



## Perspective

## The strategy for controlling COVID-19 in Kurdistan Regional Government (KRG)/Iraq: Identification, epidemiology, transmission, treatment, and recovery

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## ABSTRACT

This study has carried out a mini-review on first wave of COVID-19 infection and its control by the Kurdistan Regional Government (KRG)/Iraq. COVID-19 infection, which was named by the International Committee of Taxonomy of Viruses (ICTV) as SARS-CoV-2, is a newly identified coronavirus. The last century has seen the outbreak of numerous life-threatening human pathogens including Nipah, Ebola, Zika, Chikungunya, Middle East respiratory syndrome coronavirus (MERS-CoV), severe acute respiratory syndrome coronavirus (SARS-CoV), and more recently a novel coronavirus has been observed. COVID-19 infection has so far spread to more than 186 countries around the world and KRG/Iraq has not been free from this virus. In this survey, the control of COVID-19 infection in KRG as a part of Iraq is discussed in detail. The methods of identification as well as the drugs that are currently in common use to reduce the wide distribution of COVID-19 infection and their effects in countries around the world are considered. So far, 714 positive cases have been reported by the ministry of health in Kurdistan Region Government-Iraq (KRG), among which there have been only 8 deaths, and 420 cases have recovered. Those who died had a previous history of a chronic disease such as diabetes, hypertension, heart disease, and hypercholesterolemia. Alternative medicine based on natural green methods has been widely used by Kurdish people in past years for treatment of strong coughs. In the present study, some natural products which are cost free and effective in enhancing the body's resistance against the virus are considered. A surprising finding is that the patients in KRG have not in general had a severe cough, flu, or fever. The possible explanation may relate to the patients' strong immune systems, since none of them had a history of using alcohol and drugs, or of chronic disease. The epidemiology and transmission of the virus are discussed as well.

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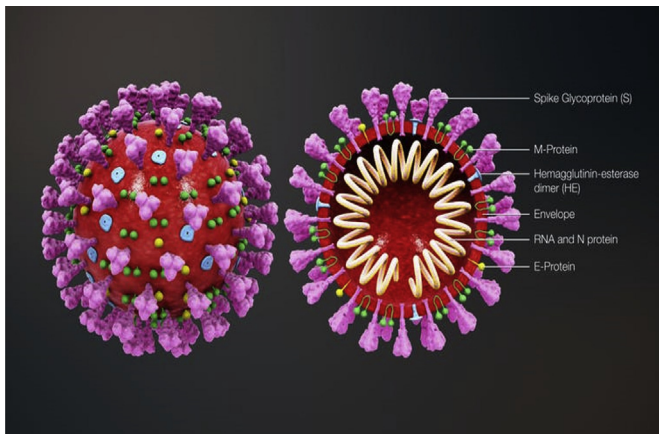
### 1. Introduction

Coronaviruses are members of the Coronaviridae family and under electron microscope observation have the appearance of spiked rings; the viruses have different types of spikes on their surface that are used to attack and bind living cells, as shown in Fig. 1 [1,2].

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**Fig. 1.** Cross-sectional model of a coronavirus showing the Glycoprotein spikes, M-Protein, E- Protein and Hemagglutinin-esterase dimer on the surface of the virus.

COVID-19 infection, named by the International Committee of Taxonomy of Viruses (ICTV) as SARS-CoV-2, is a newly identified coronavirus infection in humans that causes outbreaks of respiratory illness. This recent COVID-19 infection was recognized as a serious public health threat by the US Centers for Disease Control and Prevention (CDC). The first case of this novel coronavirus infection was identified on December 30, 2019 in Hubei province, Wuhan city, China and subsequently it spread globally [3]. Recently (March 2020), the World Health Organization (WHO) recognized this infection, which can induce severe pneumonia, as a pandemic viral disease after identification of huge numbers of cases in Iran, Italy, Spain, France, Germany, and other European countries and the USA and globally the numbers are rising every day [3,4].

Coronaviruses represent a large family of enveloped RNA viruses found in a broad range of animals including birds, camels, cattle, cats, and bats. It has been widely reported that this new coronavirus spread from animals to humans with continued circulation resulting from human-to-human exposure. Initially, COVID-2019 patients were shown to have some link to a large seafood and live animal market in Wuhan, China, suggesting animal-to-person transmission. However, subsequent cases appear to have resulted from human-to-human contact as more recent patients have not been exposed to animal markets [4,5].

COVID-2019 is the third coronavirus to emerge in the human population in the past two decades, preceded by the SARS-CoV outbreak in 2002 and the MERS-CoV outbreak in 2012. This has put global health institutions on high alert. The CDC and WHO have developed a preparedness and prevention checklist for COVID-2019 infection for use by the public and healthcare professionals [6].

At present, no antiviral medication or vaccine is available for treating COVID-2019 infection. Infected patients are managed with supportive care, although some medications, alone or in combination with other drugs, have been suggested [7,8].

## 2. Infection

Coronaviruses cause numerous diseases that affect the gastrointestinal and respiratory tract in humans and other mammals [1]. Mammalian cells become a battlefield when infected by these viruses, with cells providing antiviral defenses against the infectious virus, produced as a reaction to the infecting virus, and the end outcome of this battle is a major determinant of the pathogenesis [9,10]. The coronavirus's structure consists of a single-stranded positive-sense RNA that possesses a large viral RNA genome which is similar to the genomic organization of other beta-

coronaviruses [7]. The general signs of infection include respiratory problems, fatigue, muscle pain, high fever, sneezing, sore throat and dry cough [1]. SARS-CoV-2 coronavirus, like other viruses, infects lung alveolar epithelial cells and produces symptoms such as flu, fever, dry cough, difficult respiration, pneumonia, and death [8].

## 3. Identification

Detection of coronavirus in patients with pneumonia was carried out by testing bronchoalveolar lavage fluid, chest CT radiography, cell culture, polymerase chain reaction (PCR). Then the virus was isolated from biological samples to identify the genus, and compared to Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) [10]. Genetic analysis of COVID-19 showed that the virus was very similar to Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) [11]. WHO guidance provided on March 2, 2020 for laboratory testing of coronavirus diseases mentioned that suspected cases of infection should be screened and tested for the virus by using nucleic acid amplification tests (NAAT) such as RT-PCR.

## 4. Transmission

Patients with the coronavirus infection were in the beginning period of the infection asymptomatic, or transfer from direct contacts could cause a moderate illness. The contagious period could be up to three weeks and patients could develop a severe illness [12]. No evidence on the difference in severity of COVID-19 pneumonia was found between male and females, while pregnant women with pneumonia are considered more likely than non-pregnant women to die from the infection [13,14].

Shahabinezhad et al. reported on the age distribution of deaths among patients infected with COVID-19, and they found that the highest number of deaths was among infected people aged between 60 and 80 years, constituting 26.4% of infected people in that age range. Whereas, there were far fewer deaths (2.3% of patients) in the age range 10–50 years, and no deaths were recorded among patients of less than 10 years of age. Even though mild clinical symptoms were observed in children in comparison with adults, children should receive more protection and isolation [15,16].

## 5. Treatments

No specific antiviral drugs or vaccines are yet available for the treatment of this unanticipated and fatal pathogen. Supportive care and non-specific treatment to improve the symptoms of the patient (especially the fever) are the only alternative therapies [17]. To reduce the effect of COVID-19 infection, scientists are looking to find a new drug to eradicate the virus, and guidelines received from China and South Korea as well as some European countries include the following advice:

- (1) Oxygen therapy represents the main treatment intervention for patients with severe infection. Mechanical ventilation may be required in cases of respiratory failure refractory to oxygen therapy [17].
- (2) Chloroquine and its derivatives (Hydroxy-chloroquine), in tablet form, have been suggested for those infected with the coronavirus. The outcomes with chloroquine have indicated a certain therapeutic effect in reducing the recovery period, and decreasing the time spent in the hospital. Chloroquine is a drug that has been widely used since 1945 as an anti-malaria treatment and remedy for various other conditions such as autoimmune diseases, amoebiasis, and HIV. Its main

advantages are that it is low-cost, easily available, can be obtained globally, and it can be taken by pregnant woman as well as nursing mothers with no substantial side effects [18].

Chloroquine was developed in 1934 by Bayer and is an amine acidotropic form of quinine. Nonetheless, quinine was being extracted from the bark of Cinchona trees in Peru for use as a treatment for malaria long before chloroquine was discovered. Hydroxychloroquine is a derivative of chloroquine that contains a hydroxyl group attached to the side chain and is used as an anti-malarial drug, while another derivative of chloroquine, 4-aminoquinoline, has an amino-functional group in its structure. However, using chloroquine and hydroxychloroquine for self-treatment is not recommended [19,20].

- (3) Arbidol, which has been used to treat influenza virus infections, has also been reported to act as a coronavirus infection inhibitor at 10–30  $\mu\text{M}$  concentrations.
- (4) Favipiravir is another antiviral drug that can be used against novel influenza strains and a broad range of RNA viruses. Correspondingly, clinical trials are being conducted to assess its effectiveness in treating SARS-CoV-2. Once in the cells, favipiravir will convert to its active phosphoribosylated form which is recognized as a substrate by the viral RNA-dependent polymerase RNA, leading to a decrease in the activity of RNA polymerase [14,21,22].
- (5) Lopinavir-ritonavir has also been mentioned in the literature as having been used for the inhibition of SARS-CoV-2. According to Lim et al. [23], this drug was given to a COVID-19 infected patient in Korea, at a dosage of 2 tablets per day. After just one day there was virtually no evidence of coronavirus titers plus a considerable reduction of the  $\beta$ -coronavirus viral loads. However, more work is necessary to determine the direct influence of lopinavir-ritonavir on remedying COVID-19 infection.
- (6) Baricitinib is another drug suggested both for reducing COVID-19 infections and inflammations [24].
- (7) Mixing azithromycin with hydroxyquinone was examined in French patients, and a significant decrease in the viral load was observed at day-6 [25].
- (8) Corticosteroids have commonly been used to repress upraised cytokine levels in patients with SARS-CoV [26], and MERS-CoV [27], but are not recommended for systemic use in treating SARS-CoV-2 infected patients [28].

Additionally, the National Health Commission (NHC) of the People's Republic of China reported that 60,107 confirmed COVID-19 patients (85.20% of total confirmed cases) had been treated with traditional Chinese medicine [29].

In natural-based therapy, two compounds in the library were found to be inhibitive of SARS-COV, namely tannic acid ( $\text{IC}_{50} = 3 \mu\text{M}$ ) and 3-isothalfavin-3-gallate (TF28) ( $\text{IC}_{50} = 7 \mu\text{M}$ ) [30]. These two compounds belong to a group of natural polyphenols found in different kinds of tea including black and green tea [31,32].

There are about 200 viruses that are sources of infection and produce clinical syndromes that include a cough. Parainfluenza, rhinoviruses, influenza, and corona viruses are the main viruses that cause respiratory disease [2]. In earlier years, the Kurdish people used quince and its leaves as a medicinal plant to treat a strong cough by boiling it in water, and it was found to have a huge impact as a cough inhibitor. The biological influence and chemical structure of quince have been reported, and the leaves of quince have been found to contain bioactive phytochemicals which include phenolic compounds. Conjugated double bonds are present

in both quince leaves and chloroquine structure. In the case of quince leaves, three different functional groups can be observed, namely alcohol, ether, and ketone, while in the chloroquine structure several amine groups can be found [33].

Furthermore, the black seed is used for various pharmaceutical and nutritional purposes, and the oil extracted from the black seed has been scientifically proven to include many natural ingredients, for instance, vitamins, carbohydrates, folic acid and proteins. Additionally, the seeds' oil contains thymoquinone and derivatives that have been used as a remedy for several diseases, especially asthma, headache, and as an anti-inflammatory, antioxidant, antimicrobial and antidiabetic [34].

Recently, the Food and Drug Administration (FDA) has allowed physicians across the country to start using antibody-rich plasma extracted from the blood of those who have recovered from the disease. Approval was given on March 24, 2020, under new emergency protocols, for blood donated by coronavirus survivors to be used to treat patients who are critically sick with the virus. Some experts have argued that this could be the best possibility for combating the coronavirus until more sophisticated therapies can be developed, which could take several months.

## 6. Epidemiology and protection

Kurdistan is a region located in the north of Iraq and has a long border with Iran. On February 19, 2020, the first case of infection with a novel coronavirus was announced in Iran and the Kurdistan government started to issue strict warnings to its citizens. However, people from Kurdistan visit Iran for many different reasons, such as medical treatment, tourism, business and there are a lot of students from Kurdistan studying in Iran's universities. The government, in coordination with other organizations and media outlets, started to spread awareness and instructions to protect its citizens against coronavirus disease. In this period, the Kurdistan regional government (KRG) made the following decisions:

- 1 From the outset, to close the border with neighboring countries.
- 2 To quarantine all returnees from abroad for about 14 days.
- 3 The first COVID-19 infected case in Kurdistan was recorded on March 1, 2020 in the city of Sulaymaniyah. The patient was an old man that had visited Iran for medical treatment. After that, efforts were intensified by health teams and government-run security agencies until all citizens were quarantined in their homes and traffic was blocked in all directions, to prevent the virus's spread.
- 4 So far, 76 cases of the virus have been reported, with most of the sources being people who have returned from abroad. The KRG and health teams aim to test the relatives and close contacts of the infected patients.
- 5 A pharmaceutical factory in the city of Sulaymaniyah has begun preparations to produce a combination of both chloroquine and azithromycin products, which are theoretically considered as two common anti-coronavirus drugs available in the region [35].

For protection of health care workers such as doctors, nurses, pharmacists, medical staff and other staff working in hospitals and health sectors, the provision of personal protective equipment (PPE) is vital. It is the government's responsibility to provide for all those needs; however, a lack of PPE has emerged as a serious problem in many countries. Since such countries cannot immediately acquire the necessary equipment, international efforts are required to protect the safety of health care workers [36,37]. Moreover, collaboration between countries is necessary in order to achieve international readiness to detect, prevent, and respond to future outbreaks such as the coronavirus pandemic [38].

7. Survey and discussion

There have so far been over 6,000,000 cases globally, and more than 375,000 of those have died, whereas 2,900,000 have recovered. According to the data, the global death rate has reached nearly 6%, and the recovery rate is around 45% (Fig. 2). Six months after the onset of the outbreak of this virus, it is interesting to note that China has reported 83,017 infected cases, 4634 deaths, and 78,307 recoveries. It can be observed that the death rate in China is about 5.5%, and the recovery rate among infected people is 94.3%. The Chinese data therefore indicates that over time the number of recoveries will increase. As is known, in Iran, a neighboring country of Kurdistan, the outbreak of the virus occurred earlier than in the European countries, and it can be seen that Iran's recovery rate is approximately 78%, which is much higher than in European countries, Brazil, and the United States [39].

COVID-19 infection is a fast spreading viral disease that is especially deadly for patients with a previous immunodeficiency. In Iraqi Kurdistan, as our study area, until today 714 positive cases have been reported by the ministry of health of Kurdistan Region Government/Iraq. Among these cases only eight have died, six of whom were male, all were aged between 37 and 75 years, and all had previous history of a chronic disease such as diabetes, hypertension, heart disease, and hypercholesteremia, which are major risk factors for COVID-19 infection. Among other cases, including all ages, some of them required oxygen ventilation intervention, and most of them recovered, while the rest are experiencing fewer symptoms and suffering from the infection compared to other positive cases of COVID-19 infection in the rest of Iraq, neighboring

countries, and globally. This interesting finding may be related to patients having strong immune systems because they do not have a history of alcohol or drug use or chronic disease; alternatively, it may be due to genetic profile differences. Many factors can lead to immunodeficiency in a patient, such as old age, concomitant diseases (diabetes, renal with liver failure, solid and hematologic neoplasia, malnutrition, autoimmune diseases, and organ transplant), as well as therapies such as corticosteroid, cytotoxic agents, and stress [40–42]. Alcohol is responsible for causing widespread health problems which increase incidence of infectious diseases [43]. The chronic and acute use of alcohol is harmful to health and can directly lead to suppression of various immune responses [44]. Phagocytic cells such as macrophage and neutrophils have an important role in finding, ingesting, and killing microorganisms that enter the body, while in people with chronic alcoholism the activity of phagocytic cells is reduced [40]. Additionally, abuse of drugs such as marijuana, cocaine, opiates, alcohol and nicotine can cause changes in neuropsychological, pathophysiological, and immune function responses by increasing susceptibility to infectious diseases. It can be concluded that among the reasons for the speedier recovery of positive cases, with less suffering, in Iraqi Kurdistan is that they have an active immune system that has not been exposed to such as chronic disease, alcoholism, and chronic medication.

Some Kurdish citizens have spoken of the epidemic late last year that had similar symptoms to those of the coronavirus. The strength of the Kurdish community's immunity against COVID-19 infection may be related to overcoming last year's epidemic which resulted in the illness and death of many residents.

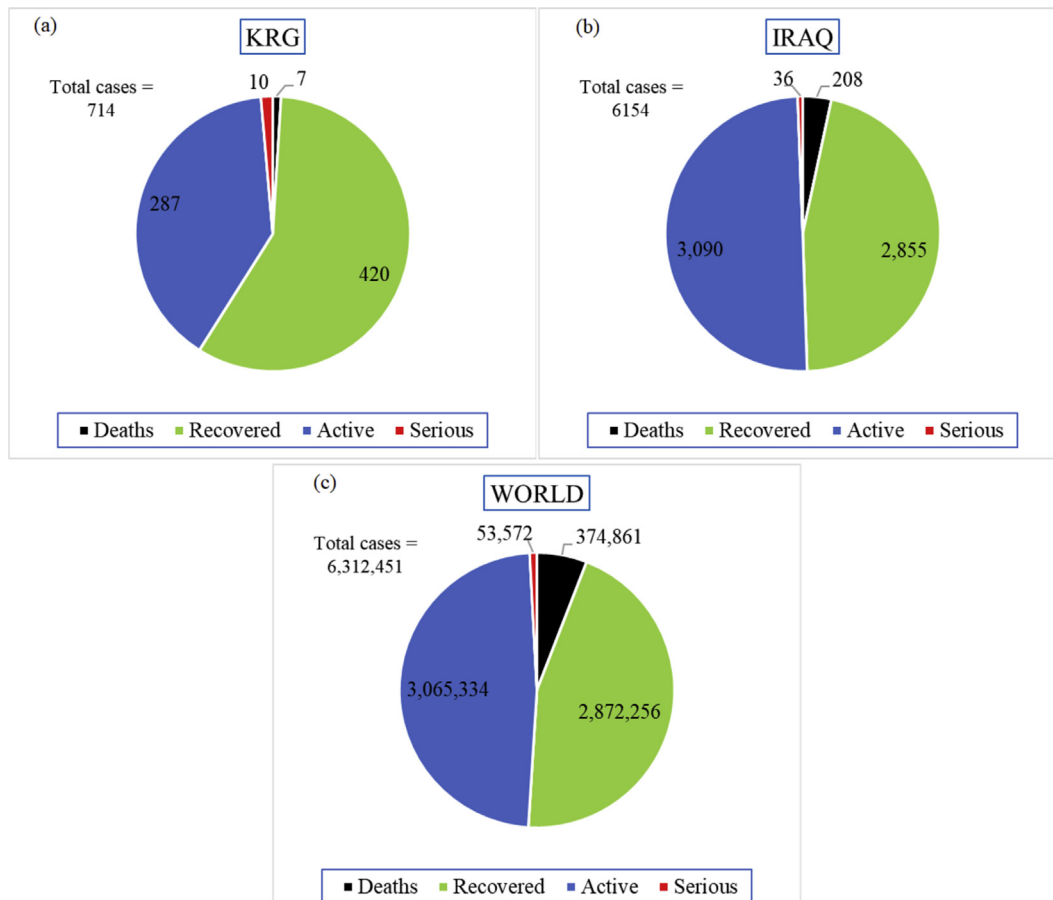


Fig. 2. Provides a breakdown of total cases, deaths, recoveries, active cases, and serious cases for (a) KRG/Iraq, (b) Iraq, and (c) Throughout the world.

## 8. Concluding remarks

Until now various countries have regarded quarantine as the best method for stopping the distribution of COVID-19 infection. The Kurdistan regional government (KRG) has so far successfully coped with the coronavirus infection. Based on various reports, people who have a strong immune system can more easily overcome the COVID-19 infection. This mini-review has mentioned some medicinal plants which are well known to boost the immune system, such as black seed and the quince plant and its leaves. Patients with a history of chronic disease, alcoholism, and drugs have been more affected by the COVID-19 infection. It can therefore be concluded that the immune system has a great influence on recovery from the coronavirus. Meanwhile, stress, anxiety, fear, and nervousness are among other main causes of lowering of the immune system and greater vulnerability to catching this disease.

### Consent

No studies on patients has been done and this is a review article.

### Ethical approval

No patient samples were used.

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### Author contribution

**Peshawa Yunis Aziz:** Writing- Original draft preparation.

**Jihad M. Hadi:** Writing- Original draft preparation.

**Aram M. Sha:** Conceptualization, visualization.

**Shujahadeen Bakr Aziz:** Supervision, Writing- Reviewing and Editing.

**Heshu Sulaiman Rahman:** Resources, Writing- Reviewing and Editing.

**Hiwa A. Ahmed:** Writing- Original draft preparation.

**Mahmood Ameen Abdulla:** Writing- Original draft preparation.

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### Conflict of interest statement

Authors declared that there is no conflict of interest to this manuscript.

### Guarantor

Prof. Dr. Heshu Sulaiman Rahman.

### Research Registration Number

There is no human participants and this is a review article.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijso.2020.06.006>.

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