.6%)	
Often	8 (5.3%)	11 (7.3%)	0.058	5 (3.3%)	0.006
Mostly	31 (20.5%)	36 (23.8%)		53 (35.1%)	
Always	111 (73.5%)	103 (68.2%)		86 (57.0%)	
Following social distancing recommendations					
Not used	-	-		-	
Rarely	5 (3.3%)	9 (6.0%)		14 (9.3%)	
Often	15 (9.9%)	33 (21.9%)	<0.001	32 (21.2%)	<0.001
Mostly	49 (32.5%)	51 (33.8%)		63 (41.7%)	
Always	82 (54.3%)	58 (38.4%)		42 (27.8%)	
Attending social gatherings during pandemic					
Not used	4 (2.6%)	1 (0.7%)		17 (11.3%)	
Rarely	51 (33.8%)	29 (19.2%)		62 (41.1%)	
Often	36 (23.8%)	57 (37.7%)	<0.001	44 (29.1%)	<0.001
Mostly	24 (15.9%)	28 (18.5%)		20 (13.2%)	
Always	36 (23.8%)	36 (23.8%)		8 (5.3%)	
Taking precautions after reaching home from hospital					
Not use	-	-		-	
Rarely	5 (3.3%)	9 (6.0%)		11 (7.3%)	
Often	6 (4.0%)	22 (14.6%)	<0.001	15 (9.9%)	<0.001
Mostly	34 (22.5%)	45 (29.8%)		53 (35.1%)	
Always	106 (70.2%)	75 (49.7%)		72 (47.7%)	
Taking bath at home					
No	1 (0.7%)	1 (0.7%)		6 (4.0%)	
Rarely	6 (4.0%)	16 (10.6%)		13 (8.6%)	
Often	10 (6.6%)	19 (12.6%)	<0.001	18 (11.9%)	0.041
Mostly	29 (19.2%)	32 (21.2%)		30 (19.9%)	
Always	105 (69.5%)	83 (55.0%)		84 (55.6%)	
Changing clothes after reaching home					
No	-	-		2 (1.3%)	
Rarely	2 (1.3%)	9 (6.0%)		3 (2.0%)	
Often	5 (3.3%)	12 (7.9%)	<0.001	5 (3.3%)	-
Mostly	12 (7.9%)	18 (11.9%)		22 (14.6%)	
Always	132 (87.4%)	112 (74.2%)		119 (78.8%)	
Hand washing after reaching home					
No	-	-		-	
Rarely	2 (1.3%)	3 (2.0%)		2 (1.3%)	
Often	3 (2.0%)	5 (3.3%)	0.038	3 (2.0%)	0.534
Mostly	10 (6.6%)	17 (11.3%)		13 (8.6%)	
Always	136 (90.1%)	126 (83.4%)		133 (88.1%)	
Use of sanitizer at work places					
No	-	-		-	
Rarely	2 (1.3%)	3 (2.0%)		1 (0.7%)	
Often	5 (3.3%)	13 (8.6%)	0.001	10 (6.6%)	<0.001
Mostly	17 (11.3%)	25 (16.6%)		46 (30.5%)	
Always	127 (84.1%)	110 (72.8%)		94 (62.3%)	

Table 3. Continued

Characteristics	Before vaccination	After vaccination		After serology assessment	
		n (%)	*p-value	n (%)	*p-value
Fear of doing procedures on COVID-19 patients					
Mild	53 (35.1%)	80 (53.0%)	<0.001	68 (45.0%)	<0.001
Moderate	56 (37.1%)	59 (39.1%)		72 (47.7%)	
Extreme	42 (27.8%)	12 (7.9%)		11 (7.3%)	
Fear of dealing of COVID-19 patients					
Mild	52 (34.4%)	75 (49.7%)	<0.001	66 (43.7%)	<0.001
Moderate	50 (33.1%)	62 (41.1%)		70 (46.4%)	
Extreme	49 (32.5%)	14 (9.3%)		15 (9.9%)	

PCR: Polymerase chain reaction, COVID-19: Coronavirus disease-2019, *compared to before vaccination

Table 4. Practice score of the respondents before and after COVID-19 vaccination and after serology stratified by various baseline characteristics.

Characteristics	Before vaccination	After vaccination		After serology assessment	
		Mean score ± standard deviation	*p-value	Mean score ± standard deviation	*p-value
Total attitude score	69.93 ± 27.1	59.5 ± 30.6	<0.001	55.1 ± 27.1	<0.001
Gender					
Male	66.2 ± 28.1	54.1 ± 31.7	t= <0.001 f*t=0.096	50.4 ± 27.0	t= <0.001 f*t=0.499
Female	78.7 ± 22.7	72.2 ± 23.8		66.2 ± 24.2	
Age (years)					
≤35 years	72.7 ± 25.7	62.4 ± 29.0	t= <0.001 f*t=0.877	57.2 ± 27.9	t= <0.001 f*t=0.696
36 to 45 years	66.2 ± 27.5	54.6 ± 32.1		51.0 ± 21.3	
>45 years	60 ± 34.6	51.5 ± 36.9		51.5 ± 36.3	
Profession					
Physician	63.2 ± 28.4	45.4 ± 29.4	t= <0.001 f*t= <0.001	43.1 ± 24.8	t= <0.001 f*t= 0.076
Nursing staff	79.7 ± 22.4	77.0 ± 22.4		70.0 ± 22.6	
Non-clinical staff	54.0 ± 26.3	46.0 ± 28.4		44.0 ± 23.2	
Type of vaccine					
Sinopharm	69.3 ± 26.8	57.1 ± 30.7	t=0.416 f*t=0.080	52.6 ± 26.7	t=0.012 f*t=0.079
Sinovac	71.7 ± 28.8	68.0 ± 28.9		65.7 ± 27.0	
Cansino-Bio	90 ± 0	90 ± 0		40 ± 0	
Days since vaccination					
≤60 days	69.3 ± 26.8	62.7 ± 30.2	t= <0.001 f*t=0.154	64.9 ± 22.6	t= <0.001 f*t=0.020
61 to 90 days	70.4 ± 29.5	63.6 ± 34.9		51.6 ± 29.5	
91 to 120 days	71.2 ± 25.1	55.6 ± 30.8		47.2 ± 26.4	
>120 days	69.6 ± 27.9	56.8 ± 29.2		52.3 ± 28.1	
Previous COVID-19 infection					
No	71.6 ± 26.2	61.7 ± 30.7	t= <0.001 f*t=0.662	58.1 ± 27.3	t= <0.001 f*t=0.482
Yes	67.6 ± 28.4	56.3 ± 30.5		50.8 ± 26.5	
Hypertension					
No	71.0 ± 26.0	60.3 ± 29.7	t=0.097 f*t=0.449	56.3 ± 26.3	t=0.008 f*t=0.678
Yes	40.0 ± 43.0	36.0 ± 49.8		20.0 ± 29.2	
Diabetes mellitus					
No	70.3 ± 26.9	59.7 ± 30.4	t=0.443 f*t=0.443	55.7 ± 26.7	t=0.028 f*t=0.446
Yes	40.0 ± 42.4	40.0 ± 56.6		10.0 ± 14.1	
Smoking					
No	69.8 ± 27.3	59.2 ± 30.8	t=0.011 f*t= 0.657	54.8 ± 27.1	t=0.011 f*t=0.713
Yes	72.5 ± 24.4	65.0 ± 27.3		61.3 ± 28.5	

Table 4. Continued

Characteristics	Before vaccination	After vaccination		After serology	
		Mean score ± standard deviation	*p-value	Mean score ± standard deviation	*p-value
Obesity					
No	71.4 ± 25.8	61.1 ± 29.8	t= <0.001 f*t=0.789	56.4 ± 26.9	t= <0.001 f*t=0.783
Yes	59.5 ± 33.7	47.9 ± 34.3		46.3 ± 27.9	
Chronic obstructive pulmonary disease/asthma					
No	70.3 ± 27.1	60.4 ± 30.6	t= <0.001 f*t=0.105	56.2 ± 27.0	t= <0.001 f*t=0.193
Yes	63.8 ± 28.8	42.5 ± 27.7		36.3 ± 22.6	
Post vaccination COVID-19 infection					
No	69.6 ± 27.6	59.6 ± 30.8	t= <0.001 f*t=0.226	55.1 ± 27.4	t= <0.001 f*t=0.605
Yes	74.6 ± 20.7	57.3 ± 29.7		55.5 ± 24.2	
Antibodies titer level (U/mL)					
≤100	71.1 ± 24.5	51.7 ± 27.5	t= <0.001 f*t=0.107	52.2 ± 24.9	t= <0.001 f*t=0.358
101 to 250	72.8 ± 28.4	64.4 ± 31.2		52.0 ± 27.5	
>250	69.1 ± 27.4	59.6 ± 31.0		56.3 ± 27.5	

COVID-19: Coronavirus disease-2019, t: p-value for the main effect, f*t: p-value for the interaction effect, *compared to that of before vaccination

but statistically noteworthy difference was seen in the post-vaccination group and the pre-vaccination group, as the participants in this study were those who were yet to be vaccinated as well as those who had been vaccinated against COVID-19. Consequently, they were eager to be vaccinated against COVID-19. Among the health belief model scale items, the post-vaccination group showed a decrease in apparent vulnerability of COVID-19, suggesting that the participants believed that the vaccination could decrease the danger of disease to some level. Hence a little better knowledge of precautionary behaviors and a slightly improved mental health status were observed in participants of the post-vaccination group compared to the pre-vaccination group.

Despite its genome mapping, very little is known about the virus (24). Significant factors like prolonged immunity remain unknown although most present knowledge is obtained from Middle East respiratory syndrome-CoV and SARS-CoV (24). Studies, which have been carried out comparatively in a short time despite evidence of antibody response, are restricted in terms of participant numbers and follow-up testing (24). An interesting study revealed low neutralizing antibody titers in 30% of the patients, and out of them, 6% did not react two weeks later (24). Even though information regarding the prolonged presence of antibody response with COVID-19 is scarce, some studies suggest that reinfection can likely occur in about 80 days (24). Hence, public safety procedures such as washing hands, wearing goggles and masks, keeping distance, isolation, and contact tracing are the basis for avoiding this virus, particularly for healthcare workers. Complying with the preventive measures helps in maintaining order in healthcare professionals. As a HCW needs to be in proximity of one meter of the patient to treat and examine, social distancing is not possible in these conditions. It is essential for both the staff and patient to put on a surgical mask to reduce the risk. Additionally, to identify the level and period of immunity to SARS-CoV-2, longitudinal serological studies are required without delay. Indeed, it will take time for these data to be accessible.

As per the data received, 3% prevalence of antibodies has been observed in healthcare professionals prior to vaccination. Although many underdeveloped countries cannot vaccinate more vulnerable people and HCWs, many countries have vaccinated HCWs (25). For the sacke of humanity, a policy should be developed in a joint effort to vaccinate vulnerable groups globally. Additionally, vaccination leads to new antibodies that might not provide immunity against new variants, which means humans would still be at risk. Thus, despite vaccination status, it is necessary for HCWs and vulnerable people to use PPE during work (25).

Conclusion

An increase in the sense of security and leniency in adherence to personal protective measures has been observed among HCWs after vaccination and after serology. Hence, personal protective measures such as washing hands, wearing masks, and keeping distance are the basis of avoidance from the transmission of this virus, particularly for HCWs. Additionally, immediate

longitudinal serological studies are required to identify the level and period of immunity.

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Ethics

Ethics Committee Approval: The ethical review committee of the National Institute of Cardiovascular Diseases approved this study (approval number: ERC-65/2021).

Informed Consent: Written consent was obtained from all participants regarding their participation in the study and COVID-19 serology tests.

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Authorship Contributions

Surgical and Medical Practices: J.A.S., A.A., W.K., R.K., F.A., S.A., Ja.A.S., T.S., Concept: J.A.S., A.A., F.A., Ja.A.S., T.S., Design: J.A.S., A.A., W.K., R.K., M.Z., Z.U.R., Data Collection or Processing: J.A.S., A.A., W.K., R.K., S.A., Z.U.R., Analysis or Interpretation: J.A.S., A.A., W.K., R.K., F.A., M.Z., Ja.A.S., Z.U.R., Literature Search: J.A.S., A.A., W.K., F.A., S.A., M.Z., Ja.A.S., Writing: J.A.S., A.A., W.K., R.K., F.A., S.A., M.Z., Ja.A.S., T.S., Z.U.R.

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