

# A REVIEW ON THE ANIMAL VIRUSES WITH SPECIAL REFERENCE TO THE COVID-19, DISEASE, SYMPTOMS, GENOMICS, TREATMENT ETC.

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**Abstract:** a group of RNA virus that mainly infect mammals and birds. There are some corona viruses that are capable of infecting human are 229E, OC43, HCoV-NL63, SARS-CoV, MERS-CoV, HKU1 etc. COVID-19 is a new strain of corona originated from Wuhan, China in December, 2019. COVID-19 has club- shaped glycoprotein spikes in the envelope that gives the virus a crown- like appearance that help them in attacking and binding. Corona viruses infect the respiratory tract and cause various infections like high fever, sore throat, dry cough, respiratory problem etc. The virus is transmitted through coughing and sneezing. Despite of great efforts, there is no specific treatment of this disease. So, for now prevention and management are the best options. It has been reported that various treatments like Remdesivir, chloroquine etc. has been use to control it. Use of convalescent plasma transfusion has also shown some sort of success for COVID-19. Several vaccines have been being prepared for the treatment of COVID-19 and hope it may available soon.

**Keywords:** *Corona virus, Covid19, Disease, DNA, RNA.*

**Introduction:** Viruses are tiny, obligate, intracellular parasitic agent which contains either a RNA or DNA as genetic material which is surrounded by a protective, virus- coded protein coat called capsid [1]. Capsid protects the genome from environmental danger and also helps in efficient delivery of viral genomes into new host cell [2]. Viruses have to rely on specialized host cells for propagation, which supply the complex metabolic and biosynthetic machinery of eukaryotic and prokaryotic cells. A complete virus particle is known as a 'Virion'. The principle role of virion is to release its DNA or RNA genome into host cell so that the viral genome can be expressed by the host cell. The viral genome is usually associated with some basic proteins, which is packed inside a protein capsid. The nucleic acid, protein, together with the genome called as nucleocapsid. In enveloped viruses, the virus is surrounded by a lipid bilayer which is modified host cell membrane and studded with an outer layer of virus envelope glycoproteins [1]. Animal viruses can be classified on the basis of the type of genome (i.e., DNA or RNA) which may be single stranded (ss) or double stranded (ds). In addition, viruses are usually called

on the basis of their morphological features. DNA viruses are divided into 5 families among which Parovirus family includes all the viruses having ss linear genome. The other families of DNA viruses are Polyomavirus, Papillomavirus (which having ds circular genome) and Adenovirus, Herpesvirus (having ds linear genome). RNA viruses are grouped into positive (+) single- stranded RNA virus, negative (-) single stranded RNA virus and double- stranded viruses. Positive (+) stranded RNA virus includes 5 families of viruses namely Picornavirus, Flavivirus, Togavirus and Coronavirus. The family Coronavirus includes prototypes namely Mouse hepatitis virus (MHV), SARS. Negative (-) single- stranded RNA viruses are grouped into 3 families namely, Rhabdovirus, Orthomyxovirus, Paramyxovirus. Double- stranded RNA viruses include Reoviruses [3]. Corona viruses are group of enveloped viruses having single- stranded, positive-sense RNA genomes and they mainly infect mammals and birds and cause respiratory or gastrointestinal disease [4]. In some cases, it also causes neurological illness or hepatitis [5]. Coronavirus infection is species specific and can be acute or persistent and it is mainly transmitted through respiratory and fecal- oral way. Corona viruses are known to have the largest genomes among all RNA viruses [4].

Human corona viruses were first identified during the mid 1960s [6]. There are various types of viruses that are capable of infecting human beings are namely 229E, OC43, HCoV- NL63, SARS- CoV, MERS-CoV, HKU1 etc [7], among which, Severe Acute Respiratory Syndrome Coronaviruses ( SARS- CoV) and middle East Respiratory Syndrome Coronaviruses (MERS- CoV) are reported as zoonotic and highly pathogenic coronaviruses [6]. In 2002, SARS corona virus emerged in humans and in 2012, MERS CoV was discovered in humans.

It is important to mention that , when the 2019- 2020 outbreak is started in Wuhan, China, [8], a new strain of corona virus was detected on 31<sup>st</sup> December, 2019 [9]. World Health Organization (WHO) has been given name to this virus as 2019- nCoV ( Novel Coronavirus 2019, 2020) which has been later renamed by the International Committee on Taxonomy of viruses as ‘Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2). The disease caused by this virus is called as corona virus disease 2019 and is shortened as ‘COVID-19’, i.e., CO stand for ‘Corona’, VI stand for ‘Virus’, D stand for ‘Disease’ and 19 stand for ‘2019 year’ [7].

**COVID- 19:** The SARS-CoV-2 (COVID-19) is a new human corona virus which was 1<sup>st</sup> reported in the end of December, 2019 in Wuhan, China and is spreading with epidemic features in China and other Asian countries and now cases have also been reported worldwide [10]. This Novel Corona Virus Disease (COVID-19) causes a respiratory illness that may lead to severe pneumonia and acute respiratory distress syndrome (ARDS). WHO categorized the COVID-19 virus as  $\beta$ - CoV of group 2B. (Carlos et.al., 2020). The genome of this virus is identified and it resembles with SARS-CoV (80% similarity) and MERS-CoV (50% similarity). The symptoms occur due to COVID-19 is also related to the infection cause by SARS-CoV and MERS-CoV, even though COVID-19 shows some peculiar pathogenetic, epidemiological and clinical characteristics which are yet not being completely understood [10].

**ORIGIN OF COVID-19:** The first human cases of COVID-19, were first reported by officials in Wuhan city of China in December, 2019 [11]. COVID-19, which subsequently named as SARS-CoV-2 was identified in early January. The full genetic sequences of SARS-CoV-2 isolated from human cases from China and different countries all over the world and their comparison with sequences of many other viruses have suggests that the virus has a natural animal origin and it has an ecological origin in Bat population. All the available evidence for COVID-19 has been suggest that SARS-CoV-2 has a zoonotic source. Since, there is generally very less contact between humans and bats, so, it is likely it is likely that there must be an intermediate source between them. This intermediate animal host could be either domestic or a wild animal which has not been identified yet [11].

**GENERAL STRUCTURE OF SARS-CoV-2:** COVID-19 virus is enveloped viruses having a diameter of approximately 120nm [12]. The virus looks like spiked rings when observed under an electron microscope. The most characteristic morphological feature of corona virus is the presence of club-shaped glycoprotein spikes in the envelope that gives the viruses a crown like or coronal appearance which gives the viruses their name [13]. The surface of the virus is covered with various spikes, that help the virus in attacking and binding with the living cells [7]. The genome of the corona virus consists of a single stranded, linear molecule of RNA [12] and helical symmetry nucleocapsid [7], [14], [15].

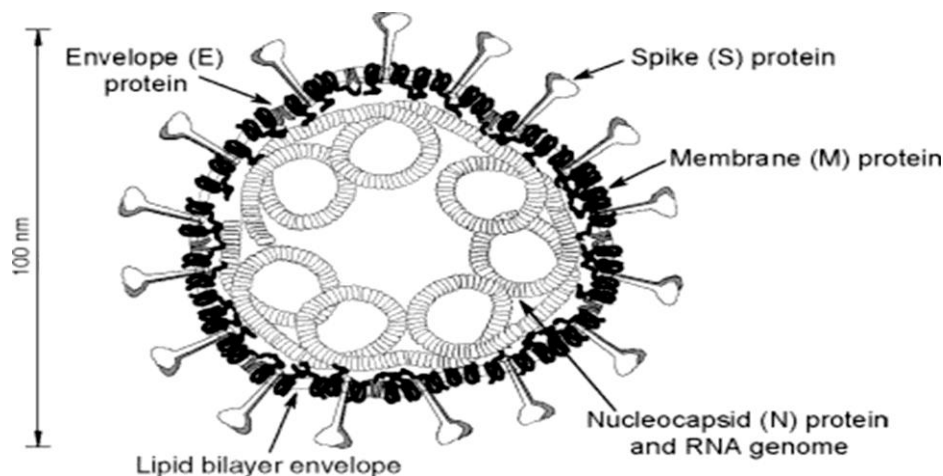


FIGURE 1: Schematic representation of structural components of coronavirus virion.

Source: This figure is taken from [16].

**GENOME OF COVID-19:** Corona viruses' possess the largest genome among all RNA viruses whose G + C contents vary from 32% to 43% [17]. The positive sense genomic RNA of the virus acts as a messenger RNA (mRNA), comprising a 5' terminal cap structure and a poly A tail. This genomic RNA acts in three capacities during the viral life cycle: 1) as an initial RNA of the infectious cycle; 2) as a template for replication and transcription; and 3) as a substrate for packaging into the progeny virus. The replicase-transcriptase is the only protein translated from the genome, while the viral products of all downstream open reading frames are derived from sub genomic mRNAs. Recent studies have shown that the SARS-CoV-2 has a similar genomic organization with that of other beta-coronavirus consisting of a 5'-untranslated region (UTR), a replicase complex (ORF1ab) encoding non-structural proteins (nsps), envelope protein (E) gene, a spike protein (S) gene, a membrane protein (M) gene, a nucleocapsid protein (N) gene, 3'-UTR and many non-structural open reading frames which are unidentified [17].

Even though SARS-CoV-2 is classified into the beta-coronavirus group, it is different from MERS-CoV and SARS-CoV in many features. Different new studies regarding the genome of COVID-19 virus have reported that the SARS-CoV-2 genes share more than 80% nucleotide identity and 89.10% nucleotide similarity with SARS-CoV genes [18]. Genetic comparison of SARS-CoV with the SARS-CoV-2 have shown that there are only 380 amino acid substitutions between SARS-CoV-2 and SARS-like coronavirus, mostly concentrated in the non-structural

protein genes, while about 27 mutations have been found in genes encoding the viral spike protein 'S', responsible for receptor binding and cell entry. This type of mutations can explain the distinct lower pathogenicity of SARS-CoV-2 compared with SARS-CoV [17].

**DISEASE AND SYMPTOMS:** Corona virus infects the upper gastrointestinal and respiratory tract of humans and other mammals and in birds also. The occurrence of the illness ranged from mild to severe. SARS-CoV-2 starts to propagate by RNA replication using RNA-dependent RNA polymerase enzyme. This virus mutates very slowly due to which it became very difficult for its treatment and control [7].

The symptoms of this disease may appear within 2 to 14 days after the infection. In some cases, the disease may arise after 27 days. The common signs of this infection may include fatigue, muscle pain, sneezing, sore throat, dry cough, high fever, respiratory problems etc. and in some severe conditions, it may lead to pneumonia, serious respiratory syndrome, kidney failure and even cause death also [19]–[21]. The risk of this disease is greater in older people, kids and the patients with other health issues such as lung disease, cardio-vascular disease, diabetes, cancer etc. It is necessary to mention that such types of symptoms are also observed in other viruses' infection also, so it is not inevitable to have COVID-19 if such symptoms are seen. The pathological conditions of this disease include increase number of chemokines, cytokines and leukocytes and also high amount of plasma pro- inflammatory cytokines and C- reactive protein [7].

**MODES OF TRANSMISSION:** It has been reported that the corona virus is spread through sneezing, cough droplets and if a person come in contact with a COVID-19 patient. Now, COVID-19 has become pandemic disease according to WHO report. Generally, this virus can enter the body through mouth, nose and eyes [22]. It has been reported that the virus can able to infect a person from a distance of 1.8 m. The virus may survive for 2 hour to few days in cough and sneezing droplets lying on any surface. Thus, the infection also may be cause that way. This virus has been detected in the stools of COVID-19 patients but there is no transmission of the infection via stool has been reported [7].

**IMPACT OF COVID-19 ON HUMAN BODY:** Scientists have learned so much about COVID-19 disease and its pathogenesis. It has been reported that not all people exposed to

SARS-CoV-2 are infected and not all the infected people develop severe respiratory illness. Therefore, SARS-CoV-2 infection can be divided into three stages, namely stage 1, an asymptomatic incubation period, stage 2, which is a non-severe symptomatic period with detectable virus and stage 3, which is a severe respiratory symptomatic stage with high viral load [23]. The virus is transmitted via respiratory droplets from coughing and sneezing [24]. It enters into the body via nose, eyes and mouth from where they pass to the lower respiratory tract where the spike proteins of the virus get binds with the epithelial cells that line the respiratory tract and also with those in the air sacs of the lungs. SARS-CoV-2 is able to stay undetected longer than other types of corona viruses and its proteins are able to gain entry by unlocking the Angiotensin- Converting Enzyme 2 (ACE2), which is attach to the cell membranes of cells in the lungs. Once they get in and able to seize control of the cells machinery, undergo replication, multiply and infect the adjoining cells [23]. This causes the body to give strong immune response. At this stage, the disease is clinically manifest [24].

**PREVENTION AND MANAGEMENT:** The prevention and management of COVID-19 disease is very important during this pandemic situation [7]. For this, we need a collective effort of the public and government to control this disease. The prevention and management mainly include regular and proper care of the homes and hospitals etc. The regular recommendation to control the infection is to cleaning of our own area. Most importantly, we should have to avoid sneezing and coughing in public places. We should cover our nose and mouth with a mask. We must clean our hands frequently with soap and sanitizer and also through washing of foodstuffs before cooking and eating also may help in this situation. The most important advisable step to protect ourselves from this disease is to stay at home and try to go out only when it is necessary [7]. It has been confirmed that the virus does not see race, religion, color, cast, creed, language or border before striking. So, it has been requested everybody to obey all the COVID-19 protocols strictly so that we can avoid the dangerous situation cause due to gradually increasing social transmission of this virus [7].

**TREATMENT:** As we have all known that there is no effective treatment and no vaccine for COVID-19 till yet, even though prevention, management and supporting healthcare may provide some sort of relief in the outbreak of COVID-19. It has been reported that there are some approaches have been used to control this disease that include various Allopathic, Unani and

Homeopathic treatments along with plasma therapy. But before all this treatment, so many testing facilities are available to the health care sectors.

➤ **ALLOPATHIC MEDICINE**

This type of treatment includes oxygen therapy, intravenous fluid infusion etc. Corona virus may show comparable proteins for virus replication to human immunodeficiency virus (HIV). Therefore, HIV protease inhibitors and nucleoside analogs may be operative to treat COVID-19 [25]. A combination of Lopinavir and Ritonavir which were previously effective for SARS-CoV and MERS-CoV, may be useful [26], [27]. It has been reported that China is doing clinical trials of 'Remdesivir', which was developed for the Ebola virus. Besides, other anti-viral medicines like Oseltamivir, Ganciclovir, Ribavirin, Flavipiravir, Nelfinavir, Arbidol, Remdesivir and Galidesivir are being examined for COVID-19 treatment [28]–[31]. It has been reported that a combination of Remdesivir and Chloroquine is also effective to treat COVID-19 [7], [32] as it significantly blocked the replication of SARS-CoV-2 and patients were declared as clinically recovered [33]. It has also reported that hydroxychloroquine is also prescribed which is found to be partially effective [24].

- **UNANI AND AYURVEDIC METHODS:** Unani and Ayurvedic methods of the treatment are based on the plant materials which are non-toxic and with no side effects. The different parts of the various plants such as Glycyrrhiza glabra, Allium cepa, A. salivum, Ocimum sanctum, Piper nigrum, Daucus maritimus, Curuma longa etc are well known for a long time for their anti-viral activities [34], [35]. Fiore et.al., 2008 have reported that Glycyrrhiza glabra plant have antiviral activities of several viruses including SARS related corona virus etc. Similarly, many researchers also have reported about the antiviral and antimicrobial activities of G. glabra [36], [37]. Therefore, it has been suggested that an aqueous extract of this plant with some other medicinal plants mentioned above may be useful to control COVID-19. It has been reported that an advisory based on Indian traditional medicine practices Ayurveda, Homeopathy and Unani medicines, New Delhi. The advisory includes the ways of preventive management and depicted a list of some unani medicines [7].

➤ **HOMEOPATHY**



In homeopathy, very low concentration of arsenic is considered as beneficial to many viral infections. It has been reported that, Directorate of AYUSH, New Delhi, India issued an order on January 30, 2020 to take prophylactic medicine against corona virus. Arsenic- Album- 30 medicine is highly diluted arsenic trioxide and it is function as homeopathic prophylaxis. It has been mention that there is no clinical evidence for Arsenic Album 30 as an effective medicine. Therefore, after that, homeopathy faced criticism and homeopathy has been called as pseudoscience [7].

### ➤ CONVALESCENT PLASMA THERAPY

The Convalescent Plasma (CP) therapy has been considered for the treatment of COVID-19 and it has shown some sort of success for COVID-19 in China [38]. In Convalescent Plasma therapy, immunoglobulins containing plasma from a recently recovered person from COVID-19 is taken and administered into the patients suffering from COVID-19 [39].

CP therapy could provide a temporary solution to lower the mortality rates in India in this current pandemic. The Indian Council of Medical Research (ICMR) has provide approbation for the trial of CP therapy which is to be conducted by the Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), although the approval is still required permission from Drug Controller General of India [40]. The US Food and Drug Administration (FDA) provide approval with the “COVID-19 Convalescent Plasma Research – Emergency” on March 24. FDA has stated that the use of CP therapy for patients with COVID-19 infections [41].

It has been reported that the use of Convalescent Plasma immediately after infection provides a promising treatment until a specific vaccine for this current pandemic is evaluated [42]–[44]. Studies of the use of CP therapy from China have shown potential benefits, including radiological features. There are some case series from China of using Convalescent Plasma for the treatment of COVID-19 has been reported [45] [46]. The people receiving CP therapy has shown reduction n viral load as well as improved oxygenation [46]. According to the reported case studies that has been collected from different published articles, 1 dose of 200 mL CP has been given to 9 patients with neutralizing antibody titers of >1:640. There is a improvement in the clinical symptoms



in the patients have seen within 3 days with improved oxyhemoglobin saturation and viral load is also became undetectable in 7 of the 9 patients who have been treated with CP therapy [38]. Shen et.al., have reported that 5 serious COVID-19 patients have received 400 ml CP from 5 different donors. Out of the 5 patients, 4 patients have shown improvement in their health within 3 days of CP transfusion as their body temperature got down into normalized state and decreased in their viral loads. They became negative within 12 days and got discharged from the hospital [47]. It has been reported in a popular press that China used Convalescent Plasma therapy on 245 COVID-19 patients, out of which 91 have recovered after the plasma therapy but there has been no mention about the other 154 patients that were treated with CP therapy [39].

**PROGRESS IN VACCINE DEVELOPMENT:** It has been reported that that the best approach to fight with viruses is vaccination [48]. Therefore, scientists are trying to develop a vaccine to provide protection against COVID-19 and hope it may available soon. Several vaccines have been being prepared such as whole- virus vaccine, recombinant protein subunit vaccine, and nucleic acid vaccines etc. which are under evaluation at clinical and preclinical stage. According to a document from World Health Organization (WHO), there are about 70 corona virus vaccines in development globally, out of which only three are in clinical trials, meaning they are being tested on human [48]. India's 1<sup>st</sup> Covid-19 vaccine, COVAXIN™, has been developed by Bharat Biotech in collaboration with the Indian Council of Medical Research (ICMR)- National Institute of Virology (NIV), gets approval from The Drug Controller General of India (DCGI) for phase I and II clinical trials [49]. To date, just one corona virus vaccine has been approved. SputnikV- formerly known as Gam- COVID- Vac and developed by the Gamalaya Research Institute in Moscow- was approved by the Ministry of the Russian Federation on 11 August, 2020. Experts have raised considerable concern about the vaccines safety and efficacy given it has not yet entered phase 3 clinical trials [50].

**CONCLUSION:** Since formal declaration of 1<sup>st</sup> COVID-19 case at Wuhan, China, in December 2019, last; Nine months already passed till now. But inspite of continuous research by 150 countries all over the world to discover a vaccine to rescue from this COVID-19 disaster, but world community is yet to receive a recognized COVID-19 vaccine by World Health Organization (WHO). Although Russia has already introduced a vaccine, but it not yet get formal

recognition from WHO. Gradually increasing public transmission of this virus has been creating panic in human society. At the time of first wave of COVID-19 about to controlled, the second wave brings great disaster in Europe for which new thinking to adopt lockdown in France, England, and Austria etc. At the first COVID-19 wave, the patients were asymptomatic. At that time major patients did not show any COVID symptoms but since last some days, patients have been scrambling for Intensive Care Unit (ICU), suffering from severe respiratory problems. So in comparison to the numbers of patients, number of ICU has been decreasing and probably for which death toll has been increasing day by day. So at this critical juncture of COVID-19 disaster, till to the invention of a successful vaccine, there is no alternative for us except to obey COVID protocols strictly. Therefore, at the end of this review, for the greater interest of our human society, we all have to promise to wear mask beyond our house, to keep 2 yards physical distance in public places and to follow all other COVID protocols so that we will be able to save ourselves, our society as well as our world communities.

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