Kurdistan Journal of Applied Research (KJAR)
Print-ISSN: 2411-7684 | Electronic-ISSN: 2411-7706

Website: Kjar.spu.edu.iq | Email: kjar@spu.edu.iq

The Epidemiological Characteristics of Coronavirus Disease (COVID-19) in Halabja Province/Kurdistan –Iraq

Osama Hamid Shareef
Medical Laboratory Science Department
Halabja Technical College of Applied Sciences
Research Center
Sulaimani Polytechnic University
Halabja, Iraq
osama.shareef@spu.edu.iq

Othman Abdulrahman Mohammed
Medical Laboratory Science Department
Halabja Technical College of Applied Sciences
Research Center
Sulaimani Polytechnic University
Halabja, Iraq
othman.mohammed@spu.edu.iq

Dashty Aziz Ghafor
Department of Laboratories
General Directorate of Health in Halabja
Ministry of Health
Halabja, Iraq
dashtybalkhay@yahoo.com

Ari Shareef Ali
Department of Laboratories
General Directorate of Health in Halabja
Ministry of Health
Halabja, Iraq
ari.shareef@yahho.com

Hardi Rafat Baqi
Medical Laboratory Technology Department
Shaqlawa Technical College
Erbil Polytechnic University
Erbil, Iraq
hardi.baqi@epu.edu.iq

Ali Aziz Ali
Department of Laboratories
General Directorate of Health in Halabja
Ministry of Health
Halabja, Iraq
aliazizbanishary@gmail.com

Aryan Mahmood Faraj
Medical Laboratory Science Department
Halabja Technical College of Applied Sciences
Research Center
Sulaimani Polytechnic University
Halabja, Iraq
aryan.faraj@spu.edu.iq

Syamand Ahmed Qadir
Medical Laboratory Technique Department
Halabja Technical Institute
Research Center
Sulaimani Polytechnic University
Halabja, Iraq
syamand.qadir@spu.edu.iq

Ali Muhi Aldeen Omar Aljabary
Food Science and Quality Control Department
Halabja Technical College of Applied Sciences
Sulaimani Polytechnic University
Halabja, Iraq
ali.omar@spu.edu.iq

Article Info

Volume 6 – Issue 2– December 2021

DOI: 10.24017/science.2021.2.17

ABSTRACT

The new highly transmitted pathogenic viral infection started from Wuhan, China, at the end of 2019. The World Health Organization (WHO) publicized that it phylogenetically belongs to severe acute respiratory syndrome (SARS), introduced as COVID-19 pandemic disease. The first confirmed case in the Kurdistan Region of Iraq (KRG) was on

Article history:

Received 12/9/2021
Accepted 26/1/2022

Keywords:

COVID-19, Halabja, Male, Female, RT-PCR, Wafa Hospital.

March 01, 2020 and the first COVID-19 case in the Halabja province/KRG was recorded on March 27, 2020. This study was designed when the Wafa Hospital was constructed in the Halabja city and it is specified for patients who infected with corona disease. The data were collected from April 14 to the end of December 2020. Samples were obtained from nasopharyngeal using a sterilized swab according to the WHO guidelines, and then the real-time PCR (RT-PCR) machine was used for analysis. This study particularly represented the epidemiological characteristics of COVID-19 disease on population of Halabja province. During this study, 5183 cases were tested. Among these, 2796 (54%) cases were confirmed as positive result including all ages, males and females. Among 3116 male cases, high number of 1646 (60.1%) males had the disease, while less number of 1150 female cases infected with the disease. In addition, the most confirmed positive cases were among (30-39) and (40-49) year groups with 1521 and 1223 cases, respectively. The lowest positive cases were among over 80 years old and below 9 years old with 10 and 3 cases, respectively. Besides, the confirmed cases for other age groups for both sexes were a (50-59) year old was 397, a (60-69) year old was 205, and (70-79) was 77. Finally, the data showed that, the common confirmed cases were among groups 20-59 years old and the rare cases were under 9 and over 80 years. To recap our research observed that the viral infection in both genders was common in middle age between 20 to 59 years old. Besides this, the infection was rare in people were under 10 years and above 80 years old.

1. INTRODUCTION

Severe acute respiratory syndrome coronavirus-2 (SARS-COV-2) is a new type of virus belongs to the Coronaviridae family that affected the lower respiratory system and caused an infectious disease named COVID-19 [1], [2]. COVID-19 emerged in late December 2019. On January 30, 2020, WHO declared the virus as a public health emergency. Compared to other coronaviruses, COVID-19 is less deadly but far more transmissible [3]. Respiratory droplets and direct contact are the first modes of transmission from human to human [4], [5]. After an incubation period of 5 to 6 days, the most common symptoms are fever, dry cough, fatigue and headache [1], [6]. Before the invention of vaccines such as Moderna, Pfizer, Sinopharm and AstraZeneca, different methods were followed as a prevention way. For example, using supplements and supporting the immune system with different kinds of macronutrients such as carbohydrates, lipids, and proteins as well as the micronutrients including vitamins and minerals [7]. On of November 21, 2020, there was 57,274,018 confirmed cases of COVID-19 worldwide, resulting in 1,368,000 deaths [8].

Up to March 14, 2020, KRG as most of the countries and a neighboring of Iran, that had the third-highest number of COVID-19 deaths after China and Italy [9] with 14,991 cases [10]. KRG includes four major cities: Erbil, Sulaymaniyah, Duhok and Halabja. Halabja locates in 14 km far away from the Iranian border.

The first confirmed COVID-19 cases in KRG were in Sulaymaniyah province on March 01, 2020, including four travelers returning to KRG from Iran. On March 27, the first confirmed COVID-19 case was reported in Halabja. In response to this case, the KRG announced to lockdown and closed the borders and airports, ban on travel between cities, cancelling public events and Friday prayers, shopping centers, universities, schools, and bazaars. These restrictions resulted in decreasing the COVID-19 cases for a period. The situations were

caused new peak in the number of new cases and deaths because of raising the infected and death cases. By the November 24, 2020, 94,421 cases have been confirmed, resulting in 3,036 deaths in KRG [11].

The main signs of this disease are evaluated by clinical examination include blood pressure, lung sounds, and heart rate. For the symptoms are experienced by patients with mild COVID-19 might be cough, high temperature, sore throat, diarrhea, muscle or joint pain, fatigue, headache, and loss of sense of smell and taste. Symptoms of COVID-19 are pneumonia include confusion, pain or pressure in the chest, breathlessness, loss of appetite, and high temperature (above 38 °C) [12], [13]. The most crucial action of KRG, Ministry of Health, to deal with the COVID-19 was opening a new molecular laboratory in Halabja city on April 13, 2020 to detect this virus from the infected people. The COVID-19 patients were identified based on their real-time reverse transcription-polymerase chain reaction (RT-PCR) test from nasopharyngeal swab samples. This study aimed to summarize and analyze the epidemiological characteristics of the COVID-19 disease in Halabja province, including age and gender, on a relatively large sample size from April to December 2020 to provide reliable information for the prevention and control of this pandemic disease.

2. METHODS AND MATERIALS

2.1. Study Design

In early January 2020, a real-time RT-PCR diagnostic test was proposed for COVID-19 [14], [15]. In early April 2020, the samples were also tested by a real-time PCR laboratory/ Halabja city- KRG. All diagnosed cases of COVID-19 were analyzed in there, starting from early April 2020 to the end of December 2020. This study did not require informing the patient individually because all data were handled as a de-identified set to protect patient confidentiality and privacy.

2.2. Isolation and management cases

By collaboration of both Ministries of Interior and the Ministry of Health of the KRG, a protocol for quarantine, isolation and managing the cases was planned. In the Halabja city, the Wafa Hospital was then constructed and it had 50 beds that were prepared for COVID-19 cases.

2.3. Data source and study duration

The data used in this study were collected in the Central Laboratory, Department of Molecular, General Hospital of Halabja city, KRG. Also, they were available in the coronavirus/dashboard system of the KRG website [16]. The data were collected for nine months since from the first reported case of COVID-19 in Halabja on April 14, 2020, until December 31, 2020. All case records contained name, gender, age and test result. All cases were recorded with no duplications. The COVID-19 cases were collected from the molecular laboratory record unit as a single dataset. All personal information and identification were hidden.

2.4. Laboratory methods and testing

The oropharyngeal and nasopharyngeal samples were collected from suspected patients with COVID-19 and required information by a paramedic's trained team for sample collecting at the Wafa Hospital of the Halabja city. They were collected from the suspected patients with COVID-19 to test by an RT-PCR following WHO guidelines [17].

2.5. Quantitative real-time RT-PCR

This was the most common method which used for the detection of COVID-19. This had rapid detection and high sensitivity. To detect COVID-19, many companies and scientific teams have been successively proposed and developed methods in the last few year [18], [19]. The reagents used were RTA viral RNA isolation kit, High Pure Viral RNA Kit, Roche, add a bio, BIOBASE (automated), QIAamp (QIAGEN automated and manual), KOGENE BIOTECH, EliGene, for nucleic acid extraction and GENESIS primer design Kit, DAAN GENE kit, EliGene kit and powerChek™ kit, KOGEN BIOTECH, LightCycler® Multiplex RNA Virus Master, Roche, STAT-NAT COVID-19 MULTI, MutaPLEX for Coronavirus detection.

2.6. Statistical Analysis

Completely Randomized Design (CRD) within the factorial experiment (two factors) was performed. The data were offered to the analysis of variance using XLSTAT software. Means comparisons were conducted following the Duncan's Multiple Range test at 0.05.

3. RESULTS

3.1. Epidemiology

Total number of 5183 suspected cases of COVID-19 was tested in Halabja province. More than half of these cases were positive (n=2796, 54%), while the negative cases were (n=2387, 46%). These data were collected from April 14, 2020, until December 31 2020. The majority of the participants were male (n=3116, 60.1%). Among these male cases, 1646 cases had the COVID-19 (Figure 1). Less female cases were recorded in this region than males (n=2067, 39.9%) and only 1150 female participants had the COVID-19.

The distribution of the confirmed cases is shown in figure 2. The age groups were divided into ten subgroups, starting with (0-9) to (90-99) years old, respectively. Each sub-group of age shows the mean for both male and female in both positive and negative cases, separately. The most prominent age groups reported among the cases were between: (30-39) and (40-49) years old with (n=1521) and (n=1223), respectively.

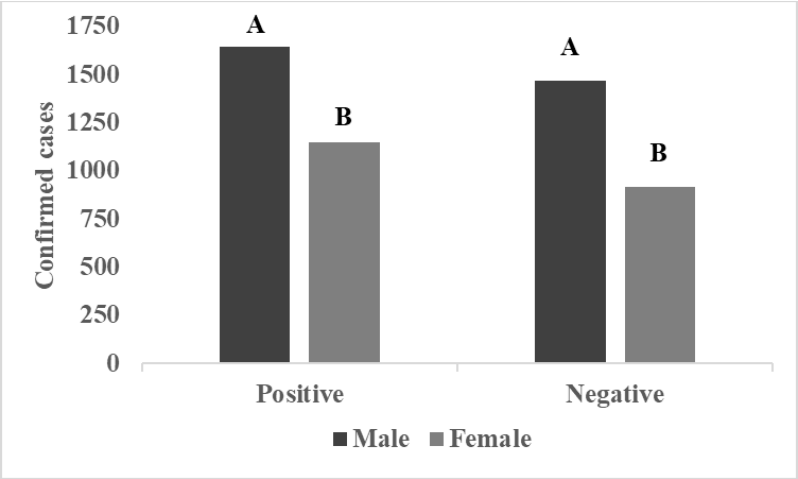
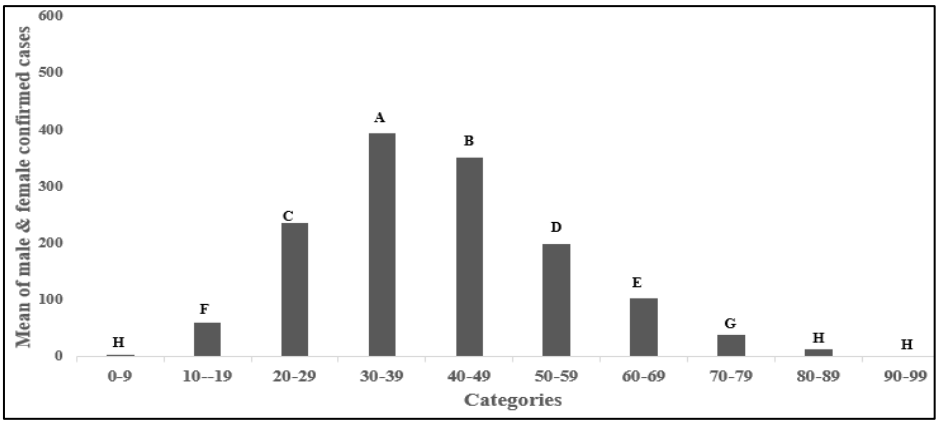


Figure 1: Confirmed COVID-19 cases in the Halabja province by gender. Fisher (LSD)/ Analysis of the differences between groups with a confidence range of 95.00 % were used.

A- Test of positivity by age groups



B- Test of negativity by age groups

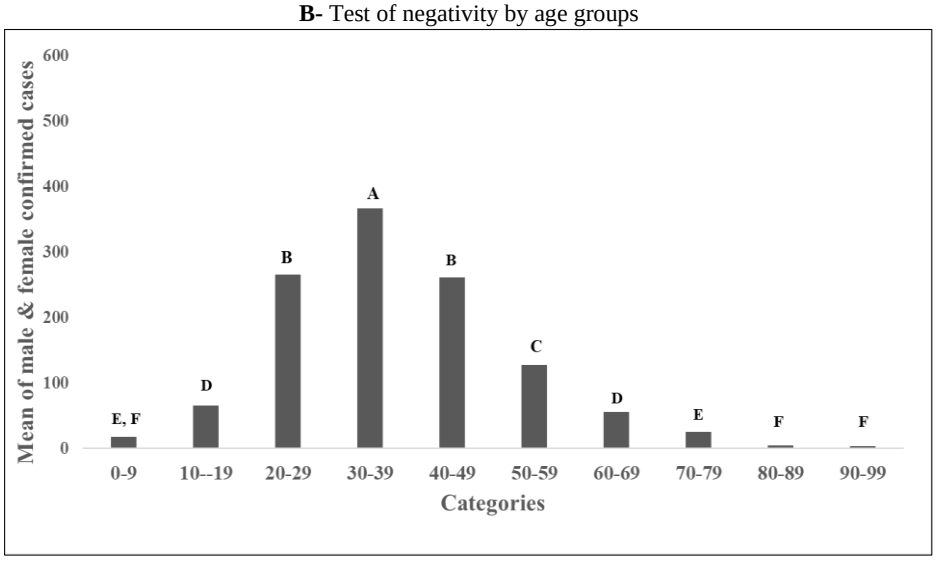


Figure 2: Age distribution with confirmed COVID-19 by mean of both male/female in Halabja province. Fisher (LSD)/ Analysis of the differences between groups with a confidence range of 95.00 % were used.

3.2. The rate of infection according to age subgroups

The positive and negative cases for subgroup ages of both genders were clarified in Table 1. The positive confirmed case for adults included group ages of (20-29), (30-39) and (40-49) years with (n=472), (n=788) and (n=701) represented both male and female, respectively. This was compared to people with the same age groups who had no the COVID-19 disease with (n=531), (n=733) and (n=522), respectively. In addition, positive confirmed cases for both genders in infants, children, and teenagers were age groups (0-9) and (10-19) years old with (n=7) and (n=119), respectively. In contrast, those who had the same age groups were reported as negative confirmed for COVID-19 with (n=36) and (n=132), respectively. In addition, the positive cases of older ages were (50-59), (60-69), (70-79), (80-89) and (90-99) years old with (n=397), (n=205), (n=77), (n=27) and (n=3), respectively. However, for the same ages groups negative cases were reported with (n=652), (n=317), (n=127), (n=36) and (n=10), respectively.

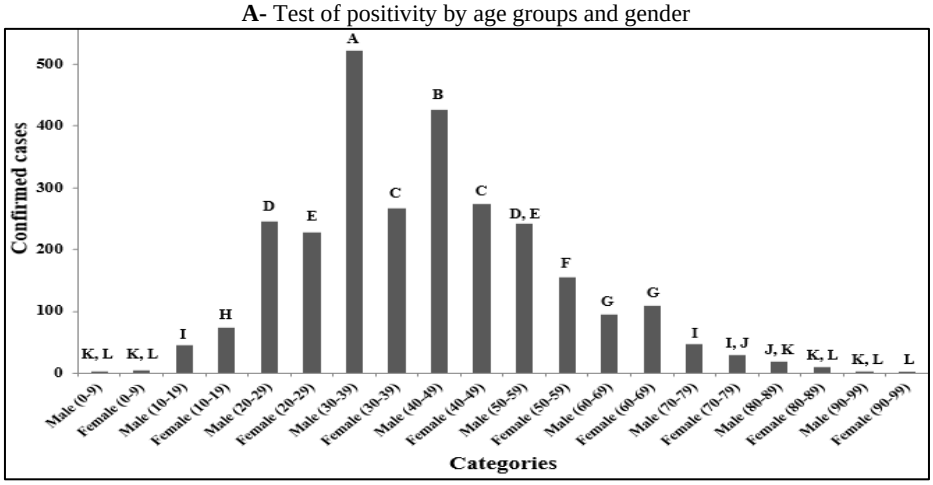
Table 1: COVID-19 cases based on age subgroups in Halabja province.

Age subgroups	Result		
	Positive	**Negative**	**Total**

		(n)	(n)	
Age	0-9	7	36	43
	10--19	119	132	251
	20-29	472	531	1003
	30-39	788	733	1521
	40-49	701	522	1223
	50-59	397	255	652
	60-69	205	112	317
	70-79	77	50	127
	80-89	27	9	36
	90-99	3	7	10
	Total			5183

The COVID-19 was commonly found in 20-59 years of age in both sexes, whereas positive cases in over 80 and below 9 years old were relatively rare. The highest number of infections by the virus was found in male group aged 30-39 (n=522, confirmed positive cases) (Figure 3, A). The rate of this age group was significantly different from the other age groups. The followings had different rate of infection to the virus compared to the first age group, male age group 40-49 (n=427, confirmed positive cases), and female age groups 40-49 (n=274, confirmed positive cases) and 30-39 (n=266), respectively. The rest of the participated age groups were less infected with the disease. For instance, a few numbers of the infectious cases were recorded in male 0-9 (n=3), female 0-9 (n=4), male 80-89 (n=18) and female 80-89 (n=9). A similar pattern was noticed among age groups in both genders for the confirmed negative cases (Figure 3, B). However, there were some exceptions. For example, a significant number of the participants were negative for the virus that belonged to age group male 20-29 (n=315, confirmed negative cases).

A- Test of positivity by age groups and gender



B- Test of negativity by age groups and gender

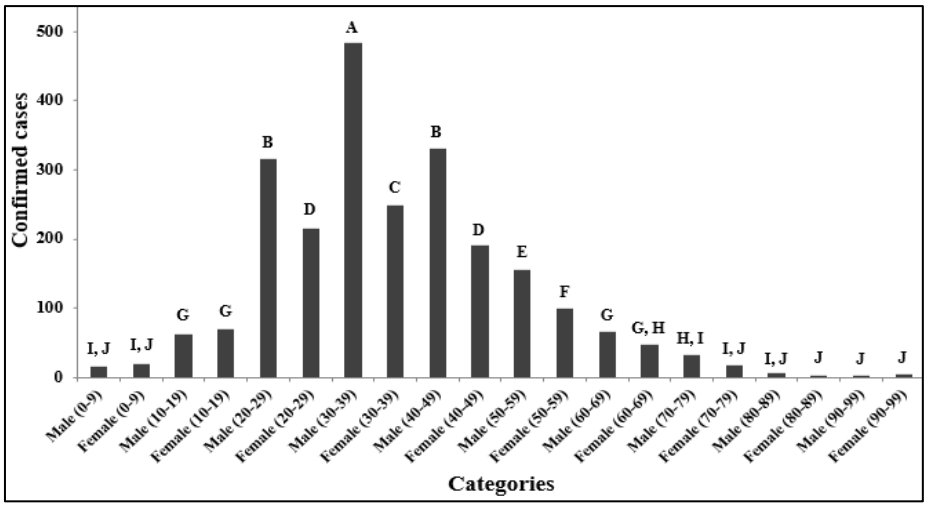


Figure 3: Confirmed COVID-19 cases in the Halabja province by age groups and gender. Fisher (LSD)/ Analysis of the differences between groups with a confidence range of 95.00 % were used.

4. DISCUSSION

By observing the results of the current study, it can be seen that more than half of the tested samples were resulted positive for the virus. This higher percentage of positive rate shows cases two possibilities: either the actual infection rates were too high in the population, or the number of tests was too low compared with the population living in the city. However, the higher percentage of positive rate also indicated higher transmission rates of the virus among the population. Yet, by studying the KRG's dedicated website for the COVID-19, the second hypothesis seems to be more accurate in Halabja's case [20], [21]. Many factors contributed to the lower testing levels at the beginning of the pandemic, including insufficient resources and the social stigmatization that came with the pandemic as patients with symptoms avoided admission to the hospitals or testing centers to keep away from the social impacts accompanied with the COVID-19 patients. It was well-known that COVID-19 created an unprecedented situation around the globe that led the public in many countries to mistrust the scientific facts and stigmatize the COVID-19 infection [22], [23]. According to this study results, the majority of the infected patients were male. In the local community of Halabja city, it is evidence that males have more outdoor activities and social lives than females. That is due to many social norms of Kurdish society. So, males are more exposed to the virus than females. Though, the females also had a high level of infection. This difference in infection rate was also reflected in the mortality rate per gender in the infected patients. A review article by Lakbar *et. al* shows that the infection severity and mortality rates of the males are higher than their female's counterparts [24]. The data is broken down according to the different age groups to compare the groups' susceptibility and indicate the highest risk group to infect COVID-19. Accordingly, people in their (31-39) for both genders are the most that face the risk of infection. The (21-29) and (41-49) age groups came at the second higher group of patients. According to Monod *et al*., young people in their early 21-29 years old up to late forties face the highest transmission rates in COVID-19 and, therefore, sustain resurging COVID-19 among themselves [25]. However, the favorable rates among young children and elderly patients were relatively low. The reason might be related to the small sample numbers for these two groups. Although the rates of infection in children are low, it can infect children, although the severity of the infection was not the same as the adults. It was milder and sometimes asymptomatic [26]. The result of this study shows the epidemiology of COVID-19 in Halabja province. However, the study and the methods employed have limitations, including the lack of the severity of infection and the mortality rate in the subjects. The study was merely based on the positive and negative test results of

the patients who had signs and symptoms. So, many positive cases might have been missed especially those who were asymptomatic or had mild symptoms. Regarding the molecular testing, there might have also been some false negative test results due to improper sampling techniques or the accuracy of the test kits used for the diagnosis. Regardless of the limitations, the results of the study present the COVID-19 profile in Halabja province in a clear and scientific way that can be used to interpret the epidemiology of the pandemic disease in the targeted region.

5. CONCLUSION

Current research observed that the viral infection in both genders was common in middle age between 20 to 59 years old. Besides this, the infection was rare in people were under 10 years and above 80 years old. The viral infection in all various ages was higher in the male of Halabja province. This may be due to social contact, outdoor working, and the number of men workers is much higher than women in healthcare organizations. These factors might have cause spreading and raising the number of this infection. In addition, people in middle age have more social contacts, outdoor task performance, and outgoing. Moreover, a low infection rate in elderly people was observed. This may be related to more care to them from care providers as a result of their outdoor missions and task performance inability. However, the children and teenagers in the city normally go out of home and make social contact, but the infection in adolescents especially the children under 10 years old was in a low rate. This may return to the KRG stopped all educational activities in all sectors and the infection among children was not symptomatic.

REFERENCE

[1] S. P. Adhikari, S. Meng, Y. J. Wu, Y. P. Mao, R. X. Ye, Q. Z. Wang, C. Sun, S. Sylvia, S. Rozelle, H. Raat, and H. Zhou, "Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review," *Infect Dis Poverty*, vol. 9, no. 1, p. 29, Mar 17 2020, doi: 10.1186/s40249-020-00646-x.

[2] C. Giesen, L. Diez-Izquierdo, C. M. Saa-Requejo, I. Lopez-Carrillo, C. A. Lopez-Vilela, A. Seco-Martinez, M. T. R. Prieto, E. Malmierca, C. Garcia-Fernandez, C. E. Surveillance, and G. Control Study, "Epidemiological characteristics of the COVID-19 outbreak in a secondary hospital in Spain," *Am J Infect Control*, vol. 49, no. 2, pp. 143-150, Feb 2021, doi: 10.1016/j.ajic.2020.07.014.

[3] E. Petersen, M. Koopmans, U. Go, D. H. Hamer, N. Petrosillo, F. Castelli, M. Storgaard, S. Al Khalili, and L. Simonsen, "Comparing SARS-CoV-2 with SARS-CoV and influenza pandemics," (in eng), *Lancet Infect Dis*, vol. 20, no. 9, pp. e238-e244, Sep 2020, doi: 10.1016/s1473-3099(20)30484-9.

[4] W. M. de Souza, L. F. Buss, D. D. S. Candido, J. P. Carrera, S. Li, A. E. Zarebski, R. H. M. Pereira, C. A. Prete, Jr., A. A. de Souza-Santos, K. V. Parag, M. Belotti, M. F. Vincenti-Gonzalez, J. Messina, F. C. da Silva Sales, P. D. S. Andrade, V. H. Nascimento, F. Ghilardi, L. Abade, B. Gutierrez, M. U. G. Kraemer, C. K. V. Braga, R. S. Aguiar, N. Alexander, P. Mayaud, O. J. Brady, I. Marcilio, N. Gouveia, G. Li, A. Tami, S. B. de Oliveira, V. B. G. Porto, F. Ganem, W. A. F. de Almeida, F. Fantinato, E. M. Macário, W. K. de Oliveira, M. L. Nogueira, O. G. Pybus, C. H. Wu, J. Croda, E. C. Sabino, and N. R. Faria, "Epidemiological and clinical characteristics of the COVID-19 epidemic in Brazil," (in eng), *Nat Hum Behav*, vol. 4, no. 8, pp. 856-865, Aug 2020, doi: 10.1038/s41562-020-0928-4.

[5] C. Huang, Y. Wang, X. Li, L. Ren, J. Zhao, Y. Hu, L. Zhang, G. Fan, J. Xu, X. Gu, Z. Cheng, T. Yu, J. Xia, Y. Wei, W. Wu, X. Xie, W. Yin, H. Li, M. Liu, Y. Xiao, H. Gao, L. Guo, J. Xie, G. Wang, R. Jiang, Z. Gao, Q. Jin, J. Wang, and B. Cao, "Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China," (in eng), *Lancet*, vol. 395, no. 10223, pp. 497-506, Feb 15 2020, doi: 10.1016/s0140-6736(20)30183-5.

[6] H. A. Rothan and S. N. Byrareddy, "The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak," (in eng), *J Autoimmun*, vol. 109, p. 102433, May 2020, doi: 10.1016/j.jaut.2020.102433.

[7] H. A. M. Farag, H. R. Baqi, Y. T. Hussein, O. H. Shareef, S. A. Qadir, A. E. Afifi, and A. H. E. Bilbeisi, "The Role of Nutrients in Supporting The Immune System Against Viral Infection; Newly Emerged Coronavirus (COVID19): A Narrative Review," *Kurdistan Journal of Applied Research*, no. Special Issue on Coronavirus (COVID-19), 2020, doi: 10.24017/covid.10.

[8] WHO. WHO Coronavirus Disease (COVID-19) Dashboard. https://covid19.who.int/ (accessed 21 november, 2020).

[9] B. Jamshidi, M. Rezaei, F. Najafi, and A. Sheikhi, "The Prediction of Covid-19 Spread in Iran From 15 March to 15 April 2020," *International journal of the Iranian Red Crescent Society*, vol. 22, 05/09 2020, doi: 10.5812/ircmj.102822.

[10] M. K. Al-Malkey and M. A. Al-Sammak, "Incidence of the COVID-19 in Iraq - Implications for travellers," (in eng), *Travel Med Infect Dis*, vol. 38, pp. 101739-101739, Nov-Dec 2020, doi: 10.1016/j.tmaid.2020.101739.
[11] KRG. Kurdistan Regional Government Dashboard COVID-19 https://gov.krd/coronavirus-en/dashboard/. (accessed 27 May, 2020).
[12] T. Struyf, J. J. Deeks, J. Dinnes, Y. Takwoingi, C. Davenport, M. M. Leeflang, R. Spijker, L. Hooft, D. Emperador, S. Dittrich, J. Domen, S. R. A. Horn, and A. Van den Bruel, "Signs and symptoms to determine if a patient presenting in primary care or hospital outpatient settings has COVID-19 disease," (in eng), *The Cochrane database of systematic reviews*, vol. 7, no. 7, p. Cd013665, Jul 7 2020, doi: 10.1002/14651858.cd013665.
[13] A. Çalıca Utku, G. Budak, O. Karabay, E. Güçlü, H. D. Okan, and A. Vatan, "Main symptoms in patients presenting in the COVID-19 period," (in eng), *Scottish medical journal*, vol. 65, no. 4, pp. 127-132, Nov 2020, doi: 10.1177/0036933020949253.
[14] A. A. Hama, O. A. Mohammed, F. M. Ali, O. H. Shareef, S. M. Wli, S. Sharif, and S. A. Qadir, "The Molecular Diagnosis Protocols of New Coronavirus (COVID-19); Specificity and Sensitivity an Overview," *Kurdistan Journal of Applied Research*, no. Special issue, 2020, doi: 10.24017/kjar.
[15] P. Zhou, X. L. Yang, X. G. Wang, B. Hu, L. Zhang, W. Zhang, H. R. Si, Y. Zhu, B. Li, C. L. Huang, H. D. Chen, J. Chen, Y. Luo, H. Guo, R. D. Jiang, M. Q. Liu, Y. Chen, X. R. Shen, X. Wang, X. S. Zheng, K. Zhao, Q. J. Chen, F. Deng, L. L. Liu, B. Yan, F. X. Zhan, Y. Y. Wang, G. F. Xiao, and Z. L. Shi, "A pneumonia outbreak associated with a new coronavirus of probable bat origin," (in eng), *Nature*, vol. 579, no. 7798, pp. 270-273, Mar 2020, doi: 10.1038/s41586-020-2012-7.
[16] KRG. Kurdistan Regional Government COVID-19 Dashboard. https://gov.krd/coronavirus-en/dashboard/. (accessed 22 April, 2021).
[17] WHO. "Laboratory testing strategy recommendations for COVID-19." Interim guidance. https://apps.who.int/iris/handle/10665/331509 (accessed 22 April, 2020).
[18] K. K. To, O. T. Tsang, C. C. Yip, K. H. Chan, T. C. Wu, J. M. Chan, W. S. Leung, T. S. Chik, C. Y. Choi, D. H. Kandamby, D. C. Lung, A. R. Tam, R. W. Poon, A. Y. Fung, I. F. Hung, V. C. Cheng, J. F. Chan, and K. Y. Yuen, "Consistent Detection of 2019 Novel Coronavirus in Saliva," (in eng), *Clin Infect Dis*, vol. 71, no. 15, pp. 841-843, Jul 28 2020, doi: 10.1093/cid/ciaa149.
[19] D. K. W. Chu, Y. Pan, S. M. S. Cheng, K. P. Y. Hui, P. Krishnan, Y. Liu, D. Y. M. Ng, C. K. C. Wan, P. Yang, Q. Wang, M. Peiris, and L. L. M. Poon, "Molecular Diagnosis of a Novel Coronavirus (2019-nCoV) Causing an Outbreak of Pneumonia," (in eng), *Clin Chem*, vol. 66, no. 4, pp. 549-555, Apr 1 2020, doi: 10.1093/clinchem/hvaa029.
[20] KRG. Kurdistan Regional Government Dashboard COVID-19. https://gov.krd/coronavirus-en/dashboard/ (accessed 16 May, 2020).
[21] KRG. Kurdistan Regional Government Dashboard COVID-19. https://gov.krd/coronavirus-en/dashboard/ (accessed 16 May, 2021).
[22] S. Bagcchi, "Stigma during the COVID-19 pandemic," *The Lancet*, vol. 20, no. 7, p. P782, July 01, 2020 2020, doi: https://doi.org/10.1016/S1473-3099(20)30498-9.
[23] P. Bhattacharya, D. Banerjee, and T. S. Rao, "The "Untold" Side of COVID-19: Social Stigma and Its Consequences in India," *Indian Journal of Psychological Medicine*, vol. 42, no. 4, pp. 382-386, 2020, doi: 10.1177/0253717620935578.
[24] I. Lakbar, D. Luque-Paz, J. L. Mege, S. Einav, and M. Leone, "COVID-19 gender susceptibility and outcomes: A systematic review," (in eng), *PLoS One*, vol. 15, no. 11, p. e0241827, 2020, doi: 10.1371/journal.pone.0241827.
[25] M. Monod, A. Blenkinsop, X. Xi, D. Hebert, S. Bershan, S. Tietze, M. Baguelin, V. C. Bradley, Y. Chen, H. Coupland, S. Filippi, J. Ish-Horowicz, M. McManus, T. Mellan, A. Gandy, M. Hutchinson, H. J. T. Unwin, S. L. van Elsland, M. A. C. Vollmer, S. Weber, H. Zhu, A. Bezancon, N. M. Ferguson, S. Mishra, S. Flaxman, S. Bhatt, and O. Ratmann, "Age groups that sustain resurging COVID-19 epidemics in the United States," (in eng), *Science*, vol. 371, no. 6536, Mar 26 2021, doi: 10.1126/science.abe8372.
[26] I. M. Ciuca, "COVID-19 in Children: An Ample Review," (in eng), *Risk Manag Healthc Policy*, vol. 13, pp. 661-669, 2020, doi: 10.2147/rmhp.S257180.