

Evaluation of the Vitamin C and Some Antioxidants in Patients with COVID-19

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ABSTRACT

Across sectional study was carried out to evaluate the Vitamin C (Vit C) and some anti-oxidant in Sera of patients with corona virus. The study conducted on 60 blood samples, Group1(G1) includes 40 samples for patients with COVID-19, Control group which included 20 samples for healthy individuals with age range (35–60) year. Patient samples were collected from Al-Karama General Hospital (isolation unit), in Iraq. The present study includes the determination of serum C-reactive protein-CRP, Vitamin-C, Zinc, Glutathione (GSH) and Malonaldehyde (MDA). The results indicate that the level of serum CRP significantly increased ($p \leq 0.01$) in G1 compared with Control group. The level of Sera Vit. C, Zinc and GSH significantly decreased ($p \leq 0.01$) in G1 compared with control group. The MDA level significantly increases ($p \leq 0.01$) in G1 compared with a control group.

From the present study, we conclude that the infection with coronavirus may reduce the antioxidant level and increase the oxidative stress in sera of patients with COVID-19.

Keywords: Antioxidant, COVID-19, Vit. C.

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INTRODUCTION

In 2019, another type of coronavirus appeared, which is the coronavirus which was first reported in the Chinese city of Wuhan, and then cases of infection spread throughout the world, as the causative agent belongs to one of the coronaviruses with RNA. Linear, single-enveloped, later called SARS-CoV-2, which has the potential to target lung cells^{1,2} and the World Health Organization (WHO) renamed it as COVID-19 on February 11th 2020.³ The clinical symptoms of the COVID-19 virus have varied and ranged from mild respiratory diseases to severe, sometimes leading to death due to respiratory failure.⁴

Coronaviruses are a large family of viruses that cause disease to humans and animals; as seven coronaviruses can cause infection to healthy individuals around the world, but humans are infected with coronaviruses (229E, NK63, OC43, HK41). They usually cause infection in the respiratory system and range from common to cold to more severe diseases such as respiratory diseases in the Middle East, middle east respiratory syndrome (MERS) syndrome, acute respiratory syndrome, severe acute respiratory syndrome (SARS) and the last severe virus is coronavirus called (COVID 19) which is an infectious disease.⁵ Symptoms of COVID-19 include fatigue, Aches Headache, vomiting, diarrhea, fever, coughing, shortness of breath or difficulty breathing.^{6,7}

Some biomarkers were used to predict severe disease in patients with COVID-19 such as C-reactive protein (CRP), ferritin, lactate dehydrogenase, fibrinogen and D-dimer.^{8,9} Many studies found that the increased levels of D-dimer may contribute to mortality associated with a weak immune system and lead to many diseases, as the immune system is primarily sensitive to high D-dimer, which is a predictive biomarker of infection with viruses.¹⁰ Some studies have also confirmed a significant association between CRP concentrations and exacerbation of COVID-19 patients.¹¹

However, the activity of the virus decreases with an increase in the levels of antioxidants, like Vit C and glutathione. Antioxidants maintain the main function of immune cells against the disorders caused by oxidative stress. Therefore, the immune system is considered an indicator of health, and the availability of these antibodies has important effects on the immune response and thus protection from viruses.¹² Oxidative stress is one of the main aspects contributing to deaths related to immune system dysfunction, so it is recommended to take antioxidants, including vitamin C.¹³

Vitamin C is a water-soluble enzymatic antioxidant found in plasma.¹⁴ The main functions of Vit C are neutralizing free radicals, reducing iron, and regenerating vitamin E.¹⁵ Vit. C works in the human body, inhibiting or scavenging free

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radicals, and for this reason, it prevents cell damage induced by free radicals,¹⁶ The deficiency of the vitamin is associated with exposure to respiratory infections during infection with viruses, so the vitamin may have a role as an antioxidant that reduces respiratory infections.¹⁷

Vitamin C is one of the proposed nutritional supplements for the treatment of coronaviruses because it works to reduce levels of oxidative stress.¹⁸ A study on 146 patients with COVID-19 observes that the administered dose of 200 mg/kg can lead to a reduction in symptoms and infection¹⁹ and this reduction was also observed in patients infect with influenza virus.²⁰

MATERIAL AND METHODS

Sample Collection and Study Design: The study was conducted on 60 blood samples (males and females), 40 samples for patients with COVID-19 (25 males and 15 females), and 20 samples of healthy individuals as a control group (12 males and 8 females), the age range (35–60) year. Patient samples were collected from Al –Karama General Hospital (isolation unit). The serum samples were obtained from the collected blood after centrifugation and used to determine the biochemical parameters under investigation. The total samples collected were divided into two categories:

Control group(C): Consists of 20 samples of healthy individuals
Group one(G1): Consists of 40 patients with COVID-19.

Methods

The present study include the determination of:

- Serum C-reactive protein-CRP by using CRP-latex test kit provided from Specterum -Spanish²¹
- Serum Vit. C also estimated by the present study by using method.²²
- Serum zinc also estimated by the present study by using method²³

Serum glutathione was also according by the present study by using Elman’s reagent in the modified method^{24,25} and MDA according to the method of the colorimetric method.²⁶

Statistical Analysis

The statistical package for the social sciences (SPSS) statistical program was used to analyze the result between patients and control using the F-Test and at a probability level $p \leq 0.01$.

RESULTS AND DISCUSSION

The present study includes determining the serum CRP, Vit.C, Zinc, GSH and MDA in sera of patients with COVID-19 and control. The results obtained are summarized at Table 1.

Estimation of CRP Level

Table 1 showed that the mean \pm S.D of the CRP level was (56.103 \pm 18.134) mg/L in patients with COVID-19 and (8.632 \pm 2.554) mg/L in control group. The results indicate a significant increase ($p \leq 0.01$) in the level of CRP in the sera of patients with COVID-19 as compared with healthy group, Figure 1.

The result of the present study agreed with other research,^{27,28} which showed that the level of CRP was signifi-

cantly higher in patients with coronavirus compared with the healthy group.

CRP is an acute-phase nonspecific inflammatory protein whose concentration increases in response to tissue injury and the occurrence of inflammation and infection.^{29,30} It is a protein produced by the liver and serves as an early indicator of infection and inflammation.³¹ Its normal concentration in the blood is less than (10 mg/L), as this percentage increases rapidly within hours and gives the highest peak in 48 hours from the onset of the disease.³²

Since the COVID-19 virus is one of the acute respiratory syndrome diseases, it was found that the level of CRP reflects the resulting changes in the intensity of the inflammatory response upon the emergence of strong inflammation.^{33,34}

Estimation of Vitamin C Level

Table 1 showed that the mean \pm S.D of the Vit C level were (59.58 \pm 2.30) mg/dL in patients with COVID-19 and (35.75 \pm 14.87) mg/dL in control group. The results indicate a significant decrease ($p \leq 0.01$) in the level of Vit. C in the sera of patients with COVID-19 as compared with healthy group (Figure 2).

The result of the present study agreed with the finding of other research,³⁷ who indicated that the level of Vit C was significantly Low in patients with COVID-19 compared to the control group. The Low vitamin C is associated with respiratory tract exposure to pneumonia.^{38,39} These infections can be eliminated by using vitamin C⁴⁰ as its use as an antioxidant works to reduce the inflammatory response syndrome that causes the virus, as the use of a dose of 6 gm per day leads to a reduction in the risk of infection with viruses^{41,42} and helps to improve health conditions.⁴³ A study was conducted in China for 50 patients who were given doses of Vit C with a concentration of 10–20 g/day led to a reduction in symptoms and infection with COVID-19.⁴⁴

Table 1: Mean \pm S.D of the of Vit. C, GSH, MDA and CRP in sera of patients and control group

Parameter	Control	Patients
CRP(mg/L)	8.632 \pm 2.554	56.103 \pm 18.134
Vit.C	2.30 \pm 59.58	4.87 \pm 35.75
Zinc(mg/dL)	5.04 \pm 92.97	2.87 \pm 29.17
GSH μ mol/L	0.297 \pm 7.720	0.337 \pm 2.617
MDA μ mol/L	0.181 \pm 2.028	0.418 \pm 6.530

Significant $p \leq 0.01$ **

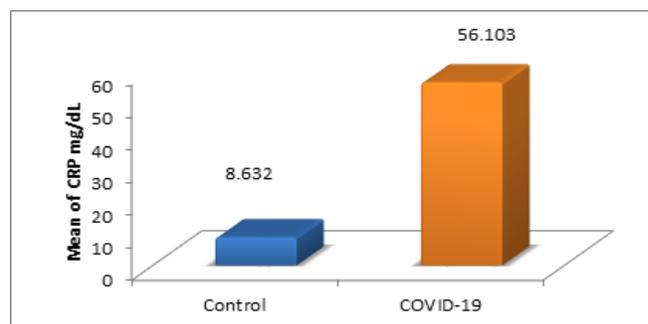


Figure 1: Mean of serum CRP level in groups under investigation

Estimation of Zinc Level

Table 1 showed that the mean ± S.D of the Zinc level were (92.97 ± 5.04) mg/dL in patients with COVID-19 and (29.17 ± 2.87) mg/dL in control group. The results showed a significant decrease (p ≤0.01) in the level of zinc in the sera of patients with coronavirus as compared with control group (Figure 1).

The result of the present study agreed with other researchers,^{37,45} who indicated that the level of zinc was significantly decreased in patients with COVID-19 compared with the healthy group.

Zinc participates in different cellular processes and possesses various anti-viral properties; its deficiency is associated with a decrease in antibodies.⁴⁶ It also affects the secretion of pro-inflammatory cytokines that interfere with the antigen associated with the function of white blood cells and thus suppresses the inflammatory reaction⁴⁷ as zinc affects aspects of multiple immune system.⁴⁸ Some studies have found that Zn is useful in the treatment of COVID-19, due to its immune and anti-viral properties, as well as being an antioxidant that stabilizes membranes and its role in preventing virus infection caused by free radicals.⁴⁹ The Zn deficiency is a cause of disease development and exacerbation, and this confirms the importance of a deep understanding of the different functions of zinc in the immune system and thus health and disease.⁵⁰ Zinc deficiency causes respiratory infections from pneumonia.⁵¹ As zinc deficiency leads to an effect, the levels of inflammatory cytokines are affected.⁵²

Estimation of the GSH level

Table 1 shows also the mean ± standard deviation of the level of GSH, as it was (2.617 ± 0.337) μmol/L in patients with COVID-19, and (7.720 ± 0.297) μmol/L in control group. The results indicate that serum GSH level was significantly decreased (p ≤0.001) in G1 and as compared with a control group (Figure 2).

This finding was agreed with other researchers,⁵³ who indicated that a low level of glutathione is the main cause of the excessive inflammatory response associated with COVID-19, while a high level of GSH may prevent the infection and reduce the severity of the disease in patients with COVID-19 syndrome.

GSH- is important in many biological processes. Not only is it an antioxidant but it is anti-viral, and works to

regulate the immune system and remove toxins from the body.⁵⁴

Most research emphasized the advantages of GSH on the human body, which acts as an anti-virus, and its role in pathology and clinical classifications is misunderstood.⁵⁵ GSH exhibits anti-viral activity through its important role in inhibiting types of virus replication, as the ratio of ROS/GSH is associated with the development of coronaviruses.⁵⁵ People with COVID-19 have high levels of ROS and Low in GSH level.⁵⁵

Estimation of MDA level

Table 1 shows the mean ± S.D of the level of MDA as it was (6.530 ± 0.418) μmol/L in sera of patients with Covid-19, while the control group was (2.028 ± 0.181) μmol/L. The results indicate that the level of MDA is significantly elevated (p ≤0.01) in sera of patients with coronavirus compared to the control group, as shown in Figure 3.

The result agrees with the finding of Muhammad,⁵⁶ who indicated the level of MDA elevates in sera of patients with COVID-19 compared to healthy individuals. Oxidative stress plays an important role in coronavirus infections, as high levels of oxidative stress have an important effect during the early stages of virus infection by preventing the viral protein from binding to host cells (Figures 4 and 5).⁵⁷

The antioxidants maintain the main function of immune cells against the disorders caused by oxidative stress. Therefore, the immune is an index of health. The availability of these antibodies has important effects on the immune response and thus protection from viruses.⁵⁸ Therefore, the

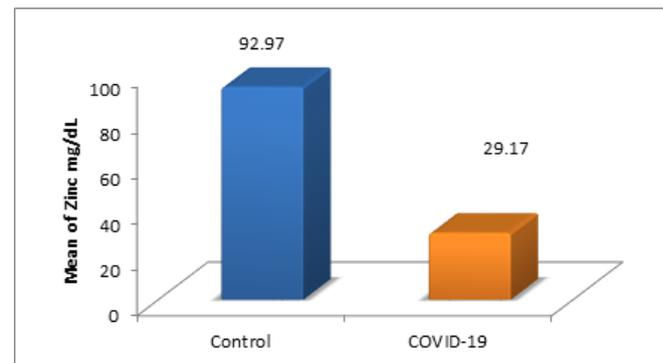


Figure 3: Mean of serum Zinc level in groups under investigation

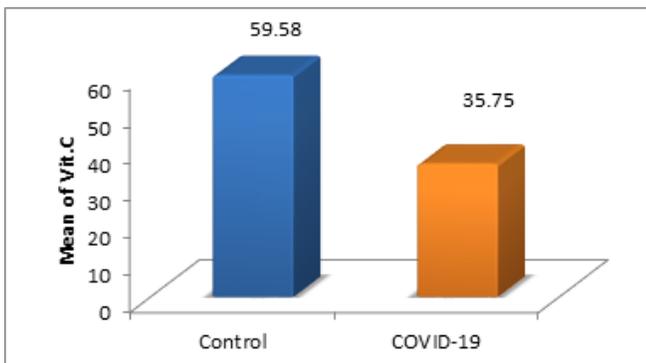


Figure 2: Mean of serum Vit.C level in groups under investigation

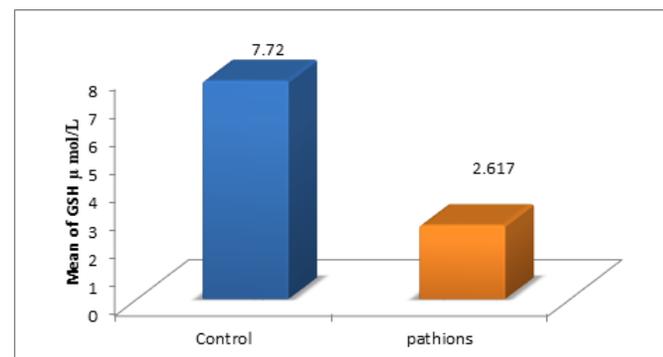


Figure 4: Mean of serum GSH level in groups under investigation

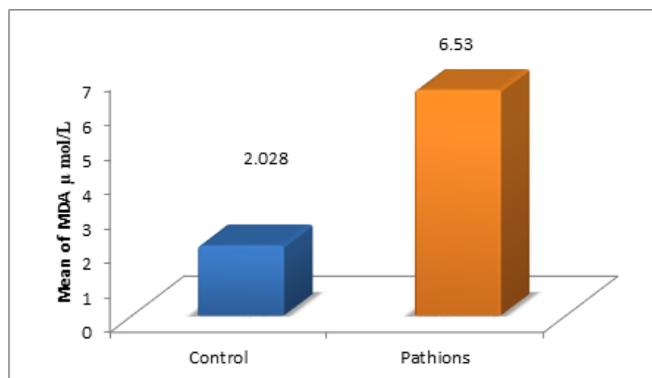


Figure 5: Concentration of serum MDA in groups under investigation

imbalance between free radicals and antioxidants negatively affects immune cells, causing many diseases.⁵⁹

Therefore, a study indicated that COVID-19 patients are most vulnerable to infections, as well as responses related to the dangerous and even fatal respiratory system, as the study indicated the relationship between oxidative stress and COVID-19, which can cause serious respiratory infections as well as bronchitis and pneumonia, if found. That oxidative stress affects the repair mechanisms and the immune, which allows the conclusion that oxidative stress is a factor danger of the Coronaviruses.⁶⁰

CONCLUSION

From the above results, we can conclude that COVID-19 is a disease that decreases the antioxidant in patients with COVID-19. Therefore, giving nutritional supplements rich in antioxidants and vitamins may weaken the development of the virus.

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