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Post-Vaccination Side Effects After the First Dose of Inactive CoronaVac® in Healthcare Personnel in Türkiye

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Abstract: This study aimed to investigate the side effects observed in healthcare personnel who were the first to receive the first dose of inactivated CoronaVac® vaccine in Türkiye. Healthcare personnel vaccinated for the first time with the inactivated CoronaVac® vaccine between February and March 2021 during the initial administration of COVID-19 vaccines were asked to respond to an online questionnaire to investigate local and systemic side effects they observed after vaccination. Of the 2601 participants included in the study, 72.5% (n=1886) were female, and 27.5% (n=715) were male. The mean age was 37.6±11.7 years. Regarding side effects, 39.9% had at least one local side effect, and 54.4% had at least one systemic side effect. These side effects lasted for 4.0±2.6 days on average. The three most common local side effects were local pain (38.1%), swelling (1.9%) and redness (1.5%), whereas the most common systemic side effects were weakness (28.4%), headache (27.9%), fatigue (26%), myalgia (18.2%), and arthralgia (11.8%). Systemic side effects were significantly more common in females, nurses and midwives, younger age groups, and people without a history of chronic disease (P<0.05). Myalgia and fever were significantly more common in people without a previous history of COVID-19, but localized redness was found more often in people with previous COVID-19 (P<0.05). This comprehensive study reveals the potential side effects expected due to CoronaVac®, as healthcare personnel are more conscious of observing their symptoms. It is worth noting that severe or long–term side effects were not detected. ©2025 NTMS.

Keywords: COVID-19; Vaccination; Side Effect; Inactivated Vaccine; CoronaVac.

1. Introduction

Novel coronavirus disease 2019 (COVID-19) was first detected on 31 December 2019 in Wuhan, China. Later, it spread worldwide and was declared a pandemic by the World Health Organization (WHO) on March 11, 2020 [1]. By the end of 2022, 650 million positive cases were seen worldwide, and deaths reached more than 6.5 million [2]. Although some measures have been suggested and implemented to protect against COVID-19, the most important preventive measure that will end the pandemic has been the development of the vaccine and its application to the population. The rapid development of COVID-19 vaccines within the scope of combating the pandemic and the issuance of emergency use permits for early use have caused

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doubts in the community as to whether they are safe. Therefore, it is a scientific necessity and a social responsibility to determine the side effects after vaccinations and present them to the public.

The first COVID-19 vaccine brought to Türkiye with emergency use approval was the CoronaVac® vaccine belonging to the Chinese Sinovac® company. Health workers were determined to be the first to be vaccinated because of their high–risk level. Within the scope of the vaccination program in Türkiye, the healthcare workers started to be vaccinated with the CoronaVac® vaccine as of January 2021, and first data was obtained at that time. WHO recommends that particularly vulnerable, at-risk, and elderly patients be vaccinated annually with the seasonal flu vaccine and the COVID–19 vaccine [3], which will be the future target perspective for combining the two vaccines in one vaccine. Unlike other novel COVID–19 vaccines, CoronaVac® is a conventionally produced inactivated type vaccine and may have the advantage of being combined with other inactivated vaccines, especially influenza vaccine. This highlights the need to identify the side effects of CoronaVac® before the development of combined vaccines.

Healthcare workers are expected to be conscious about identifying and monitoring postvaccination symptoms. In this context, we aimed to investigate the postvaccination side effects of the CoronaVac® vaccine administered to healthcare personnel of our university.

2. Material and Methods

2.1. Study Design

This study was an observational and descriptive study, conducted in the form of an online questionnaire.

2.2. Ethical Approval

Prior to the study, necessary permission was obtained from the Scientific Research Platform of the Ministry of Health of the Republic of Türkiye, and ethical approval was obtained from the Erzurum City Hospital Clinical Research Ethics Committee (Ethics Committee Approval number: 15.02.2021; 2021/04-83). During the study, the Helsinki Good Clinical Practice criteria were complied with. The voluntary participation of the participants in the study was questioned and their online consent was obtained.

2.3. Setting

The study was conducted in a tertiary university hospital and faculty of dentistry of a university in Erzurum, in eastern Türkiye.

2.4. Participants

The eligible participants of the study consisted of the healthcare personnel working at the university hospital and the Faculty of Dentistry, or the 4th, 5th and 6th grade students of the Medical Faculty, and the 4th and 5th grade students of the Dentistry Faculty, who required and received first dose CoronaVac® vaccination due to the risk of COVID–19 in their jobs or in their clerkships. During the COVID-19 pandemic in Türkiye, all universities switched to online education and students (including lower-class medical and dental students) were not required to come to campus, but 4th, 5th and 6th grade interns had to continue working in the hospital (or in the Faculty of Dentistry). Moreover, last year intern students in faculties of medicine and dentistry are accepted as healthcare workers and are paid monthly salaries. Therefore, as these students, like all other health staff, are easily accessible in the hospital or in the Faculty of Dentistry, the research was conducted in two centers to reach health professionals and students of medicine and dentistry.

2.5. Sample Size and Response Rate

The total number of health personnel in the hospital and faculty of dentistry is 2648 and 823, respectively. The total number of intern students in the 4th, 5th and 6th grades in the Faculty of Medicine is 792, and the total number of intern students in the 4th and 5th grades in the Faculty of Dentistry is 308. Therefore, the population size of our study consists of a total of 4571 people. In terms of sample size, since this was a convenience sample, the aim was to include all vaccinated people in the study.

The study questionnaire form was delivered to all study population via official online links. According to the responses received, the number of participants who had the first dose of CoronaVac® vaccine and voluntarily answered the questionnaire was determined as 2607. Due to missing answers, 6 people were excluded from the study. As a result, 2601 people were included and the participation rate was found as 56.9%.

2.6. Questionnaire

The online questionnaire method was adopted to prevent the risk of contact and transmission of COVID–19, and the questionnaire created in Google® Forms was delivered to healthcare workers online. As healthcare personnel, voluntary participation to be vaccinated with the first dose of CoronaVac® (Sinovac®, Beijing, China) vaccine was accepted as the inclusion criteria. The participants' sociodemographic characteristics and postvaccination local and systemic side effects were questioned. The study was carried out between 17 February and 02 March 2021.

2.7. Statistical Analysis

The obtained data were analyzed with the SPSS 23.0 (IBM®, NY, USA) program. Categorical data are presented as frequencies and percentages, and numerical data are presented as the mean and standard deviation. The normal distribution of numerical data was investigated with the Kolmogorov–Smirnov test. In the analysis of two independent variables, Student's t–test was used if there was a normal distribution, and the Mann–Whitney U test was used if not distributed normally. In analyzing three or more independent variables, one-way ANOVA was used if there was a normal distribution. The Kruskal–Wallis test was used

if not distributed normally. The chi–square test was used in the analysis of categorical data. $P<0.05$ was considered statistically significant.

3. Results

Of the 2601 participants, 72.5% (n=1886) were female, and 27.5% (n=715) were male. The mean age was 37.6±11.7 years. The most participating occupational groups were nurses, midwives and emergency medical technicians, with 822 people (31.6%), and doctors, with 697 people (26.8%). The demographic properties of the participants are presented in Table 1.

Table 1: Sociodemographic features of the participants.

		Frequency	Percent
Gender	Male	715	27.5
	Female	1886	72.5
Occupation	Doctor	697	26.8
	Assistant doctor	63	2.4
	Nurse, midwife, emergency technician etc.	822	31.6
	Dentist	218	8.4
	Pharmacist	41	1.6
	Health co–worker	289	11.1
	Student (medicine, dentistry)	471	18.1
Chronic Disease	Yes	615	23.6
	No	1986	76.4
Smoking	Yes, still smoking	787	30.3
	No, never	1396	53.7
	Yes, but quitted	418	16.1
Alcohol Usage	Yes	460	17.7
	No	2141	82.3
COVID-19 History	Yes	431	16.6
	No	2170	83.4
Previous COVID-19 Severity	Mild	180	6.9
	Moderate	198	7.6
	Severe	51	2.0
Allergy History	Yes	612	23.5
	No	1989	76.5
Total		2601	100.0

Regarding postvaccination side effects, 1037 (39.9%) of the participants stated that at least one local side effect developed after vaccination. The remaining 1564 people (60.1%) did not describe any local side effects. While the majority (n=979) of the participants with local side effects expressed only a single side effect, two local side effects were detected in 54 people, and three or four side effects were detected in two people (Figure 1).

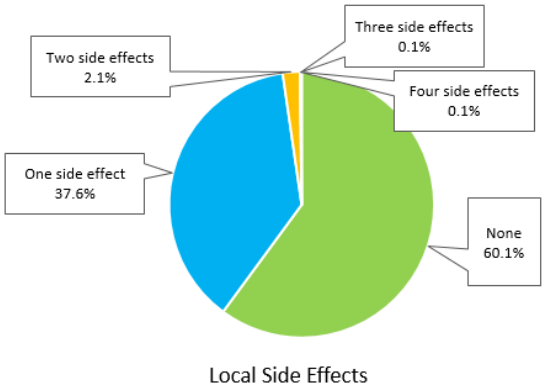

Figure 1: Distribution of number of local side effects.

Among the local side effects, 991 (38.1%) had local pain, 50 (1.9%) had swelling, 38 (1.5%) had redness, six (0.2%) had itching, four patients (0.2%) reported abscess, eight (0.3%) had more than normal bleeding, three (0.1%) had tingling and numbness in the arm, and one person had bruising (Table 2).

Table 2: Postvaccination local and systemic side effects.

		Frequency	Percent	95%C.I.
Local Side Effects	Local pain	991	38.1	36-40
	Swelling	50	1.9	1-2
	Redness	38	1.5	1-2
	Itching	6	0.2	0-0
	Abscess	4	0.2	0-0
	Bleeding more than normal	8	0.3	0-1
	Numbness and tingling in arm	3	0.1	0-0
	Bruise	1	0.0	0-0
Systemic Side	Weakness	739	28.4	27-30
Effects	Headache	725	27.9	26-30
	Tiredness	675	26.0	27-35
	Myalgia	474	18.2	17-20
	Arthralgia	308	11.8	11-13
	Nausea	141	5.4	5-6
	Fever	121	4.7	4-5
	Runny nose	111	4.3	3-5
	Sore throat	96	3.7	3-4
	Cough	71	2.7	2-3
	Shaking	57	2.2	2-3
	Dyspnea	31	1.2	1-2
	Elevation of blood pressure	27	1.0	1-1
	Allergy	23	0.9	1-1
	Loss of taste	21	0.8	0-1
	Swelling in lymph nodes	12	0.5	0-1
	Vertigo	9	0.3	0-1
	Metallic taste in mouth	9	0.3	0-1
	Loss of smell	5	0.2	0-0
	Sleepiness	4	0.2	0-0
	Itching	2	0.1	0-0
	Vomiting	2	0.1	0-0
	Diarrhea	2	0.1	0-0
	Herpes labialis	2	0.1	0-0

In terms of systemic side effects, 1416 people (54.4%) stated that they developed at least one systemic side effect, while 1185 (45.6%) did not observe any systemic side effects.

Of them, 470 participants had one side effect; two side effects were reported in 358 people, three side effects in 228 people and four side effects in 139 people (Figure 2). Six people had 20 different systemic side effects.

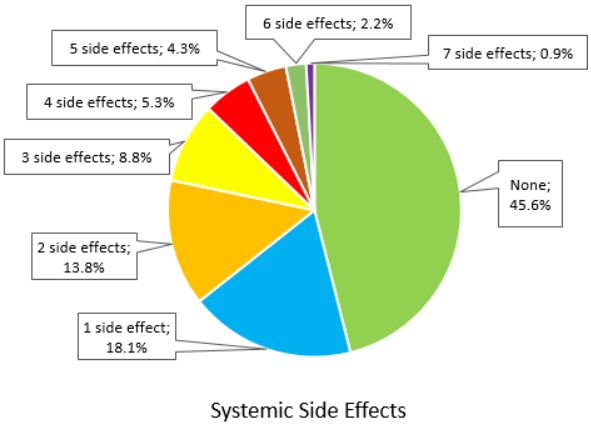

Figure 2: Distribution of the number of systemic side effects.

When systemic side effects were examined, 739 people (28.4%) had a weakness, 725 people (27.9%) had a headache, 675 people (26%) had fatigue, 474 people (18.2%) had myalgia, 308 people (11.8%) had arthralgia, 141 (5.4%) had nausea, 121 (4.7%) had fever, 111 (4.3%) had a runny nose, 96 (3.7%) had a sore throat, 71 people (2.7%) reported cough, 57 (2.2%) had shivering, 31 (1.2%) had shortness of breath, and 27 (1%) had hypertension. Other systemic side effects included systemic allergy in 23 (0.9%), taste loss in 21 (0.8%), swelling in the lymph nodes in 12 (0.5%) and a metallic taste in the mouth in nine (0.3%) (Table 2).

Table 3: Association of local side effects with demographic variables.

	Age	Gender	Occupation	Chronic Disease	COVID History	Allergy History	Smoking	Alcohol Usage
Local Pain	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	0.987	**0.003**	0.161
Swelling	0.754	0.129	0.055	0.782	0.154	0.797	0.650	0.287
Redness	0.998	0.350	0.384	0.125	**0.039**	0.982	0.066	0.160
Itching	1.000	0.748	0.434	0.172	0.995	0.571	0.757	0.315
Abscess	**0.002**	0.911	0.548	0.949	0.650	0.945	0.515	0.701
Bleeding more than normal	**0.001**	0.342	0.264	0.458	0.207	0.351	0.782	0.189
Numbness, Tingling in Arm	0.961	0.286	0.773	0.079	0.440	0.689	0.363	0.422
Bruise	1.000	0.538	0.904	0.578	0.656	0.579	0.649	0.643

It was determined that the side effects developed after vaccination lasted 4.0 ± 2.6 days on average.

The relationship between the local side effects and the participants' demographic data are given in Table 3. Accordingly, local pain was significantly higher in young participants who had no chronic disease, had a previous COVID-19 history, had never smoked and were students in the health field. The local redness was significantly higher in participants with a history of COVID-19 (P<0.05). While abscess and bleeding more than normal were found to be related to age (respectively P=0.002 and P=0.001), local pain was found to be related to gender (P<0.001).

The systemic side effects and the participants' demographic data are presented in Table 4. Systemic side effects such as arthralgia, increased blood pressure, weakness, and fatigue were found to be significantly more common in younger participants (P<0.05). When systemic side effects were compared according to gender, it was found that many side effects, such as fatigue, headache, myalgia, and high blood pressure, were significantly more common in women. Regarding the participants' occupations, systemic side effects such as fatigue and joint pain were significantly more common in nurses and midwives, who were primarily female.

When systemic side effects were evaluated according to whether there was a chronic disease, many systemic side effects, such as joint pain and muscle pain, were more common in those without chronic disease. At the same time, only high blood pressure was found to be significantly more common in those with chronic disease. While alcohol consumption did not cause any side effect differences (P>0.05), fatigue, headache, and joint pain were significantly higher in nonsmokers. Shaking was associated with gender, ocupation and presence of chronic disease, loss of taste was associated with presence of chronic disease, and runny nose was associated with gender and ocupation (P<0.05 for all).

In terms of a previous history of COVID-19, only myalgia and fever were significantly more common among systemic side effects in people without previous COVID-19. In terms of known allergy history, many side effects, such as weakness, fatigue, and headache, were more common in those without a history of allergy. In contrast, taste loss, lymph node swelling and postvaccine allergy development were significantly higher in individuals with an allergic constitution (P<0.05).

Table 4: Association of systemic side effects with demographic variables.

	Age	Gender	Occupation	Chronic Disease	COVID History	Allergy	Smoking	Alcohol
Weakness	**0.002**	**<0.001**	**<0.001**	**0.023**	0.053	**0.001**	**0.041**	0.593
Headache	**0.008**	**<0.001**	**<0.001**	**0.026**	0.297	**0.002**	**0.018**	0.750
Tiredness	**0.039**	**<0.001**	**<0.001**	**0.022**	0.606	**<0.001**	0.600	0.921
Myalgia	**0.018**	**<0.001**	**<0.001**	**<0.001**	**0.048**	**<0.001**	0.693	0.411
Arthralgia	**<0.001**	**<0.001**	**<0.001**	**<0.001**	0.074	**0.003**	**0.028**	0.694
Sleepiness	0.988	0.218	0.120	0.949	0.650	0.945	0.417	0.701
Cough	0.387	**0.005**	0.056	**0.009**	0.171	**0.001**	0.217	0.861
Dyspnea	0.629	0.067	**0.001**	**0.001**	0.061	**0.015**	0.362	0.819
Allergy	0.180	0.119	**0.001**	**<0.001**	0.915	**<0.001**	0.497	0.970
Swelling in lymph nodes	0.878	**0.045**	0.083	**0.031**	0.442	**0.004**	0.619	0.926
Shaking	0.383	**0.001**	**0.001**	**<0.001**	0.603	0.078	0.304	0.280
Itching	1.000	0.384	0.885	0.431	0.203	0.433	0.422	0.512
Loss of taste	0.811	0.064	0.311	**0.038**	0.370	**<0.001**	0.604	0.682
Elevation of blood pressure	**<0.001**	**0.005**	**0.010**	**<0.001**	0.198	**0.010**	0.656	0.694
Runny nose	**0.040**	**<0.001**	**<0.001**	**0.046**	0.497	0.116	0.519	0.728
Fever	0.903	0.273	**0.007**	0.458	**0.006**	0.579	0.320	0.733
Sore throat	0.227	**0.002**	**0.001**	0.250	0.800	**0.021**	0.454	0.582
Metallic taste in mouth	1.000	0.064	0.252	0.095	0.181	0.926	0.084	0.605
Nausea	0.146	**0.002**	**0.004**	0.249	0.397	0.710	0.168	0.989
Vomiting	0.970	0.384	0.475	0.431	0.203	0.377	0.360	0.231
Diarrhea	0.970	0.384	0.475	0.431	0.203	0.377	0.360	0.231
Vertigo	0.827	0.064	0.779	0.375	0.181	0.487	0.451	0.605
Loss of smell	**0.008**	0.531	0.820	0.848	0.159	0.385	0.189	0.892

4. Discussion

The side effects observed after inactive CoronaVac® vaccination were investigated with the broad participation of individuals working in the health field. While the rate of people with local side effects was 39.9%, the rate of people with systemic side effects was 54.4%. In other words, half of the participants had no systemic side effects and the vast majority had no local side effects. Pain was described as the most common local side effect, and among the systemic side effects, weakness, headache and fatigue were commonly detected.

It is known that prospective controlled trials are a better approach to evaluate the safety of a vaccine. Therefore, with this survey-based research, we cannot easily detect rare events, the population surveyed is not representative of the population at large (i.e. predominantly women and healthcare professionals), and a prospective design may be superior. However, a major purpose of this study was to identify relatively minor side effects that may deter vaccination. According to the data obtained, local side effects that may cause non-vaccination or hesitancy in vaccination were not observed in the vast majority of the study group. This result can be emphasized when informing people about the safety of the vaccine in order to overcome possible barriers to vaccination.

Another important aspect of our study is that the study was conducted on health professionals, and therefore it is possible to obtain more realistic and accurate results with this study group that is aware of, monitors and defines post-vaccine side effects. Another advantage is the lack of prior knowledge and prejudices, since this study population was vaccinated in the first place in our country with the acquisition of the vaccine, and any possible side effects were not known yet at the time of vaccination. Thus, a more objective result was obtained.

There is still a lack of studies regarding side effects after the CoronaVac® vaccine. Acute asthma exacerbation was reported in one case report [4]. Another postvaccine side effect after CoronaVac® was described as petechial rash on the skin [5].

In a study conducted on 780 people questioning the side effects after the CoronaVac® vaccine in healthcare personnel, the most common local side effect was reported as pain (41.5%). The most common systemic side effects were weakness (23.6%), headache (18.7%) and muscle pain (11.2%) [6]. Our study was conducted with more participants than this study. When the results of the study were compared, although the complaints of

local pain and weakness were similar, headache and fatigue were more common in our study. Another common result of this study and our study was that the incidence of side effects increased due to female sex and young age. However, our study found fewer side effects in patients with chronic diseases.

In another study, pain at the injection site (48.6%) was the most common local side effect that developed after vaccination, and itching outside the injection site (2.3%) was the most common systemic finding. In addition, they found that such side effects were more common in patients with a history of allergic disease [7]. Wan et al. investigated the safety of the CoronaVac® vaccine in people over 60 years of age and did not find an increase in the incidence of serious events. However, they found that the incidence of anaphylaxis increased after the second dose of the vaccine [8].

In the current study, all local and systemic side effects were higher than those reported in the first clinical trial studies investigating the safety and efficacy of vaccines involving 809 and 743 people [9-11]. In the study of Riad et al., the side effects were found to be high, similar to our study [6]. We think that this difference is due to methodological differences. Considering that our study numerically represents a large cross-section, we think that our findings reflect real-life data.

Although there were various local and systemic side effects in our study, these were acceptable side effects that were commonly seen in other vaccines, lasted for 4-5 days and improved over time.

A study comparing the efficacy and safety of four different COVID-19 vaccines showed that CoronaVac® had fewer side effects and no serious side effects compared to other vaccines [12]. Other studies have also found that CoronaVac® is a safe vaccine, has fewer local and systemic side effects than other vaccines and is well tolerated [13-16] .Our study found no life-threatening serious or permanent side effects, and it was determined that CoronaVac® is a safe inactivated vaccine.

5. Conclusion

In this study, postvaccination side effects of the inactive CoronaVac® vaccine were investigated with a large-participation study conducted on healthcare workers. A valuable result has been obtained since healthcare professionals are more conscious and can describe side effects more accurately. In this study, the CoronaVac® vaccine was evaluated as a safe inactivated vaccine with no serious life-threatening side effects other than acceptable effects. Future studies should be continued to monitor the safety and tolerability of the vaccine in real-world settings. This will be important for ensuring that the vaccine is safe for widespread use and for identifying any rare or serious side effects that may not have been observed in clinical trials.

Limitations of the Study

One strength of this study is that it can provide valuable information on the safety and tolerability of the Inactive CoronaVac® vaccine in a real-world setting. This may be particularly important for at-risk individuals who are at high risk of exposure to COVID-19 but cannot tolerate the risk of serious post-vaccine side effects. In addition, this study, which was conducted with a relatively large number of people, may provide more descriptive information due to the examination of post-vaccine side effects in healthcare personnel who are more conscious of describing the side effects. However, the study may not have a control group, making it difficult to determine if the side effects observed were caused by the vaccine or other factors. Additionally, there may be some missing, rare but serious side effects that are overlooked and not thought to be related to vaccination. It is also essential to note that the study is focused on a specific region and may not be generalizable to other parts of the world.

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Conflict of Interests

The authors have no conflicts of interest to declare.

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Author Contributions

Concept – ECT, ZO, PGG; Design - ECT, ZO,PGG; Supervision - ZO; Resources - ECT, ZO; Materials - ECT, ZO; Data Collection and/or Processing - ECT, ZO, PGG, MB; Analysis and/or Interpretation – MB; Literature Review - ECT, MB, ZO,PGG; Writing – ECT, ZO, PGG; Critical Review – MB, ECT, ZO, PGG

Ethical Approval

The study was approved by the Erzurum City Hospital Clinical Research Ethical Committee (Date: 15.02.2021; Number: 2021/04-83).

Data sharing statement

All data generated or analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

Consent to participate

No consent to participate is required for this study.

Informed Statement

Participation in the study was voluntary. Informed consent was obtained from participants online.

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