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# COVID-19 IN OLDER ADULTS ANTIBODY RESPONSES OF INACTIVATED SARS-CoV-2 (VERO CELL-SINOVAC) VACCINE FOR ELDERLY COMPARING WITH YOUNGER

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***Abstract: Background:*** **Nowadays, researches are being done along with the ongoing vaccination process worldwild. Although the Covid-19 mostly affected the elderly, evidence based studies about the effectiveness and reliability of the vaccine in geriatric population older than 65, is insufficient. So this unique scientific review, aimed to evaluate the Sinovac vaccine outcomes.**

***Methods:*** **The two doses of the inactivated SARS-CoV-2 (Vero Cell-SINOVAC) vaccine was applied to lodgers and staff. 3 weeks after each dosage, the blood samples were taken from participants to evaluate antibody formation ratios. The outcomes between the lodger and staff groups were compared for vaccine effectiveness at different age groups.**

***Results:*** **Datas from 34 lodgers with the average age of 78.85±12.56 and from 39 staff with the average age of 48.37±11.37 were taken. In lodgers, 61.8% efficiency of SARS-CoV-2 vaccine with first dose, is increased to 85.3% after the second dose. The increased antibody ratios in the lodgers group is found statistically significant ($p<0.05$).In staff, 69.2% efficiency of SARS-CoV-2 vaccine with first dose is increased to 97.4% after the second dose. This improved antibody formation between doses was statistically significant within staff group. Also statistically significant difference at the antibody scores between two doses of vaccination in both groups is seen.**

***Conclusion*****: According to the age related results with the young staff presented with higher scores compared to elderly lodgers, in our Barınyurt Nursing Home conducted research study, the SARS-CoV-2 (SINOVAC) vaccine is found 91.8% beneficial with the positive antibody score in 67 individuals.**

***Keywords:*** **Covid-19, Pandemic, Sinovac vaccine, Geriatric population, Nursing home, Antibody score.**

## I. INTRODUCTION

Corona virus which emerged on December, 2019, became a public health problem across worldwide by spreading and infecting more than 94 million people and causing more than 2 million deaths [3]. According to the genetic evaluations, Covid-19 was found as a member of the family of coronaviridae as a beta type Coronavirus like SARS-CoV and Middle East Respiratory Syndrome which all, infects the human and animal kinds [5]. Because of the genomic appearance of the virus is similar to the severe acute respiratory syndrome Coronavirus (SARS-CoV), the current name of the emerged virus was determined as SARS-CoV-2 and because of the rapid widespread of the cases, it is declared as pandemic on March 11, by World Health Organization (WHO) [2] [5]. Although the virus affects the people from all ages, most severely elderly people who are older than 60 years old of age or have chronic diseases, were faced with serious symptoms and

death compared to the younger individuals [2] [3]. The most common symptoms vary as, difficulty in breathing, cough, headache, fever and further pneumonia while there were also some asymptomatic individuals who were not aware that they were infected because of the absence of the symptoms [5].

Since the genomic structure of the virus was revealed on January 10, 2020, the diagnostic tests to determine the antibodies and respiratory specimen PCR tests were developed and became in demand [5]. Although both methods are used, PCR test may cause late diagnosis so can lead to poor outcomes and burden during the treatment process and prevention of the spread of the infection.[5] That's why, immunologic examination by testing antibody IgM, IgG and immunosorbent assay (ELISA) instruments for the recognition of the Covid-19 is found more preferable [5].

Along with the health problems, current corona virus also cause many economic, social and educational burden in societies [3].And to prevent and decrease these unfavorable issues and to get closer to the end of this pandemic, the necessity to find the efficient and reliable vaccine is occured [4]. To find the efficient and reliable vaccine and to not face with the serious adverse events, it is essential to do the preclinical and clinical tests briskly during the vaccination generation [9]. Thus far, many scientists from different countries, worked on more than 64 applicants at the clinical phase while another 173 different applicants were being tested at the early phases of the trials [3]. According to the studies, inactivated vaccines was found beneficial in antibody development without causing any adverse events [3]. CoronaVac (SINOVAC) which is one of the inactivated vaccine againts the new covid-19 that produced in China, was found favorable and helped to the natural humoral process towards corona virus in individuals at 18-59 ages [3]. Since the Brazil is one of the leader country that finished the advanced phases of the CoronaVac studies, they asserted that, the Covid-19 vaccine was almost %20 much more effective, if the two doses were applied with londer duration like 3 or 4 weeks in between. [6] [7].

Concurrently, the common usage of the Chinese manufactured CoronaVac (SINOVAC) is still continuing in Turkey and the results of the third phase trials of the vaccine is examined by combining datas from 10,216 individual and 24 different center [8]. The research was designed as double blinded randomized plasebo controlled study and aimed to evaluate the vaccine's safety and protectiveness against the virus [8]. The Hacettepe University is confirmed that the effectiveness of the CoronaVac (SINOVAC) is calculated as %83,5 and the hospitalization prevention rate of the vaccine was found as %100 [8]. During the study process, while any death was seen in either groups (CoronaVac / Plasebo), the broad seen side effects were fatigue, headache, muscle pain, fever, shaking [8].

According to our researches, the number of the evidence based studies about the effectiveness and safety of the Covid-19 vaccination, is not at the adequate amount and lacking in elderly population older than 65 years old of age. One of the most seen study limitation is, the decreased possibility to generalize the study results into the whole population from different age groups [10] [11]. For example, in one trial which is conducted in China, they included people between the ages of 18 and 59, that's why it was not possible to compare the unfavourable effects of the vaccine and decide it's protectiveness [11].

On the other hand, in some of the studies, the bodies response to the vaccine was found less in elderly people related with the changes in the immune system by aging [3]. So conducting researches about the impact of the vaccination in geriatric community is required [3]. In this novel and evidence based review article, as administrator and staff members, we aimed to report the experienced outcomes and antibody results both after the first and second doses of the inactivated SARS-CoV-2 (Vero Cell-SINOVAC) vaccine in Barınyurt Nursing Home which is the first Geriatric Care Center in Turkey who took the Quality Conformity Certificate ISO 9001 and holding carrying the certificate. And we analysed these outcome results to see it's effectiveness in elderly lodgers and compare these outcomes with the young staff.

## II. METHODS

### *STUDY POPULATION*

We collected and analyzed the antibody results both after the first and second doses of vaccination by taking the blood samples from total 73 individuals both staff and lodger population in NŞMS Vakfı Barınyurt Nursing Home. While analysing the antibody (IgG) values, we seperated the individuals into two groups as staff (n=34) and elderly lodgers (n=39).

Inclusion Criteria for vaccination; Members of the nursing home between the ages of 22-77 who didnt have the Covid-19 in the past

Exclusion Criteria for vaccination; People who had diagnosed with Covid-19, survived it previously and are healthy at the current time; People who are pregnant; People whose family members didn't give a consent

***STUDY DESIGN***

***Vaccination Process***

The members of the nursing home who didn't undergo Covid-19 disease and some volunteer personnel who had the Covid-19 disease before, were vaccinated on January 19, 2021, with inactivated SARS-CoV-2 Vaccine (Vero Cell), SINOVAC. After shaking the vaccine and bringing it to it's homogen form, it is applied on deltoid muscle as intramuscular injection. Each dosage of the vaccine, contained 0,5 ml SARS-CoV-2 antigen in addition to aluminium hydroxide, disodium hydrogen phosphate, sodium dihydrogen phosphate, sodium chloride. After the vaccination, the particapants were warned to not drink coffee and tea for the upcoming 1 to 3 days to not have any side effects like blood pressure problems. Also the vital signs of all the participants were checked regularly and asked for any adverse events related with the vaccine. During the whole vaccination process (24 hours long), an ambulance was kept in front of the outside door for quick intervention against these complications. Besides all these precautions, although any serious adverse events was developed in any of the participants after the applied Sinovac vaccine, some mild side effects like sneezing, headache, muscle or joint pain, fatigue and increased blood pressure is seen within both staff and lodger groups.

The first dose of the vaccine was applied on January 19, 2021 to 73 members in total which is divided into two groups at the analysis as 34 lodgers and to 39 personnel.

According to the Ministry of Health Instructions, the second those of the vaccination is applied, 30 days after the first vaccination, on February 19, 2021, again to the same 73 participants who had the first dose of the SARS-CoV-2 vaccine previously.

***Antibody Testing***

To see the effects of the first dose of the vaccine, on February 11, 2021, and to see the effects of the second dose of the vaccine, on March 11, 2021, the blood samples were taken either from participants who were vaccinated and also who didnt vaccinated but survived Covid-19 to see if the vaccination is also effective as well as the natural antibody formation process after corona disease.

Our blood samples were analyzed in the Ministry of Health approved and NOVA International ISO 9001:2015 certified center, named as Merkez Laboratory.

Ichroma$^{TM}$ COVID-19 Ab test (Boditech), which is an in vitro diagnostic device, was used to measure IgG and IgM antibodies to fastly diagnose current new corona virus (2019-nCoV) that is placed in human blood, serum, plasma. The ichroma$^{TM}$ device is formed by 'cartridges', 'detectors', 'detector diluent', 'ID chip' and 'instruction paper' for usage. With the 'sandwich immunodetection method', antibody-antigen complexes were formed and more antibody amount in sample forms, resulted in more and stronger antigen-antibody complexes and fluorescence signal by the detector antigen. So the ichroma$^{TM}$ test shows the concentration of the developed IgG and IgM antibodies againts the Covid-19 disease.

***Antibody Types***

The IgG antibody gives an information about the bodies defense against Covid-19. So if a person is found as IgG positive, that person developed protection, immunity against the novel corona virus.

The IgM antibody gives an information about the virus transmission activation within a population. So if a person is found as IgM positive, that person might transmit and infect the other people around him/herself.

In our study, we concentrated on the IgG antibody to understand the protection effect of the inactivated SARS-CoV-2 Vaccine (SINOVAC).

***Statistical Analysis***

Analyses were conducted with Statistical Package for Social Sciences software version 22.0 (SPSS Inc, Chicago, USA). Descriptive data were expressed as means and standard deviations, or as number and proportion as appropriate. The Paired Sample t Test was used to compare dependent variables within-group after the vaccinations. $p<0.05$ was accepted as significance value.

## III. RESULTS

***Study Population:***

Thirty four lodgers and thirty nine staff were included into the study. The average age of Lodger Group (n=34) was 78.85 ± 12.56, and the average age of Staff Group (n=39) was 48.37 ± 11.37. There was a statistically significant difference between the groups in terms of age (p<0.05). Distribution of demographic data was shown in Table 1.

**Table 1. Distribution of demographic data**

| | | Lodger Group (n=34) | Staff Group (n=39) | Z | p value |
|---|---|---|---|---|---|
| Age (Avg ± SD) | | 78.85 ± 12.56 | 48.37 ± 11.37 | -6.719 | 0.000* |
| Gender | Female (n / %) | 14/41.1% | 24/61.5% | | |
| | Male (n / %) | 20/58.8% | 15/38.5% | | |

Avg: Average, SD: Standard deviation. *p<0.05

***Participant Characteristics***

Out of all participants, there was only 1 elderly who hasn't been diagnosed with any chronic diseases before. The common seen chronic diseases in our elderly members of the nursing home were, diabetes, heart failure, hypertension, COPD, asthma, heart failure, etc.

***Vaccination Process***

Although there are 151 indivuduals in the Barınyurt Nursing Home, 45 individuals, equal to or younger than age 65, and 26 individuals, older than age 65, had the Covid-19 diagnosis in the past and 7 members didn't give a consent for the vaccine application. That's why, only 73 individuals in total, had the vaccination in the institution**.**

***Lodger's Antibody Results After The First Dose***

The SARS-CoV-2 vaccine was applied to 34 elderly guests. At the antibody analyses, while 13 members were resulted with negative antibody score (IgG < 1), 21 lodgers were found as antibody positive with the average IgG score of 8.49 ± 10.33. So only the single dose of inactivated SARS-CoV-2 vaccine was found 61.8% efficient againts the novel Corona virus in geriatric lodger population (Avg age ± SD)78.85 ± 12.56). (Table 2)

***Staff Antibody Results After The First Dose***

The SARS-CoV-2 vaccine was applied to 39 staff member. At the antibody analyses, while 12 members were resulted with negative antibody score (IgG < 1), 27 participants were found as antibody positive with the average IgG score of 10.48 ± 9.54. So the inactivated SARS-CoV-2 vaccine was found 69.2% efficient againts the novel Corona virus in staff of the nursing home. ((Avg age± SD)48.37 ± 11.37) (Table 2)

***Lodger's Antibody Results After The Second Dose***

The second dose of the SARS-CoV-2 vaccine was again applied to 34 elderly guests. At the antibody analyses, while 5 members were resulted with negative antibody score (IgG < 1), 29 lodgers were found as antibody positive with the average IgG score of 25.35 ± 20.92. So the second dose of inactivated SARS-CoV-2 vaccine was found 85.3% efficient againts the novel Corona virus in geriatric population ((Avg age ± SD)78.85 ± 12.56). (Table 2)

***Staff Antibody Results After The Second Dose***

The second dose of the SARS-CoV-2 vaccine was applied to 39 personnel. At the antibody analyses, while 1 member was resulted with negative antibody score (IgG < 1), 38 staff was found as antibody positive with the average IgG score of 26.01 ± 13.44. So the inactivated SARS-CoV-2 vaccine was found 97.4% efficient againts the novel Corona virus in staff of the nursing home. ((Avg age± SD)48.37 ± 11.37) (Table 2)

***Comparison Between The First and Second Dose Of the Inactivated SARS-CoV-2 Vaccine (SINOVAC)***

The IGG changes within groups were shown in Table 2. The percentage of IGG positive was changed from 61.8% to 85.3% in the Lodger Group between vaccination I and II. A statistically significant difference was found between the percentages of having IGG within Lodger Group (p<0.05). The percentage of IGG positive was changed from 69.2% to

97.4% in the Staff Group between vaccination I and II. A statistically significant difference was found between the percentages of having IGG within Staff Group ($p<0.05$).

**Table 2. IGG Changes within groups**

| | | | Vaccination I (n / %) | Vaccination II (n / %) | t | p value |
|---|---|---|---|---|---|---|
| **Lodger Group** | IGG | >1 | 21 / 61.8 | 29 / 85.3 | 3.187 | **0.003*** |
| | | <1 | 13 / 38.2 | 5 / 14.7 | | |
| **Staff Group** | IGG | >1 | 27 / 69.2 | 38 / 97.4 | 3.864 | **0.000*** |
| | | <1 | 12 / 30.8 | 1 / 2.6 | | |

Avg: Average, SD: Standard deviation. *Paired Sample t Test.* $p<0.05$

The changes in terms of antibody scores within groups were shown in Table 3. There were statistically significant differences in terms of antibody scores within groups in both groups ($p<0.05$).

**Table 3. Antibody Score Changes within groups**

| | Vaccination I (Avg ± SD) | Vaccination II (Avg ± SD) | CI | t | p value |
|---|---|---|---|---|---|
| **Lodger Group** | 8.49 ± 10.33 | 25.35 ± 20.92 | (-22.90/-10.80) | -5.669 | **0.000*** |
| **Staff Group** | 10.48 ± 9.54 | 26.01 ± 13.44 | (-18.71/-12.33) | -9.854 | **0.000*** |

Avg: Average, SD: Standard deviation, CI: Confidence interval. *Paired Sample t Test.* $p<0.05$

## IV. DISCUSSION

In this new, detailed examined review study, the inactivated SARS-CoV-2 (SINOVAC) vaccine is found effective both in adult and the geriatric population groups. The efficiency of the Sinovac vaccination on the antibody formation ratios, was less in elderly individuals when compared with the adult staff group. According to the study which is conducted in China, this may be the consequence of the age related changes in the elderly people's immune system.[3] Similar to how elderly people face with more severe symptoms and how there are different indicators of the disease according to the age like the common confusion problem in older individuals, the results of the body's immune system response against to the vaccine is also found different [12]. Although the CoronaVac (SINOVAC) vaccine was found safe, reliable and applicable at the Covid-19 protection in one double blinded, randomized controlled trial which included the adults between the ages of 18-59, the research of the vaccine in individuals older than 65 years old of age is missing [3]. There are some available resources in the literature about the effect of the Pfizer and BioNTech vaccine. But despite the fact that the nursing homes are one of the most risky places about the Covid-19 related highly seen complications and death ratios in vulnerable geriatric population, the amount of these researches are limited [13]. In a study which is released on March 2021 and is conducted in two nursing home facilities, the vaccine's protective ability and how the Pfizer and BioNTech vaccine affected the lodgers in the nursing home after a single dose of vaccination, is evaluated [13]. Totaly 72 lodgers, between the 65 and 85 years old of age, were vaccinated with the first dose and as a result the Pfizer and BioNTech vaccine is found 63% efficient at the prevention from the SARS-CoV-2 virus [13]. In a study which is conducted in Israel with the adult individuals, they asserted that, the testing time of the formed antibody ratios after the vaccination is also an important determinant as well as the vaccine effectiveness itself [1]. At the study results, while the vaccine efficiency ratio was 46%, 14-20 days after the first dose, it increased to the 60%, 21-27 days after the first dose [1]. And in both of the time intervals, the vaccination effectiveness was less in the geriatric population older than age 70 and in participants with past chronic conditions [1] In another vaccination trial which is conducted in Germany and United States, the two different forms of Pfizer and BioNTech vaccine (BNT162b1/BNT162b2) were evaluated in people at the ages of 18-85 and while the immunogenicity of the two forms is found kind of same, again the immune systems antibody response to the vaccine was found lower with the increased age [14].

When we compare our study results with previous vaccination study results above, while the Pfizer and BioNTech vaccine effectiveness is researched with the participation of 72 elderly people from two different nursing homes, our study included 34 elderly lodgers. According to the results after the first dose of application, the Pfizer and BioNTech vaccine is found 63% effective while the inactivated SARS-CoV-2 (SINOVAC) vaccine is found 61.8% effective in the lodgers group in Barınyurt Nursing Home. So the Sinovac vaccine is found less protective than the Pfizer and BioNTech vaccine

with a little difference (1.2%) in the positive antibody ratio. In the Pfizer and BioNTech vaccine study, that is done in Israel with adults, antibody testing 21-27 days after the vaccination is found more favourable than testing 14-20 days after the vaccination. Similar to that knowledge, the antibody scores and positiveness ratios in our study, were tested 3 weeks (21 days) after the Sinovac vaccination. So although the vaccines in this and previous studies are different than eachother, maybe the time factor is affected the study outcomes, similar to those forgoing researches. When we compare the age related outcomes in our study and the 2020 published study that is conducted in Germany and United States with Pfizer and BioNTech vaccine, the same results are found as the vaccine's efficiency is decreased with an increasing age. When we analyse the study results according to the Sinovac vaccine related side effects, the applied Sinovac vaccine to the elderly lodgers in this study is found safe and reliable, same as the double blinded study results which included the adult participants between the ages of 18-59. So all the above comparisons may be interpreted as, our research study results is equivalent to the previous researches and this novel study is a confidential resource in the literature.

## V. CONCLUSION

In Conclusion, either the single dose and the two doses of the Sinovac (inactivated SARS-CoV-2) vaccine is found 91,8% efficient in total against to novel corona virus with some differences between the adult personel with the average antibody score of 97.4% and the elderly lodgers with the average antibody score of 85.3% in the Barınyurt Nursing Home. The efficiency of the vaccination was higher in the adult staff when compared to the lodgers which may be related with the seen mild symptoms with the Covid-19 infection in young individuals than the elderly. Because of the deficient amount of vaccine studies in geriatric population, this study was a unique and scientfic review by searching the effectiveness of the developed inactivated Sinovac vaccine against the Corona virus in especially elderly people which are older than 65 years old of age. Further researches are recommended with the highly risky geriatric population to see either the Sinovac vaccine and other vaccine's effectiveness, to be aware of the common side effects and to evaluate it's protection level against the Covid-19 infection to lessen the new cases and cease the pandemic.

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