Covid-19 pandemic outburst in Saudi Arabia: A glimpse

Fuad Ameen a, Touseef Amna b,*, Abdullah A.A. Alghamdi c, Muneera D.F. AlKahtani d, Sami A. AlYahya e

a Department of Botany & Microbiology, College of Science, King Saud University, Riyadh 11451, Saudi Arabia
b Department of Biology & Biotechnology, Faculty of Science, Al Bahah University, Al Bahah 1988, Saudi Arabia
c Department of Biology, College of Science, Albaha University, Albaha 1988, Saudi Arabia
d Department of Biology, College of Science, Princess Nourah Bint Abdulrahman University, Riyadh 11675, Saudi Arabia
e National center for Biotechnology, King Abdulaziz city for Science & Technology, Riyadh, Saudi Arabia

ABSTRACT

Synopsis: Severe Acute Respiratory Syndrome Coronavirus2 (SARS-CoV2) provoked alertness globally. Existing pandemic eruption of infections with SARS-CoV2 has been phrased as coronavirus disease 2019 (covid-19). Worldwide pneumonia outburst attributable to new SARS-CoV2 alleged to be originated in Wuhan city of China and has affectionate of enormous danger regarding civic wellbeing. As of 11 March 2020, international death toll owing to outburst of new coronavirus was approximately 3,800, and about 110,000 have been declared as confirmed cases. The novel SARS-CoV2 demonstrated competence with respect to human to human communication; therefore depicted exponential intensification of cases. As of March 23, there are 374,513 collective cases of global infections; more than 16,350 deaths and number of recovered cases is 101,554. Now Europe has turn out into new epicenter of lethal coronavirus.

More than one third of the covid 19 cases are currently outside China. Presently Italy is one of worst hit countries followed by Spain. The rapid global widespread of novel covid-19 viruses lead to World Health Organization (WHO) to declare outbreak as pandemic. Given to seriousness of present scenario an accurate and rapid classification of noxious pathogenic virus is important which will lend a hand in opting for best fitting drugs. The screening program will aid saving people’s lives and help to put off the pandemic situation. The scientists and researchers should collaborate nationally and internationally to win the battle against novel covid-19. We aimed to represent covid 19 outbreak scenario in general and Saudi Arabia in particular. This short review report very briefly highlights covid-19 syndromes; propagation; Middle East outburst, natural products as cure for viral diseases, probable psychosomatic effects, protective measures and Islamic wisdom. SARS-CoV2 is subsequent coronavirus outburst that perturbs Middle East, after SARS-CoV and MERS-CoV which has been originated in kingdom of Saudi Arabia in year 2002 and 2012 respectively. The report covers information and developments till 23rd of March 2020 on basis of current published data and studies published on different scientific web-pages.

© 2020 The Author(s). Published by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
1. Overview

Coronavirus 2 (SARS-CoV2) frequently abbreviated as covid-19 (Fig. 1) is succeeding coronavirus outburst that impinge on Middle East after eruption of MERS-CoV which was documented in Saudi Arabia in 2012. United Arab Emirates (UAE) being primary Middle East nation to account a patient affected by coronavirus, next to Wuhan coronavirus outburst in China. This killer pandemic is totally out of control. The world is dying due to robust covid-19. Nonetheless; there are some Middle East countries which are not/or least affected by pandemic eruption of coronavirus such as Syria, Turkey, and Yemen (As of March 17). However; on the other hand Iran has utmost numeral of coronavirus patients, tracked by other nations such as Bahrain and Kuwait respectively. To best of author’s acquaintance there is no study till now which provides Middle East (in particular Saudi Arabia) scenario due to robust covid-19 infection. In this review paper; we briefly provide glimpse about severity of covid-19 transmission as well as current protective measures the Government of KSA has taken to prevent fatal situation as experienced by China; Italy, South Korea; Spain and rest of the world.

Nevertheless, in recent years tremendous scientific advance-ment has been made in medical systems in order to wrestle with communicable ailments; however infections caused by viruses still remains a tough task to deal with successfully. The infectious syndromes create noteworthy human health hazards and has given rise to roughly one fourth of casualties internationally (Bogoch et al., 2020; Lu et al.). Overwhelming covid-19 patients are fighting a war and finally losing. The coronaviruses represent Coronaviridae family which lead to neurological respiratory arrest and sickness (Zhao et al., 2020). To date, six human being coronaviruses (HCoVs) were recognized viz., HCoV-229E, HCoV-HKU1, HCoV-OC43, HCoVNL63, SARS-CoV, and MERS-CoV (Du Toit, 2020). It is noteworthy to mention here that among above mentioned viruses; the SARS-CoV and MERS-CoV are prominent with respect to pandemic (Ren et al., 2020). Appearance of new SARS-CoV2 in Wuhan and its consequent extend at national and international level like wildfire is being awfully demanding to global health care society to tackle this potential infectious sickness i.e. covid-19. Conclusively; uniqueness of virus, quick intercontinental spread as well as deficient remedial measures have impelled WHO International Health Regulation (IHR) emergency committee to affirm infection as Public Health Emergency of International Concern (PHEIC) on January 30, 2020 (Barry et al., 2020). As of 22 February 2020, there were 77,816 established patients of covid-19 and 1,021 deaths (https://www.worldometers.info/coronavirus/). At present (March 23, 2020), there are 374,513 recorded covid-19 cases, over 16,350 deaths authentication from all over earth. Astonishingly, Europe has been turned out as recent focal point of covid-19. In less than a month; covid-19 deaths exceeded 6,000. More to the point, in one single day 793 deaths have been recorded. Interestingly till date no death information has been reported by Kingdom of Saudi Arabia. Given to seriousness of infections as a result of novel covid-19; it is imperative to set up quick standard diagnostic test for uncovering infectious covid-19 in order to avoid successive secondary outbreak. Additionally there is an immediate need of vaccine which should be safe and effective with least/or no side effects.

1.1. Covid-19 syndromes/or manifestations

Extensive and continuous studies going on covid-19 infections have specified initial and later disease syndromes (Fig. 2). In broader sense the warning signs of covid-19 infection normally emerge out following an incubation time of roughly two to fourteen days (Li et al., 2020). However; commencement of covid-19 warning signs to death varied as of 6 to 41 days, mean of 14 days (Wang et al., 2020b). However; this syndrome may vary with age and condition of patient’s immune system. Wang et al. have suggested shorter duration in cases with age above seventy and may take longer time in patients below seventy years (Wang et al., 2020b). Fever, cough, and fatigue, sputum production, headache, haemoptysis, diarrhoea, dyspnoea, and lymphopenia have been
listed as frequent signs after inception of covid-19 disease (Carlos et al., 2020; Huang et al., 2020; Ren et al., 2020; Wang et al., 2020b). A very recent (23rd March) investigation by The American Academy of Otolaryngology has reported that loss of smell (Anosmia) and altered taste (Dysgeusia) could be significant warning signs of covid-19 (Fig. 2) irrespective of signs of respiratory disease. (https://www.today.com/health/coronavirus-covid-19-symptoms-may-include-loss-smell-or-taste-t176597)

2. Covid-19 host and propagation

Rigorous hard work is being made by distinguished researchers and scientists throughout globe to identify authentic host and intermediate carrier of this scary, life taking covid-19 infections to human beings. Investigations suggested that most of infected persons were found having contact with wet animals in Wuhan (Rothan and Byrareddy, 2020). Considering present scenario, it has been recommended probably to be of zoonotic origin. Primary information recognized two species of snakes may be potential host of covid-19. Till now no substantial confirmation of covid-19 host other than mammals and birds (Bassetti et al., 2020; Ji et al., 2020) is achievable. The new covid-19 depicted approximately 88% similarity with two bat originated severe acute respiratory syndrome (SARS) akin to coronaviruses (Lu et al., 2020). Recently a lot of studies recommended that human to human communication/or droplets of diseased person is a possible mode for transmission of covid-19 infection (Carlos et al., 2020). During an alternative scientific research it has been stated that covid-19 infection is not transmittable from infected pregnant mothers to unborn/or newborn babies; however covid-19 infection can pass at time of birth (Chen et al., 2020a). To restrict propagation of lethal covid-19 WHO and other scientific societies have issued specific guidelines which are shown in the below given figure (Fig. 3).

2.1. Covid-19 Middle East outburst scenario

Covid-19 is subsequent coronavirus outburst after SARS-CoV and MERS-CoV; documented in Saudi Arabia in 2002 and 2012 correspondingly. UAE was first Middle East country to inform a coronavirus positive case, subsequent Wuhan coronavirus eruption in China. Up to date covid-19, has reached to 195 countries and territories including China (https://www.worldometers.info/corona-virus/); prompting WHO to declare disease as a global pandemic. As of March 23, there are 374,513 cumulative cases globally, more than 16,350 deaths. Now Europe has turn into new epicenter of coronavirus. More than one-third of the Covid-19 cases are currently outside China. The numbers of recovered cases till now (March 23, 2020) are 101,554 (https://www.worldometers.info/coronavirus/). A huge number of cases (23,049) have been reported from Iran alone and 1,812 deaths; one of worst hit countries in Middle Eastern region. Other Middle East countries which have been reported to have covid-19 infection are as follows: Qatar, Egypt, Bahrain, Kuwait, Iraq, Lebanon, Saudi Arabia, UAE, Algeria, Palestine, Morocco, Oman, Tunisia, Jordan, Sudan, Somalia and Mauritania. The number of covid 19 cases reported and deaths have been shown in Table 1. Minimal cases have been reported from Somalia followed by Mauritania and Sudan (Table 1).

As of March 23, 2020, The Saudi Arabian Health Ministry broadcasted that total number of covid-19 cases had augmented to 767, with 51 recent confirmed cases. The distributions of infections are shown in figure (Fig. 4). Out of the 767 cases, 28 have recovered, remaining are getting intensive medical care in quarantine, while 2 cases are serious. Till date (June 19, 2020) there is huge rise in covid 19 cases. Out of total 150,292 cases, recoveries are 95,764. However, total deaths are 1,184. The reported mortality on partic-
2.2. Life with uninvited covid-19 in Saudi Arabia

Primary outburst case of covid-19 has been announced in Saudi Arabia on 2 March, a Saudi native way back to country from Iran via Bahrain. After that, number of cases increased rapidly. It is famous proverb that extraordinary times require extraordinary measures. Therefore as a preventive step; for time being, Saudi government has restricted tourists and visitors from covid-19 affected countries. The Great Mosque (Masjid al-Haram) of Mecca and the Prophet’s (peace be upon him) Mosque in Medina (Masjid al-Nabawi), has been closed for safety and sterilization purposes. Mecca is one of the busiest cities in world as this city never sleeps. But due to covid-19 pandemic all congregational prayers have been suspended (Fig. 6). The first public decision was issued (04th of March 2020) to prevent Umrah pilgrims and tourists from entering to limit the spread of covid-19 in Kingdom. Accordingly there are some precautionary measures including that Saudi Ministry of Sports halted fans from attending all sports competition. Moreover; Saudi authorities imposed a temporary ban on citizens and residents from nine countries (UAE, Kuwait, Bahrain, Lebanon, Syria, South Korea, Egypt, Italy, and Iraq). Saudi airline clogged all international flights temporarily and also closed malls and recreational places excluding medicine cabinet and supermarkets. As of 17 March 2020, The Saudi Ministry of Islamic Affairs, Dawah and Guidance announced that daily five congregational prayers and weekly Friday prayer have been suspended across the Kingdom’s mosques. As of 20 March, General Presidency of Grand mosque and prophet’s (peace be upon him) mosque halted presence of people and prayers even in outer courtyards. As of 23rd of March public quarantine has been applied from 7 pm to 6 am for 21 days.

2.3. Islamic guiding principles

Isolation and quarantine practices have been recommended in Islamic scriptures for the comfort of sick individuals and protection of healthy community ages back. It has been narrated by prophet Mohammed (peace be upon him) to his companions that in case of plague or any other communicable disease; if you listen to rigorous eruption of contagion in specific territory, never visit there; but if it outbreaks into your place also, do not leave that place (Sayili, 1980). The establishment of present quarantine system has now become basis of modern preventative medicine after discovery of communicable diseases. However; in Islamic history, the first hospital was built in 706 under kind instructions of Umayyad caliph Al-Walid in Damascus to isolate leprosy patients from other patients in hospital (Sayili, 1980). In addition to that; it is also mentioned in holy Quran that one shouldn't cause harm to oneself and others as well (Source: Al-baqarah, chapter 2: verse 195). Furthermore; Islamic protocol encouraged suspension of congregational prayers during adverse circumstances; which has been implemented during the covid-19 pandemic in almost all the Middle East countries. Conclusively the Islamic wisdom leads a way to deal with frightening and panic situations such as pandemic covid-19.

2.4. Natural products/or medicinal plants to cure viral infections

Worldwide catastrophe due to viral diseases is massive. Recently, it has been reported that internationally half a million causalities are exclusively due to influenza (Weier and Zaidi, 2019). Previous investigations have reported plentiful plants and herbs which have produced incredible antiviral components (flavonoids, terpenoids, lignans, sulphides, polyphenolics, coumarins, saponins, feryl compounds, alkaloids, polynes, thiophenes as well as proteins and peptides). In addition to earlier mentioned photo-
chemicahs; culinary herbs, spices and herbal teas too harbor superb antiviral potential (Jassim and Naji, 2003). Convincingly; bioactive components of therapeutic plants are previously being utilized to lucratively cure various viral syndromes such as Boehravia diffusa, Eclipta alba, Phyllanthus amarus (Anbazhagan et al., 2019) etc. Similarly; plant flavonoids impart bountiful healthcare uses such as boost immune system, endow with antioxidant, anti-inflammatory, cholesterol lowering, anticancer potential. Therefore these are considered as novel compounds for advancement of drugs for viral diseases (Burkard et al., 2017). The KSA possess floral diversity and these plant species are dispersed all through Kingdom which are being applied by native people for cure of various of diseases (Al-Asmari et al., 2015; Ibrahim et al., 2017). The native plants are hardly ever been intensively explored for viral diseases; so can be screened for the same. Analogously, a lot of traditional Chinese medicinal plants are being applied for cure of endemic diseases (Maryam et al., 2020). Identically, numerous polysaccharides from medicinal plants/or mushrooms were authoritatively got certified as medicines. These can hamper viral contamination by probing some phases in virus life cycle or boosting host immune system. China Food and Drug Administration has permitted a few polysaccharide based drugs (He et al., 2019). Coupled with; there is also prevalent exploitation of medicinal plants to manage HIV infection (Anywar et al., 2020). Nevertheless; SARS patients (in year 2003) dealt with medicinal plants/or mushrooms were greatly benefitted and accounted rationale was considered as metabolism. Therefore natural products acknowledged in their investigation possibly will facilitate to establish lead drug molecules for Covid-19 (ul Qamar et al., 2020). Irrefutably; development of potential anti-covid-19 medicine/or vaccine will take months to year time. Consequently; conventional medicine based on local medicinal plants will serve as a substitute.

2.5. Whether hydroxychloroquine is a drug of choice?

Nonetheless hitherto there isn't any authorized medication for covid-19. Commonly applied medicines for virus are protease inhibitors, lopinavir and ritonavir or virus replication inhibitor, remdesivir etc. Medical research with aforementioned drugs is in progress. Taking into consideration cycle of SARS-CoV2 WHO has recommended focal points for medication formulation; such as targeting virus with monoclonal antibodies, suppression of viral endocytosis via antimalaria drugs, e.g., chloroquine or hydroxychloroquine. A couple of very recent investigations have also indicated that chloroquine exhibits inhibitory effect towards SARS-CoV2 under in vitro conditions. Its antiviral action pre- and post-infection against SARS and other coronavirus has been demonstrated in in vitro studies (Herraiz, 2020). Alternatively a few professionals have suggested antimalarial drug to covid-19 patients (Chen et al., 2020b; Kumar et al., 2020). Chloroquine and hydroxychloroquine possess wide range antiviral potential towards HIV, hepatitis B, Herpex simplex virus type 1, Ebola and also SARS and MERS respectively by hampering stages of replication of different viruses. Moreover; theoretically chloroquine/hydroxychloroquine may possibly interlock hemoglobin distressing cysteine proteases essential for viral propagation (Herraiz, 2020). The high hopes regarding treatment of covid-19 patients with hydroxychloroquine was due to outcome of limited clinical trials in France. The treated patients depicted noteworthy reduction in viral count. On the other hand some patients did not react to hydroxychloroquine and accounted rationale was considered as metabolism. Therefore advance clinical investigations and trials are necessary as well as are in progress.

2.6. Psychosomatic after effects

Due to covid-19 pandemic, earth planet has been shut down; taking a siesta. It is given to understand that infected as well as healthy folks may suffer depression due to quarantine, travel ban, fear of infection, and recurrence of disease as well as side effects of treatment itself. To overcome abovementioned worries, National Health Commission of China released a national guideline for psychological problems intervention on 27 January 2020 (Duan and Zhu, 2020). Nevertheless, psychological counseling of persons (who are suffering and had gone through covid-19 infections) will extremely be helpful to come back to normal life again.

2.7. Conclusive statements

Conclusively, scientists, researchers, health care practitioners as well as pharmaceutical agencies around the world are trying hard to discover cure for fatal covid-19 virus. Enormous measures such as complete shutdown, quarantine and lockdowns have already been taken worldwide to prevent fatal covid-19 virus spread. However; immediate development of new vaccine is the need of hour. It has been anticipated that existing antiviral drugs akin to Nucleoside analogues, also HIV-protease inhibitors may reduce covid-19 infection (Lu, 2020). Additionally existing antivirals like ribavirin, 5-Fluorouracil, 5-Azacytidine, Remdesivir etc were also thought to be effective (Rothan and Byrareddy, 2020) as these nucleoside analogues operate by enhancing mutations in RNA viruses and ultimately extinction (lethal mutagenesis). However;
till date no success has been obtained against robust covid-19 outbreaks. Besides; taking aforementioned measures The Saudi Health Ministry reaffirmed to control further spread of covid-19 viruses. Proper screening on airports is being done to screen passengers for covid-19 in order to avoid any untoward incident. In all cities quarantine rooms have been created in hospitals to properly treat patients. Nevertheless; funds have also been dedicated to research with Global bodies for thorough understanding of covid-19 mechanisms of infection, establishment of diagnostics systems and fast track development of vaccines.

In summary; till date (As of 31 March) WHO has not proposed any therapy for covid-19. The entire world is eagerly looking forward for a vaccine which can fight with covid-19 and can save millions of lives. There are twenty vaccines which are being in developmental stage. We expect broad-spectrum anti-covid-19 vaccine which possesses potential to combat the deadly covid-19 virus effectively and with maximum safety.

Acknowledgments

This research was funded by the Deanship of Scientific Research at Princess Nourah bint Abdul Rahman University through the Fast-track Research Funding Program.

References

Al-Asmari, A.R.K., Siddiqui, Y.M., Athar, M.T., Al-Buraidi, A., Al-Eid, A., Horaib, G.B., 2015. Antimicrobial activity of aqueous and organic extracts of a Saudi medicinal plant: Rumex nervosus. J. Pharm. Bioallied Sci. 7 (4), 300.

Anbazhagan, G.K., Palaniyandi, S., Joseph, B., 2019. Antiviral Plant Extracts Plant Extracts. IntechOpen.

Anyarw, G., Kakudidi, E., Byamukama, R., Mukonzo, A., Schulert, A., Oryem-Origa, H., 2020. Indigenous traditional knowledge of medicinal plants used by herbalists in treating opportunistic infections among people living with HIV/AIDS in Uganda. J. Ethnopharmacol. 246, 112205.

Barry, M., Al Amri, M., Memish, Z.A., 2020. COVID-19 in the Shadows of MERS-CoV in the Kingdom of Saudi Arabia. J. Epidemiol. Global Health.

Baxter, M., Vena, A., Roberto Giacobbe, D., 2020. The Novel Chinese Coronavirus (2019-nCoV) Infections: challenges for fighting the storm. Eur. J. Clin. Investig., vol.e13209.

Bogo, L., Watts, A., Thomas-Bachli, A., Huber, C., Kramer, M.U., Khan, K., 2020. Pneumonia of Unknown Etiology in Wuhan, China: Potential for International Spread Via Commercial Air Travel. J. Travel Med.

Burkard, M., Leischner, C., Lauer, U.M., Busch, C., Venturelli, S., Frank, J., 2017. Dietary flavonoids and modulation of natural killer cells: implications in treating opportunistic infections among people living with HIV/AIDS in China. J. Nutr. Biochem. 46, 1–12.

Carlos, W.G., Dela Cruz, C.S., Cao, B., Pasnick, S., Jamil, S., 2020. Novel Wuhan (2019-nCoV) Coronavirus. Am. J. Respir. Crit. Care Med. 201 (4), P7–P8.

Chen, H., Guo, J., Wang, C., Luo, F., Yu, X., Zhang, W., Li, J., Zhao, D., Xu, D., Gong, Q., 2020a. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. The Lancet 395 (10226), 809–815.

Chen, Z., Hu, J., Zhang, Z., Jiang, S., Han, S., Yan, D., Zhuang, R., Hu, B., Zhang, Z., 2020b. Efficacy of hydroxychloroquine in patients with COVID-19: results of a randomized clinical trial. MedRxiv.

Du Toit, A., 2020. Outbreak of a novel coronavirus. Nat. Rev. Microbiol. 18 (3), 123.

Duan, L., Zhu, G., 2020. Psychological interventions for people affected by the COVID-19 epidemic. The Lancet Psychiatry.

He, X., Fang, J., Guo, Q., Wang, M., Li, Y., Meng, Y., Huang, L., 2019. Advances in antiviral polysaccharides derived from edible and medicinal plants and mushrooms. Carbohydr. Polym. 115548.

Herraz, T., 2020. Chloroquine and hydroxychloroquine as antimalarials and antivirals against SARS-CoV-2: The hemin factor.

Huang, C., Wang, Y., Li, X., Ren, L., Zhao, J., Hu, Y., Zhang, L., Fan, G., Xu, J., Gu, X., 2020. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. The Lancet 395 (10223), 497–506.

Ibrahim, S.R., Abdallah, H.M., Mohamed, G.A., Farag, M.A., Alshifi, K.Z., Alshrief, E.A., Ross, S.A., 2017. Volatile oil profile of some lamiaceae plants growing in Saudi Arabia and their biological activities. Zeitschrift für Naturforschung C 72 (1–2), 35–41.

Jassim, S.A.A., Naji, M.A., 2003. Novel antiviral agents: a medicinal plant perspective. J. Appl. Microbiol. 95 (3), 412–427.

Ji, W., Wang, W., Zhao, X., Zai, J., Li, X., 2020. Homologous recombination within the spike glycoprotein of the newly identified coronavirus may boost cross-species transmission from mink to human. J. Med. Virol.

Kumar, S., Zhi, K., Mukherji, A., Gerth, K., 2020. Repurposing antiviral protease inhibitors using extracellular vesicles for potential therapy of COVID-19. Viruses 12 (5), 486.

Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., Ren, R., Leung, K.S., Lau, E.H., Wong, J.Y., 2020. Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. N. Engl. J. Med.

Ling, C.-q., 2020. Traditional Chinese medicine is a resource for drug discovery against 2019 novel coronavirus (SARS-CoV-2). J. Integr. Med. 1–4.

Lu, H., 2020. Drug treatment options for the 2019-new coronavirus (2019-nCoV). Biosci. Trends.

Lu, H., Stratton, C.W., Tang, Y.W. Outbreak of Pneumonia of Unknown Etiology in Wuhan China: the Mystery and the Miracle. J. Med. Virol.

Lu, R., Zhao, X., Li, J., Niu, P., Yang, B., Wu, H., Wang, W., Song, H., Huang, B., Zhu, N., 2020. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. The Lancet 395 (10224), 556–574.

Maryam, M., TE, K.K., Wong, F.C., Chai, T.T., Gary, K., Gan, S.C., 2020. Antiviral activity of traditional medicinal Chinese plants Dryopteris crassirhiza and Morus alba against dengue virus. J. Integr. Agric., vol. 19, pp. 1085–1096.

Ren, L.-L., Wang, Y.-M., Wu, Z.-Q., Xiang, Z.-C., Guo, L., Xu, T., Jiang, Y.-Z., Xiong, Y., Li, Y.-J., Li, H., 2020. Identification of a novel coronavirus causing severe pneumonia in human: a descriptive study. Chin. Med. J.

Rothan, H.A., Byrareddy, S.N., 2020. The epidemiology and pathogenesis of COVID-19 outbreak. J. Autoimm. 102433.

Sayili, A., 1980. The emergence of the prototype of the modern hospital in medieval Islam. Belleten Türk Tarih Kurumu Ankara 44 (174), 279–286.

Wang, W., Tang, J., Wei, F., 2020b. Updated understanding of the outbreak of 2019 novel coronavirus (2019-nCoV) in Wuhan, China. J. Med. Virol.

Weier, N.E., Zaidi, S.T.R., 2019. Pharmacotherapy of Viral Infections and the Role of Pharmacists in the Prevention and Treatment of Viral Diseases.

Wuhan, China. The Lancet 395 (10227), 809–815.