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A Comprehensive Review: On Recent Outbreak of Coronavirus in the Light of Unani Medicine and Veterinary Science

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ABSTRACT

Three coronaviruses have caused catastrophic outbreaks of pneumonia in humans since early 21st century. The latest Covid-19 (Coronavirus disease 2019) is the third zoonotic origin coronavirus outbreak to occur in the current century that spread from one city in china to the whole world within 30 days. Corona virus is the re-emerging virus, which has spread in a very deadly way nowadays. It is now known that the SARS-CoV2 genome has a structural similarity of 96.2 per cent to a bat coronavirus (CoVRaTG13) and 79.5 per cent to SARS-CoV, respectively. Approximately 50-80 per cent of the virus transmission comes from asymptomatic carriers and speech droplets transmission is considered to be a major mode of disease transmission. Unani and Veterinary services should work together to exchange information and conduct a risk assessment using a One Health approach when a person who is infected with SARSCoV2 reports is in touch with their pets or animals. Before the era of chemical air purifiers, Unani physicians used medicinal herbs as decoction or distillate for spray or as fumigants to keep the air free from pollutants. Various unani herbs like vinegar and some aromatic drugs can kill infectious agents and should be used as fumigants during epidemics. Hand hygiene, food hygiene, avoid consumption of bushmeat are some veterinary's preventive measures which help to control the infection during epidemic conditions.

1. Introduction

Since the beginning of the 21st century, three coronaviruses have caused catastrophic outbreaks of pneumonia in human beings: Severe acute respiratory syndrome coronavirus (SARS-CoV) in 2002–03 and Middle-East respiratory syndrome coronavirus (MERS-CoV) in 2012 (Čivljak *et al*., 2020).

The new Covid-19 (Coronavirus disease 2019) is the third coronavirus outbreak of zoonotic origin to occur in the present century (Sun *et al*., 2020), which spread from one city in China to the entire country within 30 days (Wu and McGoogan, 2020); and spread to almost 72 countries in less than three months (Chinazzi *et al*., 2020). In essence, it is known to have affected 'all continents except Antarctica' (Acharya, 2020).

Covid19 was declared a pandemic by the World Health Organization (WHO) on 12 March 2020 (Gautretet al., 2020). As of 17th April 2020, there have been 2,074,529 confirmed cases and 139,378 deaths worldwide due to Covid-19 as reported by the WHO (WHO, 2020). In India, the first case of Covid-19 was a student who returned from Wuhan, China on 30th January 2020 (Sahasranaman and Kumar, 2020). By 14th April 2020, there have been a total of 13,387 cases and 437 deaths in the country. Although community transmission is not reported,

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clusters of cases have been identified (WHO, 2020).This virus was initially named as 2019 nCoV or Wuhan Corona virus. The popular name of the virus is now SARS-CoV-2 or Corona Virus and the disease is known as COVID -19 or CoV-19 which is now pandemic.

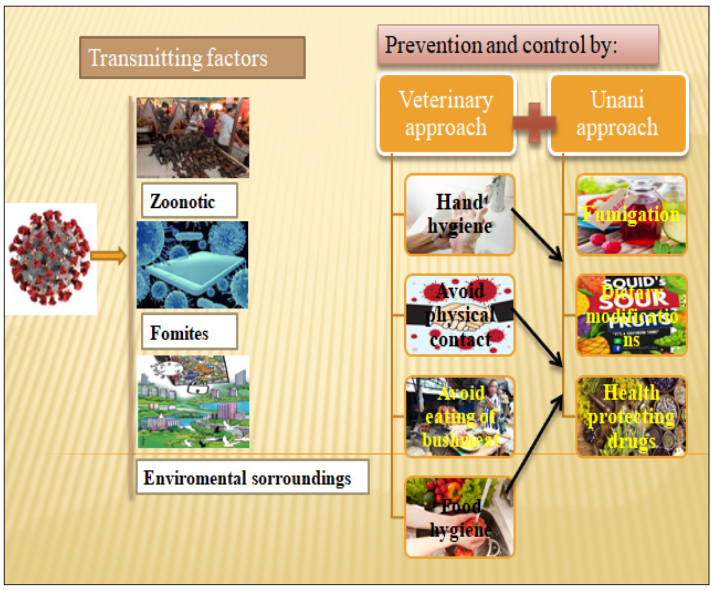
Corona virus is the re-emerging virus and now days it has been spread in a very deadly form. It is now understood that SARS-CoV-2 has a 96.2% structural similarity with a bat coronavirus (CoV RaTG13) and 79.5% similarity with SARS-CoV. However, its spike (S) glycoprotein has a 10–20 times higher affinity to human ACE2 receptors as compared to SARS-CoV, leading to more chances of human-to-human transmission; though having a lesser mortality rate (average 3.4%) than that of SARS (9.6%) and MERS (35%) respectively(Guo *et al*., 2020), but just after 2 months only, the epidemic of COVID-19 is already larger than the severe acute respiratory syndrome (SARS) coronavirus (SARS-CoV) outbreak, which during 2002/2003 lasted 8 months and infected 8096 people, with a mortality rate of 9.5%. It is a larger threat than the multiple smaller outbreaks of Middle East Respiratory Syndrome (MERS) coronavirus (MERS-CoV), a zoonotic coronavirus that was discovered in 2012 (Bermingham *et al*. 2012).

Corona viruses are enveloped RNA viruses with a positive-sense single-stranded RNA genome and a nucleocapsid of helical symmetry and cause diseases in mammals and birds(Cherry *et al*., 2017). Usually, various types of corona viruses are found that cause respiratory disease to birds and mammals including humans. These viruses are a group of related viruses that originated from very early days starting from HCoV-N163(560 to 820 years ago) to HCoV- 229E (about 200 years ago) to HCoV– OC43 (about 120 years ago) to HCoV – HKU1 (early 1950) to SARS–CoV (4 to 17 years before SARS epidemic in 2002) to MERS - CoV (about 2006) and finally to the present SARS-CoV-2(Forni *et al*., 2017)

Corona viruses that are closely related to SARS-CoV are typically found in bats (Li *et al*. 2005). There is evidence that SARS-CoV originated in bats in China and reached humans most probably after jumping to an intermediate host, the civet (Paguma larvata) (reviewed by Wang and Eaton 2007). Similarly, MERS-CoV is endemic in dromedary camels in the Middle East, from which it can be transmitted to humans, but it may also have originated in bats (Cui *et al*. 2019). Basically, coronavirus has a zoonotic potential and bats denoted as likely primary reservoirs to spread it among these three outbreaks (Perlman *et al*., 2020).

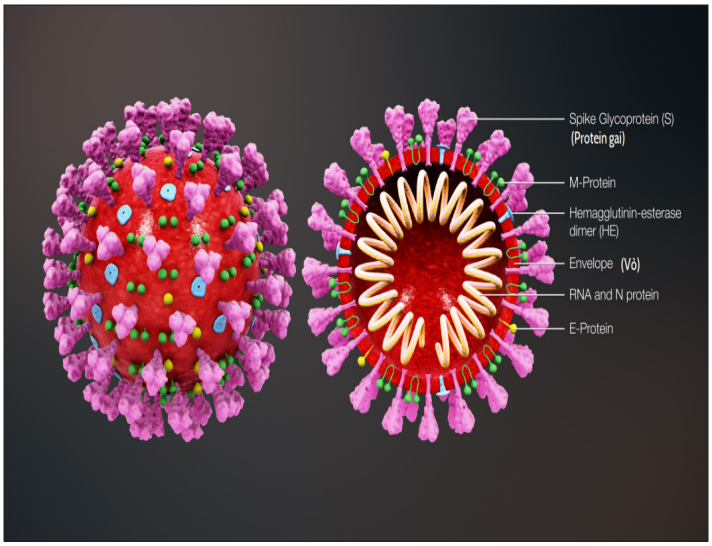
The genome sequences of 2019-nCoV that is responsible for the current outbreak suggest that it too may have originated from bats, though it may have undergone a host jump to another mammal that was sold on a live animal market in Wuhan, where the outbreak presumably had started (Zhang *et al*. 2020). , it was published that this animal might have been a pangolin (Manis javanica) (Liu *et al*. 2019). Alternatively, though less likely, a highly infectious patient zero may have been present at the market, as now know that the virus can spread via human-to-human contacts (Riou and Althaus 2020) and individuals infected with a coronavirus can be 'super-spreaders', as was demonstrated for MERS (Cho *et al*. 2016; Kang *et al*. 2017). In this paper, we present an overview of zoonotic potential of Covid-19 and SARS-CoV-2, and their preventive measures, and a possible approach to the management of Covid-19 with Unani medicine.

Graphical Abstract



2. Morphological Characteristics of Corona Virus

SARS-CoV-2 is a coronavirus belonging of the genus β-coronaviruses, of sub-genus botulinum (Sun *et al*., 2020). This is the seventh of the coronaviruses family which is known to infect humans (Andersen *et al*., 2020). SARS-CoV-2 was first isolated from bronchoalveolar lavage samples from three unexplained source of pneumonia patients (Zhu et al., 2020). Coronavirus is a special round shape, positive Single-Stain RNA virus, that is wrapped in an envelope containing a large number of glycoprotein (S) spike that infect population on wide Scale.Club-shaped spikes from the surface of the plant, which produce an image that project from their surface, which in electron micrographs reminiscent of the solar corona, from which their name derives (Almeida *et al*., 1968).The name corona virus was given by June Almeida and David Tyrrell who first identified and studied human corona viruses (Almeida *et al*.,1968)).Corona virus is typically affects the upper respiratory tract of humans (Zhu *et al*., 2019; Li *et al*., 2020; Lee *et al*., 2019).



Electronic microscopic structure of COVID-19

First coronavirus stain was first described by the two scientists- Tyrell and Bynoe, at the beginning of 1966, taking the sample from the patients suffering from the common cold. (Tyrrell, 1966). They called corona viruses (Latin: crown = crown) due to their morphology as round virions with a centre shell and surface projections taking a sun-powered crown. There are four subfamilies, specifically alpha, beta, gamma-and delta corona viruses. Although alpha-and beta-corona viruses originate from bats while gamma-and delta-infections emerge from pigs and winged animals. Of all the seven types of the corona viruses that can affect a significant number of population, severe infection and death to the population are caused by beta stains of coronavirus and on another hand, alpha stains indicate asymptomatic or symptomatic contamination at some time. COVID-19 has a position with the B inheritance of the beta-corona viruses and has a common indication with the SARS-CoV infection (GISAID and Zhou, 2020).In the beta coronavirus-HCoV-OC43 and beta coronavirus-HKU1, the four basic qualities encode the protein that is spike protein (S) present on the spike of the virus, a film protein (SM), layered glycoprotein (M) and the nucleocapsid protein (M). The whole genome of a bat coronavirus showing the 96% similarity to coronaviruses-19(SARS-CoV-19)(Zhou, 2020).

3. Transmitting Factors

At the earliest stage of the outbreak, seeing that 55% of the patients were linked to a seafood and wet animal market, a possible zoonotic origin was suggested (Sun *et al*., 2020). Researches have shown that SARSCoV-2 has close structural resemblance to bat coronaviruses, supporting the hypothesis that SARS-CoV-2 was derived from bats. Snakes have also been proposed as a possible wildlife sources for the virus. However, there was an exponential rise in unrelated cases since late December 2019 (Sun *et al*., 2020).

Because bats are a natural repository of different coronaviruses, a zoonotic angle is not completely excluded. Nevertheless, statistics show that the disease spreads quickly by human to human transmission (Guo *et al*., 2020). Bats are considered to be reservoir hosts for many human viruses, including rabies, Marburg, Nipah, Hendra, and the acute respiratory syndrome coronavirus (SARS-CoV) (Calisher *et al*., 2006).

Coronaviruses are RNA enveloped viruses that are frequently found in mammals and birds, and commonly identified in etiologies of upper respiratory tract infections in humans (Zhu *et al*., 2019; Lee *et al*., 2019). Two potentially deadly zoonotic coronaviruses have arises in the last two decades. Severe acute respiratory coronavirus syndrome (SARS-CoV), originating in China, was responsible for the first outbreak that lasted from 2002 to 2003.

The second outbreak occurred in 2012 in the Middle East, triggered by the Middle East respiratory syndrome coronavirus (MERS cov) (Zhu *et al*., 2019; Alfaraj *et al*., 219) A new coronavirus strain , known as the 2019 novel coronavirus (2019-nCoV), emerged at the end of 2019 during the third outbreak in Wuhan, China. Symptoms of pneumonia of certain etiology have been reported in many patients. The outbreak has been epidemiologically related to the Huanan seafood market in Wuhan(Huang *et al*., 2020).compared to the SARS-CoV and the MERS-CoV, bats have been established as the possible primary reservoirs of the 2019-nCoV based on their resemblance to bat coronaviruses (Perlman *et al*., 2020). The intermediary reservoir has yet to be denoted. Another special feature of this virus is that hosts are needed for their growth and replication i.e., parasitic in nature (Masters *et al*., 2006).

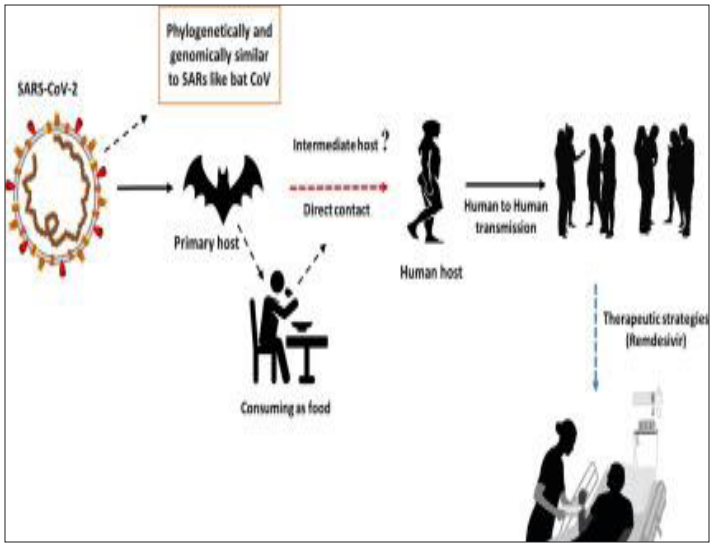
3.1. Human to Human Transmission

Approximately 50 to 80 per cent of the transmission of the virus is from asymptomatic carriers and the transmission by speech droplets is known to be a major mode of transmission of the disease. The virus may be directly by speech droplets, or fomites can transmitted the virus directly (Anfinrud *et al*., 2020). Based on result, it is estimated that 44% of the transmission can occur before symptoms begin (He *et al*., 2020). SARS-CoV-2 binds to the ACE2 receptors, which are abundant in the lungs and gastrointestinal tract. Air-borne transmission is not absolutely removed (Ling *et al*., 2020).

There is also evidence that the virus may be spread by tears and body fluids as it comes into contact with the mucosa of eyes, mouth and nose. Based on the route of entry, the virus attaches to ACE2 receptors and infects type-2 pneumocytes, ciliated bronchial epithelium in the lungs (Rodriguez-Morales et al., 2020) and small intestine enterocytes. The virus has also been found in blood, which contributes to another transmission routes (Guo *et al*., 2020). The ability of the virus to bind to

human cells is the crucial factor for effective human to human transmission.

Coronaviruses bind to host cells using a spike protein (Enserink *et al*., 2013). 2019-nCoV apparently uses the same human angiotensin conversion enzyme 2 receptor as SARS-CoV, (Munste *et al*., 2020) Thus MERS-CoV used dipeptidyl peptidase which also called as CD26(Raj *et al*., 2013). Efficient human to human transmission requires various transmission paths, including droplet transfer, direct contact, and indirect contact. Limited human-to-human transmission may involve a high dose of infective and significantly close contact with an infected person as pre-conditon. Human ingeston of bushmeat (bats, snake) may be an emerging factor for coronavirus transmission in the light of zoonosis.



4. Clinical Manifestation

COVID-19 clinical range varies from asymptomatic or paucisymptomatic types to clinical conditions characterized by respiratory failure requiring mechanical ventilation and assistance in an ICU to multi organ and systemic manifestations in terms of sepsis, septic shock, and multiple organ dysfunction syndromes (MODS). In one of the first reports on the disease, Huang et al. showed that fever, malaise, dry cough and dyspnea had develop in patients(n=41).Computerized tomography(CT) scans in the chest revealed every case pneumonia with irregular findings. About one third of those 13 (32%) required ICU care, and 6 (15%) fatal cases were reported. Li et al., case studies published in the New England Journal of Medicine (NEJM) on January 29, 2020, encapsulates the first 425 cases recorded in Wuhan. The data shows that the median age of patients was 59 years, ranging from 15 to 89 years. Therefore, they did not record any clinical case in children below 15 years of age. There were no major difference between the gender (56% male).On the contrary, there is a lower prevalence in the female, in other reports.

Clinical and epidemiological data from the Chinese CDC and regarding 72, 314 case reports (confirmed, suspected, diagnosed and asymptomatic cases) were shared in the Journal of the American Medical Association (JAMA), which provides the first important illustration of the epidemiologic curve of the Chinese outbreak. (Wu *et al*., 2020) There were 62% confirmed cases, including 1% of cases that were asymptomatic, but were laboratory-positive (viral nucleic acid test). Moreover, the overall case-fatality rate (on confirmed cases) was 2.3%. Of note, the fatal cases were mainly elderly patients, in particular those aged ≥ 80 years (about 15%), and 70 to 79 years (8.0%). Approximately half (49.0%) of the critical patients died as a result of preexisting co-morbidities such as cardiovascular disease, diabetes, chronic respiratory disease, and oncological diseases. While 1% of patients were aged 9 years or younger, there were no fatal cases occurred in this group.

The authors of the Chinese CDC report divided the clinical manifestations of the disease by their severity:

- Mild disease: non-pneumonia and mild pneumonia; this occurred in 81% of cases.
- Severe disease: dyspnea, respiratory frequency ≥ 30/min, blood oxygen saturation (SpO2) ≤ 93%, PaO2/FiO2 ratio or P/F the ratio between the blood pressure of the oxygen (partial pressure of oxygen, PaO2) and the percentage of oxygen supplied (fraction of inspired oxygen, FiO2) < 300, and/or lung infiltrates > 50% within 24 to 48 hours; this occurred in 14% of cases.
- Critical disease: Respiratory failure, septic shock, and or multiple organ dysfunction (MOD) or failure (MOF); this occurred in 5% of cases (Wu *et al*., 2020).

From the subsequent reports, it is estimated that in 70 per cent of patients have asymptomatic or with very mild symptoms, while in the remaining 30 per cent have respiratory syndrome with high fever, coughing until severe respiratory failure is reached who may require ICU admission. Thus, data obtained from reports and directives provided by health policy agencies allow division of the clinical manifestations of the disease according to the severity of the clinical pictures. COVID-19 may have with mild, moderate, or severe illness. Severe pneumonia, ARDS, as well as extra pulmonary manifestations and Systemic complications such as sepsis, and septic shock are among the severe clinical manifestation. The clinical course of the disease appears to predict a favorable trend in the majority of patients. In a percentage cases still to be defined, there is a sudden worsening of clinical conditions with rapidly worsening respiratory failure and MOD/MOF after about a week. The criteria for severity of respiratory insufficiency and the diagnostic criteria for sepsis and septic shock can be used as a reference (Kogan *et al*., 2019).

5. Diagnostic Methods

5.1. Molecular Test

WHO recommends collecting specimens from both the upper respiratory tract (naso and oropharyngeal samples) and lower respiratory tract such as expectorated sputum, endotracheal suction or bronchoalveolar lavage. The collection of BAL samples should only be performed in mechanically ventilated patients as lower respiratory tract samples seem to remain positive for a longer period of time. The amplification of the genetic material extracted from the saliva or mucus sample is performed in the laboratory by means of reverse polymerase chain reaction (RT-PCR).

5.2. Serological Test

Despite the numerous antibody tests that have been designed, serological diagnosis to date has limitations in both specificity and sensitivity.

5.3. Laboratory Examinations

- Normal or decreased total white blood cell count (WBC) and a decreased lymphocyte count may be demonstrated in the early stage of the disease. Interestingly, lymphopenia seems to be a negative prognosis factor.
- Increased values of liver enzymes, lactate dehydrogenase (LDH), muscle enzymes, and C-reactive protein may be detected.
- A normal procalcitonin value is found unless a bacterial overlap.
- The elevated neutrophil-to-lymphocyte ratio (NLR), derived NLR ratio (d-NLR) neutrophil count divided by the result of WBC count minus neutrophil count and platelet-to-lymphocyte ratio, may be the expression of the inflammatory storm.(Yang et al., 2020)
- In critical patients, the D-dimer value is increased, blood lymphocytes have decreased persistently, and laboratory alterations of the multiorgan imbalance (high amylase, coagulation disorders, etc.) are identified.

5.4. Imaging

5.4.1. Chest X-Ray Examination

As the disease manifests itself as pneumonia, radiological imaging plays a key role in the diagnostic process, management, and follow-up process. Standard radiographic examination (X-ray) of the chest has a low sensitivity in identification early lung changes and in the initial stages of the disease. It can be completely negative at this stage.The chest X-ray examination typically reveal bilateral multifocal alveolar opacities in the more advanced stages of infection,, which appear to confluence up to the complete opacity of the lung. The Pleural effusion may be associated.

5.4.2. Chest Computed Tomography

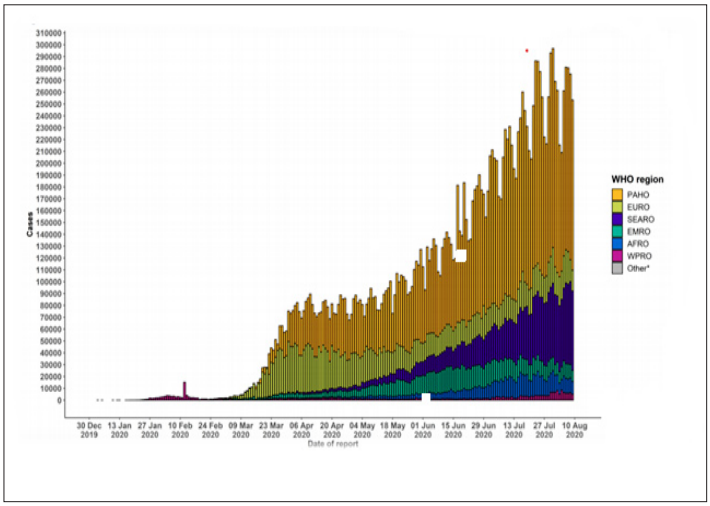
Because of the method's high sensitivity, chest computed tomography (CT), particular high-resolution CT (HRCT), is the method of choice in the study of COVID-19 pneumonia, even in the initial stages. The most common findings are multifocal bilateral "ground or ground glass" (GG) areas associated with patchy distributed consolidated areas, mainly peripheral sub-pleural and with greater involvement of the posterior regions and lower lobes. The "crazy paving" pattern can be also observed. Certain other findings are the "reversed halo sign" which is a focal area of GG delimited by a peripheral ring with consolidation, and the finding of cavitations, calcifications, lymphadenopathies, and pleural effusion.

5.4.3. Lung Ultrasound

Ultrasound approach can enable evaluation of the disease evolution, from a focal interstitial pattern up to "white lung" often with evidence often of sub-pleural consolidations .It should be performed within the first 24 hours in the suspect and every 24/48 hours and can be useful for patient follow-up, selection of mechanical ventilation setting, and for the indication of prone positioning. The main sonographic features are:

- Pleural lines often thickened, irregular, and discontinuous until almost discontinuous sub-pleural lesions may be seen as small patchy consolidations or nodules.
- Lines B. They are often motionless, coalescent, and cascaded and can flow up to the square of "White lung".
- The Thickenings. They are most evident in the posterior and bilateral fields particularly in the lower fields; the dynamic air bronchogram within the consolidation is a manifestation of disease evolution.
- Perilesional pleural effusion

6. Epidemiology



Overall, more than 19.7 million confirmed cases of COVID-19 were registered to WHO through the week ending 9 August including more than 720 000 deaths. More than 1.8 million new cases of COVID-19 have been reported over the past seven days, over, a slight decrease of 2 percent, compared to the previous week, while the number of deaths has increased by 2 percent in the past seven days with more than 41000 new deaths reported during this period. That averages 254502 cases and 5858 deaths a day. The biggest regional shift in the number of new cases in the past seven days is the marked decrease (23 percent) in the WHO Region of Africa, while deaths have continue to rise. Although the WHO Region of the Americas remains the hardest-hit, contributing over half of all newly confirmed cases recorded (54 percent) and deaths (63 percent) recorded in the past week, the West Pacific region (31 percent and 27 percent respectively) saw the highest percentage rise in new cases and deaths .Of all the nations, territories, and areas that have been reported cases, the United States of America, Brazil, and India have remained the top three countries affected in the past seven days. Countries across the globe, have made numerous prevention initiative, including compulsory mask wearing, local movement bans, and physical distancing measures to control the increases and clusters of new cases that followed the initial easing of public health and social measures initially introduced earlier in the year (WHO, 2020).

7. Preventive Measures by Unani Approach

Collectively, the preventive measures for epidemic diseases aim at enhancing immunity, preventing the spread of viruses, hygiene and anti-septic measures promoting the general health. According to Razi (865–925 CE), individual who stay physically active and regularly exercise are less prone to epidemic diseases (Razi, 2008). It is said that patients with poor constitution and those suffering from underlying diseases are more vulnerable during epidemics (Sina, 1878).

The suggested basic intervention is to avoid places where an outbreak is spread. If it is not avoidable, then a person should be advised to remain in a well-ventilated place, ideally far from the ground. Be aware when communicating with a patient that the air currents might not be guided from a patient to a healthy individual (Razi, 1991). It is always best to stop unnecessary physical exertion during epidemic (Razi, 2008 and Sina, 1878) and to remain at optimum temperature in adequately ventilated areas with, neither too cold nor too hot (Rushd, 1987).

7.1. Environmental Sanitization

Throughout epidemics, tremendous emphasis is put on purifying and sanitizing the environment, since it is the primary medium that promotes the spread of infections. Unani physicians used medicinal herbs prior to the age of chemical-based air purifiers as decoction or distillate for spray or as fumigants to keep the air free of contaminants. To keep the air clean, homes should be sprayed with distilled vinegar. It may be noted here that vinegar implies the one made from sugarcane (*Saccharum officinarum* L., Poaceae) in Unani texts, unless otherwise stated. On the body and curtains etc Arq-e-Gulab (*Rosa damascena* Herrm.) should be applied.

When the air smells bad, then sandal fumigation (*Santalum album* L.) and camphor is also recommended. Herbal fumigation such as Qust (*Saussurea costus* (Falc.) Lipsch.), kundur (*Boswellia serrata* Roxb. ex Colebr.), ood (*Paeonia emodi* Royle.) and Murr (*Commiphora myrrha* Nees Engl.) also advisable (Rushd, 1987). According to Zakariya Razi, some aromatic drugs can kill infectious agents and should be used as fumigants during epidemics. For example zanjabeel (*Zingiber officinale* Roscoe), sibr (*Aloe vera* L.), loban (*Styrax benzoides* W. G. Craib), zafran (*Crocus sativus* L.), aabnoos (*Diospyros ebenum* J. Koenig ex Retz.), amber (*Liquidambar acalycina* H. T. Chang), sandroos (*Hymenaea verrucosa* Gaertn.) mastagi (*Pistacia lentiscus* L.), izkhar (*Cymbopogon jwarancusa* (Jones) Schult.), abhal (*Juniperus communis* L.), olive gum, etc. (Razi, 2008).

7.2. Modifications in Diet

It is advisable to avoid high water content food such as meat, sweets and fruits with high water content during epidemics. When meat has to be taken, birds in mountains preferred over animal meat. Fishes should be avoided absolutely (Rushd, 1987). Probably since the zoonotic spread of infections was suspected, these restrictions were imposed and fish and animals living near the ground were more likely to get infected than those living at higher altitudes. It is also recommended to eat citrus and sour fruits, especially lemon, grapes, apples, etc. it is thought that Oxymel prepared with Arq-e-Gulab is provides effective protection during epidemics (Razi, 1991; Rushd, 1987). Both Over-consumption and under-consumption are considered unhealthy because they have adverse effects the constitution of the body. Staying thirsty was also considered to be dangerous (Sina, 1878).

7.3. Medicines for Health Protection

Unani scholars have prescribed certain drugs that can be used as during epidemics as medicines for health protection. For this purpose both single herbs and compound formulations have been prescribed. revand chini (*Rheum australe* D. Don), Imli (*Tamarindus indica* L.), gul-ebanafsha (*Viola odorata* L.), halela (*Terminalia chebula* Retz.), amaltas (*Cassia fistula* L.), turanjabeen (*Alhagi pseudalhagi* (M. Bieb.) Desv. ex B. Keller & Shap.), and aab-e-anar (*Punica granatum* L.) are said to have protective effects during epidemics. According to Ibn Rushd, such medications have a cleansing effect on body humors

(Rushd, 1987). Vinegar can also be taken orally, as part of diet or salad, etc. (Razi, 1991). Since the dose and dose pattern of these drugs is not defined in Unani medicine classical textbooks, we suggest that they can be used according to the Unani pharmacopeias guidelines (Anonymous, 2009).

Health protective measures need a special mention. Unani physicians were aware of the immunomodulatory effects of citrus fruits. Besides, other measures of health promotion during epidemics include having a wholesome diet, avoiding starvation, avoiding meat and fish, and staying hydrated (Razi, 2008; Sina, 1878). Certain drugs have also been prescribed as for the purpose of health promotion, such as revand chini (*Rheum australe* D. Don), gul-e-banafsha (*Viola odorata* L.), and halela (*Terminalia chebula* Retz.) (Rushd, 1987). Prophylactic gargling with a solution of sumaq (*Rhus coriaria* L., decoction), rub-e-toot (*Morus nigra* L.), rub-e-jauz (*Juglans regia* L.) and arqe-gulab (*Rosa damascena* Herrm.) before sleep may be advised (Razi, 1991)

8. Preventive Measures by Veterinary Approach

General measures of isolation, quarantine and distancing steps must be taken. There is highly likelihood of transmission through fomite, so caution should be taken in handling and disposing of the same. Health care workers, family members and caretakers of the patients should take appropriate precautions. Staying in well-ventilated area decrease the risk of catching the infection. For this reason, the patient should face away from healthy people while coughing, sneezing or talking, as the virus may also be excreted by mean of saliva (Razi, 1991). Since both animals and people can be affected by this zoonotic virus, it is recommended that people who are suspected or confirmed to be infected with SARS-CoV-2 should have limited contact with animals. Simple hygienic steps should always be followed when handling and caring for animals. This involve hand washing before and after being with or handling animals, food, epuipments as well as avoiding kissing, being licked by animals and sharing the food. Individual suspected or confirmed to be infected with SARS-CoV-2 should minimize close direct contact with animals, including farm animals, zoo animals, other captive animals and wildlife especially species that have been susceptible to SARSCoV-2 infection(OIE, 2020).

As good practice, acceptable and efficient bio-security measures should always be enforced when people are in contact with animals groups on farms, zoos and animal shelters. People infected with SARS-CoV-2 should avoid close contact with their animals as well as have another member in their household treatment. If their companion animals are to be looked after, they should maintain good hygiene practices and wear a face mask where possible. Animals belonging to owners infected with SARS-CoV-2 should be kept indoors in accordance with similar country or area lockdown recommendations for humans and contact with those animals should be avoided as much as possible.

Public Health and Veterinary Services should work together using a One Health approach to share information and carry out a risk assessment when a person who is infected with SARS-CoV-2 reports being in contact with their pet or other animals.

If a decision is made, as a result of a risk assessment, to test a companion animal which has had close contact with a owner infected with SARS-CoV-2, it is recommended that RT-PCR be used to test oral, nasal and fecal samples. Care should be taken to avoid contamination of specimens from the environment or by humans.

While there is a confusion about the sources of SARS-CoV-2 in line with advice offered by the WHO, as a general precaution should be applied when visiting markets that selling live and raw animals or animal products that involve daily hand washing after handling animals and animal products with soap and potable water after touching as well as avoiding touching eyes, nose or mouth, and avoiding contact with sick animals or contaminated animal products. Any contact with other animals present in the market (e.g stray cats and dogs, rodents, birds, bats) should be avoided. Precaution should be taken to avoid contact with animal waste or fluids on the soil or surfaces of shops and market facilities (OIE, 2020).

WHO's Standard guidlines for preventing the spread of infection amongst humans include frequent hand washing, elbow covering of the mouth and nose with the while coughing and sneezing and avoiding close contact with any person having symptoms of respiratory illness such as coughing and sneezing. Raw meat, milk or animal organs should be treated with care, as per general good food hygiene practices, to prevent possible cross-contamination with uncooked foods. Healthy livestock which is prepared and served in compliance with good hygiene and food safety principles remains safe to eat.

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