Original Research Article

Association of COVID-19 infection severity with vaccination and diet: a comparative cross-sectional study

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ABSTRACT

Background: The COVID-19 pandemic has drastically affected the socio-economic lives of people around the globe. Along with preventive measures like wearing mask, social distancing, practicing hand hygiene and staying home, the two main immunomodulatory strategies are vaccination and healthy diet intake. Our study was aimed to determine the inter-relationship between COVID-19 severity and vaccination status and between COVID-19 severity and diet.
Methods: This comparative cross-sectional study was performed among 183 COVID-19 patients from July 2021 to December 2021 in a COVID-19 dedicated hospital of Rawalpindi, Pakistan. The convenient sampling was used to select the participants. Self-designed proforma with high reliability (Cronbach alpha value= 0.790) was used for the collection of data. Descriptive and inferential statistics were applied for the evaluation of study variables. Chi-square test was utilized to check the correlation between vaccination and COVID-19 and between diet and COVID-19.
Results: Out of 183 participants 95 (51.91%) were vaccinated while 88 (48.09%) were un-vaccinated. Depending upon the guideline for COVID-19 infection severity provided by Government of Pakistan, 95 (51.92%) patients had asymptomatic infection, 72 (39.34%) patients had non-severe infection, 11 (6.00%) patients had severe infection, and 5 (2.74%) patients had critical infection. The association between vaccination and COVID-19 infection was statistically significant (p value 0.004). The correlation between COVID-19 infection severity and various diet types was also significant with plant-based diet (p=0.0001), animal-based diet (p=0.002), fast food (p=0.01), and micronutrients (p=0.0003).
Conclusions: In short, our study suggests that COVID-19 infection was less severe among vaccinated patients in comparison to non-vaccinated patients. Furthermore, it also showed that high intake of plant-based diet and micronutrients was protective against COVID-19 infection whereas high intake of animal-based diet and fast food was associated with more severe COVID-19 infection.

Keywords: Association, COVID-19, Severity, Vaccination, Diet

INTRODUCTION

The COVID-19 (coronavirus disease 2019) is caused by the virus known as SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2). The primary carriers of the SARS-CoV-2 are bats. Bats transmits virus to humans and act as intermediate hosts. The transmission of virus to other humans from infected humans can occur though airborne droplets or through direct contact.[1] A patient of COVID-19 infection could be present with

fever, sore throat, cough, difficulty in breathing, body aches, fatigue, loss of sense of taste and smell, diarrhea, and decrease blood oxygen saturation.[2]

This disease after the its start at the end of 2019 in China, was acknowledged as global medical emergency within very short time period. All over the world, almost 197 million cases and approximately 4.2 million deaths due to COVID-19 have been noted and they are still increasing in numbers day by day.[1] COVID-19 pandemic is not only taking lives of a great many people around the globe, but it has also destroyed the economic and social lives in every part of world.[3] Thus, all of us must try our best to end this pandemic, so that normalization of lives could be achieved as they were before pandemic.

Multiple preventive measures against the COVID-19 spread including wearing mask, social distancing, practicing hand wash, and staying home, are advised to public by world health organization to prevent the spread the COVID-19 infection.[1] Implementation of these steps in stopping COVID-19 spread has proved effective. But the other strategies which could even prevent the development of COVID-19 infection instead of its just spread prevention are also in making. Two of those strategies are vaccination and balanced diet. Both of these stop the occurrence of infection either via directly producing immunity against causative virus or indirectly by boosting the present immunity of body. Vaccines against the COVID-19 are still in its developing stage. Different types of vaccines are now available all around the world and these have different effectiveness and different side effects. Researches have been conducting throughout the world to assess the effectiveness of vaccines against COVID-19 infection. Likewise, studies have also been performing in the whole world to assess the impact of various diet types on COV1D-19 infection development or on its severity.[3-6] As researches have been executing in every part of globe to estimate the role of vaccines and diet in knocking off the present COVID-19 pandemic, our study was also aimed to determine the action of vaccination and diet in the prevention of incidence of COVID-19 infection. If we notice that these strategies are effective in our population then we would be able to fix this present major health emergency appropriately by urging people to get vaccinated and to eat specific type of diet that would have been proved protective against infection. Consequently, reduction in the infection rate would not only save human lives but it would also bring improvement in economic and social lives that has been impacted badly by COVID-19 pandemic.

METHODS

This comparative cross-sectional study was carried out among the 183 patients of COVID-19 in approximately 4 months from July 2021 to October 2021 at Rawalpindi institute of urology and transplantation, Rawalpindi, Pakistan, which was devoted for the treatment of COVID-19 patients during this study period. Ethical approval was taken from IRB (institutional review board). Only those patients who had real time polymerase chain reaction (rt-PCR) tested positive for severe acute respiratory syndrome corona virus (SARS-CoV), and had vaccinated via Sino pharm vaccines were include in this study whereas, patients who were suspected case or with negative RT-PCR and got vaccination via other than Sino pharm were excluded from the study. In this study convenient sampling was used for selection of participants. After elaboration of objectives of research, informed consent was taken from each participant before data collection.

Self-structured proforma was used for data collection. It has three parts. In first, demographic details which included age, gender, and vaccination status (vaccinated or non-vaccinated) were noted. In second part of proforma, the dietary habits were recorded. Four groups of food were included in study. These groups included, plant-based food (Fruits, vegetables, legumes, grains, and cereals), animal-based food (Meat and poultry), micronutrients like minerals and vitamins (Vitamin C, D, A, E, B_{12}, B_6, B_1, B_2, B3, folate, zinc, calcium, and iron), and fast food (burgers, pizza, and fried chips). Three frequency levels of particular food intake were noted including low, moderate and high frequencies. These levels were developed by knowing the intake frequency of all food group per week in the time of last month (i.e. low frequency: twice per week or at least once per week, moderate frequency: 3-6 times per week, and high frequency: once per day or more than once every day). Third portion was related to severity of COVID-19. Patients were classified into four classes including asymptomatic, non-severe, severe, and critical according to clinical management guidelines for COVID-19 infection of government of Pakistan.

Statistical analysis

Data analysis was performed via SPSS version 25. To assess the reliability of self-designed proforma a pilot study was conducted among 35 patients with the calculation of Cronbach alpha value. Its value was 0.790 which showed high reliability of used proforma. Descriptive and inferential statistics were utilized for the assessment of the study variables. Means and standard deviations were calculated for numerical variables whereas, for categorical variables frequency and percentages were determined. Chi square test was used to evaluate the association between vaccination status and COVID-19 severity and diet and COVID-19 severity. The p value less than 0.05 was regarded significant.

RESULTS

From the total of 183 patients who were recruited in the study 108 (59.02%) were males whereas, 75 (40.98%) were females. The mean of age of study participants was 43.09 years with SD (standard deviation) of ±6.79years.

Percentage of patients of COVID-19 infection with severe and critical disease was more among non-vaccinated group of patients as compared to vaccinated group of patients who had more asymptomatic and non-severe COVID-19 infection percentage (Table 1).

Table 1: Association between severity of COVID-19 infection and vaccination status.

Cross tabulation and Chi-square analysis (n=183)						P value
Parameters		**Severity of COVID-19 Infection**				
		Asymptomatic frequency (%)	**Non-severe frequency (%)**	**Severe frequency (%)**	**Critical frequency (%)**	
		95 (51.92)	72 (39.34)	11 (6.00)	5 (2.74)	
Vaccination status	Vaccinated n=95 (51.91)	69 (72.64)	24 (25.26)	2 (2.10)	0 (0.00)	0.0004
	Non-vaccinated n=88 (48.09)	26 (29.54)	48 (54.54)	9 (10.22)	5 (5.70)	

Table 2: Association between severity of COVID-19 infection and different diets groups.

Cross tabulation and Chi-square analysis (n=183)						P value
Diet groups		**Severity of COVID-19 Infection**				
		Asymptomatic Frequency (%)	**Non-severe Frequency (%)**	**Severe Frequency (%)**	**Critical Frequency (%)**	
		95 (51.92)	72 (39.34)	11 (6.00)	5 (2.74)	
Plant based	High frequency N=96 (52.45)	55 (57.29)	38 (39.58)	2 (2.08)	1 (1.05)	0.0001
	Moderate frequency N=45 (24.59)	22 (48.88)	18 (40.02)	3 (6.66)	2 (4.44)	
	Low frequency N=42 (22.95)	18 (42.85)	16 (38.09)	6 (14.28)	2 (4.78)	
Animal based	High frequency N=59 (32.24)	31 (52.54)	17 (28.83)	8 (13.55)	3 (5.08)	0.002
	Moderate frequency N=60 (32.78)	37 (61.68)	19 (31.66)	2 (3.33)	2 (3.33)	
	Low frequency N=64 (34.97)	27 (42.20)	36 (56.25)	1 (1.55)	0 (0.00)	
Fast food	High frequency N=55 (30.05)	12 (21.83)	30 (54.54)	9 (16.36)	4 (7.27)	0.01
	Moderate frequency N=43 (23.49)	20 (46.51)	21 (48.83)	1 (2.33)	1 (2.33)	
	Low frequency N=85 (46.44)	63 (74.11)	21 (24.72)	1 (1.17)	0 (0.00)	
Micro-nutrients	High frequency N=39 (21.31)	31 (79.48)	7 (17.96)	1 (2.56)	0 (0.00)	0.0003
	Moderate frequency N=51 (27.86)	26 (50.98)	21 (41.18)	3 (5.88)	1 (1.96)	
	Low frequency N=93 (50.81)	38 (40.87)	44 (47.31)	7 (7.52)	4 (4.30)	

The association between vaccination status and severity of COVID-19 was significant statistically with p value of 0.0004. High intake of plant-based diet and micronutrients was protective against COVID-19 infection in comparison to high intake of animal-based diet and fast food (Table 2). The percentage of patients with severe and critical infection was higher among patients with high consumption of animal-based and fast food than patients with high consumption of plant-based and micronutrients among those asymptomatic and non-severe infection was more common. The correlation between COVID-19 infection and various diet types was

significant with p values 0.0001, 0.002, 0.01, 0.0003 for plant-based diet, animal-based diet, fast food, and micronutrients respectively.

DISCUSSION

The COVID-19 after its appearance in the December 2019 in China, spread in all over the world in no time. Social and economic lives were affected by it badly. Initially the only prevention of COVID-19 infection from one person to other was only possible through preventive measures which included wearing mask, social distancing, practicing hand wash, and staying home as there was no definitive strategy against COVID-19 infection. Although these control measures were very helpful against COVID-19 infection spread, but these were not very much effectual in the reduction of mortality among COVID-19 infection. So, soon after COVID-19 pandemic emergence the search for definitive management of COVID-19 infection was started. Vaccines against infection was one of the parts of management and its development was started just after the different countries of the world including United States of America, Russia, China, and United Kingdom. Presently, different types of vaccines are available in the world. After vaccination of newly developed vaccines against the COVID-19, studies to assess the effectiveness of COVID-19 vaccines have been conducting.

In our present study we noted that 51.91% of participants were vaccinated against COVID-19 infection and the vaccinated population had more percentage of patients with less severe or even asymptomatic infection in comparison to the non-vaccinated people which means that vaccine reduce the severity of COVID-19 infection. Thus, the reduction in severity of infection through vaccination would also reduce the mortality among COVID-19 patients. Similar findings have been noted in the studies in different parts of world.[3,6,7] As we observed in our study that vaccines reduce the severity of COV-19 infection. Therefore, we must encourage people to get vaccinated for the protection of themselves and others.

One of the other strategies along with vaccination that boost up the immunity instead of immunity development as vaccine does, is balanced diet intake. Various studies in literature, that presented the idea that diet could influence the COVID-19 infection course. Our study showed that diet influence the outcome of COVID-19 infection and different diets impact infection distinctly.

In this study we found that high intake of plant-based diet and micronutrients was associated with less severe COVID-19 infection in contrast to the high intake of animal-based diet and fast food which were linked with more severe COVID-19 infection among patients. Multiple researches in literature gave similar results as the results of our study. A study that was conducted in Poland has shown that pant-based diet and micronutrients are protective against the COVID-19 infection by providing chemicals that act as antioxidant, anti-inflammatory and immunomodulatory agents in body and protect body from infection.[1] Likewise, studies that were conducted in Mexico, Iran, United States of America, and Germany, have suggested identical role of animal-based and fast foot in the increase of severity of COVID-19 infection by the production of pro-inflammatory agents.[4,8,9,10] Thus, we should aware public about the importance of diet in the prevention of COVID-19 infection. At the end study we recommend everyone to get vaccinated and eat healthy diet to avoid COVID-19 infection. Health authorities should also take actions to get people vaccinated and make people aware about the role of balanced diet in the prevention of COVID-19 infection.

Limitations

Even though, our study has brought very crucial strategies for the prevention of COVID-19 into the spot light, but our study has one limitation due its cross-sectional design. Because of this design study we could not find mechanism by which vaccination and diet decrease the severity of COVID-19 infection in our study population. So, further studies are required to highlight those mechanisms.

CONCLUSION

Our study concluded that COVID-19 infection was less severe among vaccinated patients than un-vaccinated patients. While the correlation between various diet types and COVID-19 infection severity showed that consumption of plant-based diet and micronutrients was associated with less severe infection and consumption of animal-based diet and fast food was associated with more severe infection. Therefore, our study recommends that we should get ourselves vaccinated and should add plant-based and micronutrients in our diet to prevent COVID-19 infection and if infection occurs then it's severity would be reduced.

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