



Review Of Viral Biochemistry And Safety Measures For COVID-19

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ABSTRACT

The novel coronavirus disease (COVID-19) pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) continues to pose threats on a global scale. Despite extensive worldwide research, workable vaccines or treatment options have yet to be discovered. Therefore, developing efficient treatment protocols, early virus detection, and infection prevention are the three most effective methods for reducing the spread of disease. This review examines COVID-19 safety precautions and current viral biochemistry.

Keywords: COVID-19, SARS-CoV-2, Safety Measures, Viral Biochemistry

Background

The emergence of new coronavirus infections, likely caused by Chinese bats, was anticipated by early March 2019, but no global preventive measures were taken. After several pneumonia cases with an unknown origin were noted at the end of 2019, the Public Health Commission of China finally provided more details about the epidemic in the early months of 2020. The disease-causing virus was initially referred to as the "new coronavirus 2019" (2019-nCoV) by the World Health Organization (WHO). The term was later changed to "severe acute respiratory syndrome coronavirus 2" (SARS-CoV-2) by the international committee of the Coronavirus Study Group (CSG).¹ The outbreak is believed to have started at the Hunan seafood market in Wuhan, China. Further research found that some patients had yet to visit the seafood market, despite the possibility that the COVID-19 patients in China may have consumed infected animals as food or visited the market. Thus, it was accepted that this virus might spread from person to person via coughing, sneezing, and releasing respiratory droplets or aerosols. Also, virtually every nation on every continent has documented illness transmission by inhaling aerosols into the upper respiratory system and lungs. Here in we will review the available literature related to viral biochemistry and Safety Measures for COVID-19.²

Methodology

Following the five steps of Dr. Dobbin's evidence-informed decision-making (EIDM), the methodology is advised and outlined in the Quick Review Guidebook: The review steps provide the framework. Utilizing the health Evidence™ tool, the following actions were taken: Search for and gather pertinent research evidence, assess the evidence's methodological quality, and synthesize the evidence.

Search Strategies

The rapid evaluation of research questions resulted in the creation of the Important search terms: COVID-19 safety precautions and viral biochemistry.

The final search string is as below:

In the first step, the terms "COVID-19" and "Viral biochemistry" and "Safety precautions" were searched for. Four databases have been adopted in order to conduct thorough searches for publications: Scopus, Google Scholar, PubMed, and the Cochrane Library.

Eligibility criteria

The literature search covered all COVID-19 research: reviewed papers, theses, and published articles.

Data Extraction

Two unbiased medical experts examined the articles to ensure the selection's objectivity. On the final list of articles to be used for additional data extraction, the two reviewers agreed with 80%.

Results of the literature search

Following the initial screening, 83 articles were disqualified for further review. Due to their non-English language, title, abstract, and book chapter, irrelevant articles were removed. 31 studies were found based on the inclusion criteria (Figure 1: Preferred Reporting Items for Reviews) (Health Evidence™ tool). We conducted this review according to Preferred Reporting Items for Reviews (PRISMA)

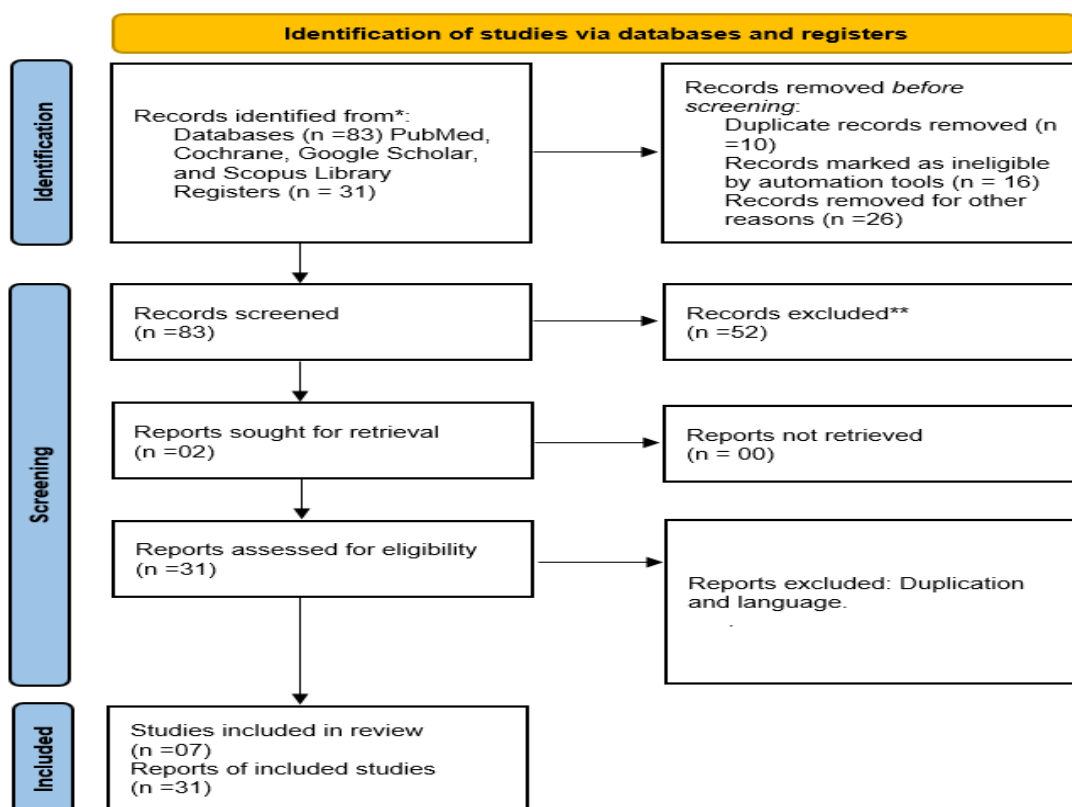


Figure 1. Preferred Reporting Items for Reviews (Health Evidence™ tool) (PRISMA) flow diagram of the literature screening process³

Result and Discussion

CoVs are classified as belonging to the family Coronaviridae, subfamily Coronavirinae, and order Nidovirales. The genera Alpha-CoVs, Beta-CoVs, Gamma-CoVs, and Delta-CoVs are members of this subfamily. Although it is known that delta and gamma-CoVs are avian viruses, they primarily infect birds, though some strains can also infect mammals. Only mammals, including bats and rats, are known to be the primary hosts of alpha- and beta-CoVs.⁴

Seven different types of CoVs have so far been identified:

- AlphaCoVs include the human coronavirus 229E (HCoV-229E) and HCoV-NL63.
- Examples of BetaCoVs include HCoVOC43 and HCoV-HKU1.
- Examples of BetaCoVs include SARS-CoV-1 and SARS-CoV-2.
- The C lineage of Beta CoVs includes MERS.⁵

Compared to COVID-19, MERS and SARS are thought to be less contagious. As of March 29, 2023, at 9:19 a.m. CEST, 76,14,02,282 confirmed cases of COVID-19, including 68,87,000 fatalities, had been reported to WHO. As of March 27, 2023, 13,311,711,247 vaccine doses had been administered, and the program is still in place because there is no known cure. The highest death rate per million people ever recorded. It is concerning that this outbreak may spread to people with compromised immune systems and other at-risk populations.⁶ The high mortality and severity rates observed in children and the elderly show that age plays a role in the spread of disease. These are virions, roughly spherical on the outside, with a core shell and projections that resemble crowns (the Latin word corona means crown). The enveloped viral particle of the COVID-19 virus can take on pleomorphic forms and ranges in diameter from 60 to 160 nm.⁷

These positive sense ssRNA genomes, which range in size from 27 to 32 kb and encode 9860 amino acids, are known to be the most complex and extensive. Additionally, they had 99.9% sequence identity with the first nine patients, demonstrating a recent change from an animal host to a human. These ssRNAs' 3 poly A tail and 5-cap structures allow them to interact with nucleoproteins. All CoVs exhibit comparable genomic organization and expression.⁸

COVID-19 shares 50%, 79%, and 96% of the genetic makeup of MERS-CoV, SARS-CoV, and other bat-SARS-related viruses, respectively. Both the SARS-CoV-1 and the SARS receptor are said to be angiotensin-converting enzyme II (ACE2). The four main structural proteins that the CoV genome encodes for in CoV2 are the spike protein (S), nucleocapsid protein (N), membrane protein (M), and envelope protein (E), and they are required for the structural synthesis of the entire viral particle. The SARS-CoV-2 structural layout makes it easier for the virus to attach to receptors on the host cell membrane and allows cell fusion, which helps the virus enter the cell. S proteins are divided into their S1 and S2 subunits using host proteases such as trypsin, furin, and endosomal cathepsins. S1 mediates membrane fusion, whereas S2 regulates receptor binding, even though both subunits are essential for viral entry into the host. In a trimeric complex, the S1-S2 dimer folds to produce a metastable prefusion structure. Our comprehension of the mode of action of spike protein is constrained by the incomplete characterization of its entire organization. The ribonucleoprotein complex that creates CoV RNA primarily binds to the structural protein known as the N protein. Investigations also suggest that this protein might be involved in viral transcription and replication.⁹ As a result of its interactions with all important structural proteins, M is known as the coronavirus assembly's chief organizer. The structural protein also gives the CoV its most comprehensive shape. E, the smallest structural protein, helps viruses form, develop, and come together. Population genetics analysis was performed on more than 100 SARS-CoV-2 genomes. L and S are the two primary types of CoVs that have developed, and each has two unique single nucleotide polymorphisms (SNPs). 70% of all cases were L-type and 70% more aggressive than S-type cases. L-type cases are said to have predominated the Wuhan outbreak in 2019, but after the first few months of 2020, it seemed as though the trend was ebbing. Even though the S-type was once believed to be the primordial form, its cases later increased due to relatively laxer selective pressure.¹⁰ We must understand the dynamics of the viral genome to create a cure for medical issues due to the numerous epidemics caused by its rapid changes over the past two decades. There are fourteen open reading frames (ORFs) in the SARS-CoV genome. In the 3' end of the genome, 12 ORFs code for structural (S, N, M, and E) and auxiliary proteins. The 5'-end, on the other hand, has two lengthy, overlapping ORFs (1a and 1b), which encode for two replicase polyproteins that, in turn, are divided into 16 mature replicase proteins known as non-structural proteins (nsp1- 16). This nbsp is produced by the endoplasmic reticulum (ER) and is a component of the membrane's replication transcription complex (RTC). CoVs are also expected to encode a few RNA processing enzymes absent from other short RNA viruses. For the mRNA to be stable and translate correctly during its cytoplasmic life, the methylation-capped structure that results from mRNA modification in the nucleus in eukaryotes is essential.¹¹

However, because they have a particular 2'-O-MTase and a complex made up of two nsp subunits: nsp16 (catalytic subunit) and nsp10 (stimulatory subunit), CoVs, which are cytoplasmically replicating eukaryotic viruses, have developed strategies that allow them to cap themselves at the 5' end and also escape from the host's innate immune recognition. Because it is unique to CoVs, including SARS-CoVs, this nsp16-nsp10 interface makes a tempting target for creating antiviral drugs for CoVs. Viruses' transmission is influenced by several variables, including how likely it is for the virus to survive in the environment and spread from host to host.¹² The ability of HCoVs to withstand extreme temperatures of up to 60–65 °C and to survive for several hours (3–72 hours) on various surfaces (wood, steel, etc.) considerably increases their likelihood of spreading between hosts through contaminated surfaces like hands, door handles, etc. The upper respiratory tract is where the coronavirus enters the human body. Nasal or oral droplets disseminate it. As there is currently no known cure for COVID-19 or vaccine, it is important to use disinfectants and sanitizers properly and understand the elements that contribute to the spread of this airborne virus in the surrounding environment. We must rely on preventative measures that could lower infection and mortality because there is no known cure for the virus. The safety measures wheel's preventative and preventative measures spokes move.¹³ Precautions must be taken to prevent the new coronavirus from spreading. They consist of isolating the suspected cases and placing the patients' close contacts under quarantine. In hospitals, confirmed cases should be completely segregated in a private room. All levels of the health sector should require PPE for medical personnel. When COVID-19 patients are released from hospitals or quarantine facilities, the appropriate room decontamination must be offered. Hotspot sites must be contained and quarantined. For passengers boarding in hotspot zones, thermal screening must be required. The areas that avoided infection should take the necessary precautions to keep themselves in the "green zones." To address this, surveillance systems must be improved. Here are some things to do: (i) Steer clear of significant public gatherings. (ii) Enforcement of strict actions against violation of social distancing in public places. (iii) Regular sanitization and awareness of personal and community hygiene. (iv) Wearing face masks and hand hygiene is mandatory.

(v) Proper investment to build up proper healthcare facilities for an early response towards a pandemic outbreak.^{14,15}

Conclusion

In conclusion, COVID-19 currently lacks a particular treatment due to the new and extremely contagious nature of SARS-CoV-2. It must be considered that occasional social alienation will persist until 2023 if no effective action is taken and medications, vaccinations, and patient tracking tools are not extensively used or successful. By then, COVID-19 may have killed over 45 million people and affected 92% of the world's population. Consequently, it is advisable to keep up preventive strategies and public health initiatives until proper vaccination and potent medications are found. Eventually, COVID-19 will be successfully treated with combination therapy that includes some of the above medications or dietary supplements, an appropriate immunomodulatory diet, appropriate emotional support, and adherence to standards.

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Conflict of Interest: There are no conflicts of interest, according to the authors.

Acceptance of participation and ethical clearance:

This evaluation does not require ethical authorization because no patient data will be gathered. The ethical issues this study examines include plagiarism, confidentiality, misconduct, data falsification, double publication and submission, and duplication.

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