

Clinicoepidemiological condition of COVID-19 patients: A single center study

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Abstract

Background: Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is one of the viruses that was first identified in Wuhan city, Hubei province, China, and is responsible for this pandemic.

Aim of the study: To describe the epidemioclinical of COVID-19 in certain areas in Baghdad Province – Iraq.

Materials and Methods: This cross-sectional retrospective study was conducted in the COVID-19 Ward where a record of 357 samples records COVID-19 patients chose conveniently admitted to Al-Kindy Teaching Hospital during the period, First of January 2020 to the first of January 2021 were searched. The checklist questionnaire was used.

Results: The mean age of the studied subject was 53.24 ± 14.45 . Regarding sex distribution, 62.2% of patients were males and the rest were females. The main chief complaint was that 78.7% of patients had shortness of breath, 26.9% had a fever and 19.9% had a cough. 56.1% of patients aged 60 or more got a critical disease which is significantly higher than the rate of the critical condition among the 40-59 years age group (32.5%) and those aged less than 40 years (19.4%), $P\text{-value}=0.001$.

Conclusions: This study demonstrated that COVID-19 affects mostly male patients than females at ages more than forty years. The main complaint was shortness of breath that needs hospital admission, treatment with antibiotics, steroids, and oxygen therapy ending with a high fatality rate.

Keywords: COVID-19; epidemiology; Iraq.

Introduction

The world had many epidemics and pandemics throughout past years that have affected millions of populations in different countries. Despite the development in different branches of medicine and researches, scientists still face challenges with new microorganisms like virus or bacteria that threaten and endanger human lives, economic, and health. Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is one of the viruses that was first identified in Wuhan city, Hubei province, China, and is responsible for this pandemic (1). World Health

Organization (WHO) declared Health emergency all over the world in January 30, and a pandemic on March 11, 2020 (2).

SARS-CoV-2 is the seventh corona virus that infects humans due to cross-species infections between human and animals (3). It is believed to be a zoonotic disease transmitted from bats that were first known to be important host for corona virus and spread through direct contact with respiratory droplets of infected person (4). Thus, Health care workers like doctors and dentists and family members of the patients are at higher risk group for infection

(5). Preventing transmission of this infection is important for reducing morbidity, mortality, and secondary transmission to healthy people from infected population and people with no symptoms through wearing masks, gloves and face shield (6). Corona virus is an envelope, positive-sense single-stranded RNA viruses causing respiratory tract infection, enteric, hepatic, and neurologic diseases and divided into subfamilies (α , β , γ , and δ) which human COVID-19 caused by α , and β (7). The virus is mainly transmitted via contact with respiratory droplets and replication of the virus occur in mucosal cells of the upper respiratory tract of the nasal cavity and pharynx then lower respiratory and gastrointestinal tract leading to viremia through binding to ACE2 receptors(8). Patients with good immunity could control the infection and remain asymptomatic while others with low immunity get pneumonia, liver, heart, testicular infection and renal failure (9).

The lung of COVID-19 demonstrated bilateral diffuse damage to alveoli with multiple cellular fibromyxoid exudates, lymphocytes, mononuclear cells, edema, multinucleated syncytial cells, hyaline membrane formation, and atypical enlarged pneumocytes indicating viral cytopathic lesion which is known as acute respiratory distress syndrome (ARDS). This infection leads to production of large amount of pro-inflammatory cytokines and chemokines like IL-6, IL-10, IL-2 and IL-17 with lymphopenia, neutrophilia, and exhausted T cells were found in the peripheral blood and lungs leading to cytokine storm (10, 11). Early diagnosis of the disease is very important using reverse transcriptase-polymerase chain reaction (RT-PCR) and next generation sequencing (NGS) (12). Potential therapy of this disease is symptomatic treatment, and no specific antiviral drug is available. Many trails of using drugs like Chloroquine, Ribavirin, Lopinavir/ritonavir, Remdesivir, Nelfinavir, convalescent plasma, Interferon (IFN), and monoclonal antibody (13).

So the aim of this study is to describe the epidemioclinical of COVID-19 in certain area in Baghdad Province – Iraq.

Patients and methods

Study design and period

This is a cross-sectional retrospective study was conducted in the COVID-19 Ward where a records of COVID-19 patients admitted to Al-kindy Teaching Hospital during the period, First of January 2020 to the first of January 2021 were searched.

Samples

The study included 357 sample records chosen conveniently during the above period. The inclusion criteria were all patients infected with COVID-19 and diagnosed positive tests with polymerase chain reaction (PCR) or lung computerized tomography (CT scan) while the exclusion criteria were all patients infected with other diseases.

Questionnaire Check list

The checklist included age (from 20 - 90years old) sex (male, female), clinical presentation like fever (body temperature of 38c or more) , shortness of breath (frightening sensation of being unable to breath normally or feeling suffocated), cough(a rapid expulsion of air from lungs typically in order to clear the lung airways of fluid, mucus, or other materials), severity of disease as critical (Table -1-) (patient with oxygen saturation below 94% or develop complications like respiratory failure or septic shock) and not critical, treatment type (Oxygen therapy, continuous positive airway pressure (CPAP), respiratory care unit (RCU) admission and drug therapy like antibiotics like (macrolides, cephalosporins or else) steroids like (dexamethasone, hydrocortisone) and antiviral drugs (remdesivir, oseltamivir) (14). Patient complications were also registered and the outcome of the patient was divided into two categories (discharged or dead).

Table-1- The clinical classification of severity (15).

	Clinical manifestation
1-	Mild: only mild symptoms, imaging shows no pneumonia
2-	Moderate: fever, respiratory tract symptoms, and imaging shows pneumonia
3-	Severe: meet any of the following signs:

	(a) Respiratory distress, respiratory rate 30 beats / min
	(b) In the resting state, finger oxygen saturation 93%,
4-	Critical, one of the following conditions:
	(a) Respiratory failure occurs and requires mechanical ventilation
	(b) Shock occurs
	(c) ICU admission is required for combined organ failure

Ethical Approval

The agreement of health authority in Al-kindy Teaching Hospital was done and the research proposal was discussed and approved by the Ethical and Scientific Committee in Al-kindy College of Medicine.

Statistical analysis

The data were analyzed using SPSS-version-26. Descriptive statistics including frequencies, percentages, Independent-Sample Chi-Square Test, were used between related categorical variables. P-value less than 0.05 were considered statically significant.

Results

The result of this cross sectional study showed that 357 COVID-19 patient was included. The mean age of studied subject was 53.24 ± 14.45 . About 17.4% of patients aged less than 40 years, 45.7% aged 40-59 years and 37% aged 60 years or more. Regarding sex distribution, 62.2% of patients were males and the rest were females. The main chief complaint was 78.7% of patient had shortness of breath, 26.9% had fever and 19.9% had cough. The drug used in the management were 97.5% received antibiotics, 58% steroids and 41.5% treated with antiviral drugs. The patients who need oxygen therapy were 96.1% while 36.4% need CPAP, and 26.9% admitted to RCU. About 32.8% of patients developed complications and 38.9% got critical status and 30.6% of them were died as demonstrated in table -2- .

Table- 2- Distribution of study variables			
		N o.	percentage %
Age	Mean±SD (53.24±14.45) years		
	<40 year	62	17.4%
	40-59 year	163	45.7%
	=>60 year	132	37.0%
Gender	Male	222	62.2%
	Female	135	37.8%
Shortness of breath	Yes	281	78.7%
	No	76	21.3%
Fever	Yes	96	26.9%
	No	261	73.1%
Cough	Yes	71	19.9%
	No	286	80.1%
Antibiotics	Yes	348	97.5%
	No	9	2.5%
Steroid	Yes	207	58.0%
	No	150	42.0%
Antiviral drug	Yes	148	41.5%
	No	209	58.5%
Oxygen therapy	Yes	343	96.1%
	No	14	3.9%
CPAP	Yes	130	36.4%
	No	227	63.6%
RCU admission	Yes	96	26.9%
	No	261	73.1%
Complication	Yes	117	32.8%
	No	240	67.2%
Severity	critical	139	38.9%
	not critical	218	61.1%
Outcome	dead	110	30.6%
	discharge	247	69.1%

Regarding table -3- demonstrated that 56.1% of patients aged 60 or more got critical disease which is significantly higher than the rate of critical condition among 40-59years age group (32.5%) and those age less than 40 years (19.4%), P -value=0.001. There was no significant association between sex of the patients and severity of the disease, (P -value=0.748). About 44.5% of patient who presented with shortness of breath developed critical condition which is significantly higher than the rate of critical condition among those who had no shortness of breath at presentation(18.4%),(P -value=0.001). There was no significant association between fever as a chief complain and severity of COVID-10 (p value=0.071). The rate of critical condition among those presented with cough (22.5%) was found to be significantly lower than those who had no cough(43%), (p value=0.002). There is no significant association between using antibiotics, steroids, anti viral drugs and O2 and severity of COVID-19 (P -value>0.05) in all condition. About 98.5% of patients who need CPAP developed a critical condition which is significantly higher than those who did not had (4.8%), (p value=0.001). Patient who admitted to RCU because of critical condition was 99% while 16.9% among those who did not admitted to RCU. About 83.8% of patient with complications developed critical condition which is significantly higher than those who did not had complications (17.1%)(p value=0.001).

Table -3 -Association between studied variables and severity of COVID19

		severity				P- val ue
		Critical		Not critical		
		N o.	Percent age %	N o.	Percent age %	
Age	<40 year	12	19.4%	50	80.6%	0.0 01
	40- 59 year	53	32.5%	11 0	67.5%	
	=>60 year	74	56.1%	58	43.9%	
Gender	Male	85	38.3%	13 7	61.7%	0.7 48

	Female	54	40.0%	81	60.0%	
Shortness of breath	Yes	125	44.5%	156	55.5%	0.001
	No	14	18.4%	62	81.6%	
Fever	Yes	30	31.3%	66	68.8%	0.071
	No	109	41.8%	152	58.2%	
Cough	Yes	16	22.5%	55	77.5%	0.002
	No	123	43.0%	163	57.0%	
Antibiotics	Yes	138	39.7%	210	60.3%	0.082
	No	1	11.1%	8	88.9%	
Steroid	Yes	76	36.7%	131	63.3%	0.312
	No	63	42.0%	87	58.0%	
Antivirals	Yes	65	43.9%	83	56.1%	0.104
	No	74	35.4%	135	64.6%	
Oxygen therapy	Yes	137	39.9%	206	60.1%	0.054
	No	2	14.3%	12	85.7%	
CPAP	Yes	128	98.5%	2	1.5%	0.001
	No	11	4.8%	216	95.2%	
RCU admission	Yes	95	99.0%	1	1.0%	0.001
	No	44	16.9%	217	83.1%	
Complication	Yes	98	83.8%	19	16.2%	0.001
	No	41	17.1%	199	82.9%	

Regarding Table-4- illustrated that death rate among old age patients (60 years or more) was found to be significantly higher than those of middle age(40-59 years) and younger age group(less than 40 years) 39.4% , 28.8% and 17.7% respectively , P - value=0.007. There was no significant association between gender and death rate. Fever was not associated with

higher death rate, P-value=0.505. Patient presented with cough were associated with significant death rate, p value=0.002. Patient who presented with shortness of breath were found to be significantly associated with higher death rate, p value=0.008. Patient who received

steroids as part of treatment or those who need CPAP or admitted to the RCU or those who developed complications and those of critical severity were found to be significantly associated with higher death rate, P-value <0.05 in all conditions.

Table- 4- Association between studied variables and outcome of COVID-19

		Total	Discharge		Dead		P- value
			NO.	%	NO.	%	
Age	<40 year	62	51	82.3%	11	17.7%	0.007
	40-59 year	163	116	71.2%	47	28.8%	
	=>60 year	132	80	60.6%	52	39.4%	
Gender	Male	222	152	68%	70	32%	0.706
	Female	135	95	70%	40	30%	
Fever	Yes	96	69	72%	27	28%	0.505
	No	261	178	68%	83	32%	
Cough	Yes	71	60	85%	11	16%	0.002
	No	286	187	65%	99	35%	
Shortness of breath	Yes	281	185	66%	96	34%	0.008
	No	76	62	82%	14	18%	
Antiviral drug	Yes	148	94	64%	54	37%	0.051
	No	209	153	73%	56	27%	
Steroid	Yes	207	148	72%	59	29%	0.028
	No	150	99	66%	51	34%	
Antibiotics	Yes	348	241	69%	107	31%	0.868
	No	9	6	67%	3	33%	
Oxygen therapy	Yes	343	234	68%	109	32%	0.05
	No	14	13	93%	1	7%	
CPAP	Yes	130	41	32%	89	69%	0.001
	No	227	206	91%	21	9%	
RCU admission	Yes	96	22	23%	74	77%	0.001
	No	261	225	86%	36	14%	
Complication	Yes	117	9	8%	108	92%	0.001
	No	240	238	99%	2	1%	
severity	critical	139	46	33%	93	67%	0.001
	not critical	218	201	92%	17	8%	

Discussion

World have witnessed a deadly COVID-19 pandemic in the twenty-first century which are responsible for causing acute respiratory tract infections and cause high mortality rate. Various epidemiological features of COVID-19 like age, sex, clinical features, treatment,

complications, and death rate have been discussed in this study in one hospital in Baghdad-Iraq. As any infectious disease like COVID-19, host factors are the key factors to determine disease severity and progression like age and sex of the patient. This study was demonstrated that COVID-19 affect mostly male (62.2%) patients than females at age more than forty years which is in agreement with other studies in other countries like China and

Italy which is the first country affected by the pandemic after China (16,17). The results of our study was in accordance with other studies in Iraq like Basrah and Kirkuk(18,19). The main complain was shortness of breath (78.7%) that need hospital admission, treatment with antibiotics (97.5%), steroids (58%) and oxygen therapy (96.1%) while other researches illustrated cough and fever (81.1%)(20). This difference with this study may be due to sample type selection because of samples in this study were all of them from hospital residence that were complained from dyspnea.

COVID-19, caused mild to moderate infection in the majority of healthy subjects, but can cause life-threatening disease or debilitating symptoms in some patients. In this study about 38.9% had sever disease and more common in old patients whom their age more than 60ys (56.1%) and non significant difference regarding sex. Patients were developed sever COVID who had shortness of breath and treated with antibiotics, steroids, oxygen therapy and CPAP and 32.8% of the patients had complications end with death (39.4%) that common in older age group (≥ 60 ys.) who had shortness of breath (34%, $P=0.008$) and treated with antiviral drug (37%, $P=0.05$), oxygen therapy (32%; $P=0.05$), CPAP (69%; $P=0.001$) and RCU admission (77%; $P=0.001$). The death rates in patients who had complications and sever COVID were 92% and 67% respectively. This in accordance with other studies that showed severity of disease increased with age (≥ 65 ys.) and requiring intensive care unit due to immunologic response to COVID differs with age, differences in the state of immune system between age and young individuals like shift from Th1 to Th2 in young group, and neutrophils lymphocytes ratio was positively correlates with older age(21, 22, 23, 24). Other difference with this study was that males more common than females in developing complications, sever COVID, and death (due to expression of Toll like receptor-7 (TLR-7) on the X chromosome of the female that binds with virus, genetic effect between males and females, social factors, presence of neutralizing autoantibodies to type-I IFN, higher expression of ACE2 receptors on respiratory epithelial cells, smoking habits, and differing exposure to virus (25,26). Other influencing factor was sex hormones that may influence viral infectivity

process through virus spike proteins utilize Transmembrane protease serine 2 (TMPRSS2) for cell entry and androgen receptors are transcription promoters for TMPRSS2 and facilitate COVID-19 cell entry (27). Other study showed that males who died from COVID-19 is 2.4 times that of females and at risk for worse outcomes and death, independent of age.

Comparing the fatality rate results in Baghdad (92%) with other provinces in Iraq were higher for example in Babylon, Missan, and Kirkuk were 62.5%, 50%, 5% respectively and this may be due to type and characteristics' of patients sample collection (patients demographics), type of treatment therapeutic protocol, secondary illness patients had, and Baghdad was high populated area with eight million inhabitants (18,19,28).

The COVID-19 pandemic has presented public health problem with its biggest infectious disease challenge. Vigorous and appropriate epidemiological measures are very important to control the rapid spread of the COVID-19 pandemic. As the pandemic continues, it is important to continue to document challenges and how these can be overcome in future public health emergencies.

Limitation of this study:

- Small sample size.
- Deficient in recording data.

Conclusions:

This study was demonstrated that COVID-19 affect mostly male patients than females at age more than forty years. The main complain was shortness of breath that need hospital admission, treatment with antibiotics , steroids and oxygen therapy ending with high fatality rate .

Ethics statement: The study was approved by Al-kindy Teaching Hospital and the Ethical and Scientific Committee in Al-kindy College of Medicine.

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Authors' contributions are as followings:

Formal analysis: NDN

Methodology: NDN

Visualization: BMM

Writing—original draft: NDN

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References

- [1] Chams N, Chams S, Badran R, Shams A, Araji A, Raad M, Mukhopadhyay S, Stroberg E, Duval EJ, Barton LM, Hajj Hussein I. COVID-19: A Multidisciplinary Review. *Front Public Health*. 2020 Jul 29;8:383. doi: 10.3389/fpubh.2020.00383. PMID: 32850602; PMCID: PMC7403483.
- [2] World Health Organization. WHO Timeline - COVID-19. (2020). Available online at: <https://www.who.int/news-room/detail/08-04-2020-whotimeline---covid-19> (accessed April 20, 2020).
- [3] Cui J, Li F, Shi ZL. Origin and evolution of pathogenic coronaviruses. *Nat Rev Microbiol*. (2019) 17:181–92. doi: 10.1038/s41579-018-0118-9.
- [4] Umakanthan S, Sahu P, Ranade AV, Bukelo MM, Rao JS, Abrahao-Machado LF, Dahal S, Kumar H, Kv D. Origin, transmission, diagnosis and management of coronavirus disease 2019 (COVID-19). *Postgrad Med J*. 2020 Dec;96(1142):753–758. doi: 10.1136/postgradmedj-2020-138234. Epub 2020 Jun 20. PMID: 32563999.
- [5] Occupational risks for COVID-19 infection [Editorial]. *Occup Med (Lond)*. 2020;70:3–5. [PMID: 32107548] doi:10.1093/occmed/kqaa036.
- [6] Spitzer M. Masked education? The benefits and burdens of wearing face masks in schools during the current Corona pandemic. *Trends Neurosci Educ*. 2020 Sep;20:100138. doi: 10.1016/j.tine.2020.100138. Epub 2020 Aug 11. PMID: 32917303; PMCID: PMC7417296.
- [7] Weiss S.R., Leibowitz J.L. Coronavirus pathogenesis. *Adv. Virus Res*. 2011;81:85–164. doi: 10.1016/b978-0-12-385885-6.00009-2.
- [8] Xiao F., Tang M., Zheng X., Li C., He J., Hong Z., Huang S., Zhang Z., Lin X., Fang Z., et al. Evidence for gastrointestinal infection of SARS-CoV-2. *medRxiv*. 2020 doi: 10.1053/j.gastro.2020.02.055.
- [9] Dawood H, Hwayyiz A, Ibrahim I, Abdul Rahman I. The clinical features of COVID - 19 in a group of Iraqi patients: A record review. *JFacMedBagdad*. 2021;63(1):8-12. <https://iqjmc.uobaghdad.edu.iq/index.php/19JFacMedBagdad36/article/view/>
- [10] Xu Z., Shi L., Wang Y., Zhang J., Huang L., Zhang C., Liu S., Zhao P., Liu H., Zhu L., et al. Pathological findings of COVID-19 associated with acute respiratory distress syndrome. *Lancet Respir. Med*. 2020 doi: 10.1016/S2213-2600(20)30076-X.
- [11] Luo XH, Zhu Y, Mao J, Du RC. T cell immunobiology and cytokine storm of COVID-19. *Scand J Immunol*. 2021 Mar;93(3):e12989. doi: 10.1111/sji.12989. Epub 2020 Nov 25. PMID: 33113222; PMCID: PMC7645942.
- [12] China Food and Drug Administration China Food and Drug Administration Emergency Approval of New Coronavirus Nucleic Acid Detection Reagents. [(accessed on 23 February 2020)]; Available online: <http://www.nmpa.gov.cn/WS04/CL2056/374264.html>.
- [13] Allawi JS, Abbas HM, Rasheed JI, Sulaiman TI, Gatea AA, Al-Lami F, Al-Diwan JK, Al-jabory AM, Waheeb M, Abdurudha YI, Al-Kaabi LS, Al-Shuwaili SJ, Tawfeeq TW, Alaboodi MK, Abdulrazak AA, Al-Samak WQ. The first 40-days experience and clinical outcomes in the management of coronavirus covid-19 crisis. Single center preliminary study. *JFacMedBagdad*. 2020;61(3,4). <https://iqjmc.uobaghdad.edu.iq/index.php/19JFacMedBagdad36/article/view/1739>.
- [14] Son, Kyung-Bok, Lee, Tae-jin & Hwang, Seung-sik. (2021). Disease severity classification and COVID-19 outcomes, Republic of Korea. *Bulletin of the World Health Organization*, 99 (1), 62 - 66. World Health Organization. <http://dx.doi.org/10.2471/BLT.20.257758>

- [15] Jin, J. M., Bai, P., He, W., Wu, F., Liu, X. F., Han, D. M., Liu, S., & Yang, J. K. (2020). Gender Differences in Patients With COVID-19: Focus on Severity and Mortality. *Frontiers in public health*.2020; 8, 152. <https://doi.org/10.3389/fpubh.2020.00152>
- [16] Chen Y, Klein SL, Garibaldi BT, et al. Aging in COVID-19: Vulnerability, immunity and intervention. *Ageing Res Rev*. 2021;65:101205. doi:10.1016/j.arr.2020.101205
- [17] Onder G., Rezza G., Brusaferro S. Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. *JAMA*. 2020;323:1775–1776.
- [18] Habib OS, AlKanan AK, Abed AH, MohammedNQ. Epidemiological Features of COVID-19 Epidemic in Basrah-Southern Iraq-First Report. *The Medical Journal of Basrah University*, 38, 1, 2020, 7-18. doi: 10.33762/mjbu.2020.126943.1008.
- [19] Darweesh, O., Abdulrazzaq, G. M., Al-Zidan, R. N., Bebane, P., Merkhan, M., Aldabbagh, R., & AlOmari, N. Evaluation of the Pharmacologic Treatment of COVID-19 Pandemic in Iraq. *Current pharmacology reports*.2021; 1–8. Advance online publication. <https://doi.org/10.1007/s40495-021-00262-9>
- [20] Wu C, Chen X, Cai Y, Xia J, Zhou X, Xu S, Huang H, Zhang L, Zhou X, Du C, Zhang Y, Song J, Wang S, Chao Y, Yang Z, Xu J, Zhou X, Chen D, Xiong W, Xu L, Zhou F, Jiang J, Bai C, Zheng J, Song Y. Risk Factors Associated With Acute Respiratory Distress Syndrome and Death in Patients With Coronavirus Disease 2019 Pneumonia in Wuhan, China. *JAMA Intern Med*. 2020 Jul 1;180(7):934-943. doi: 10.1001/jamainternmed.2020.0994. Erratum in: *JAMA Intern Med*. 2020 Jul 1;180(7):1031. PMID: 32167524; PMCID: PMC7070509.
- [21] Webb, K. et al. Sex and pubertal differences in the type 1 interferon pathway associate with both X chromosome number and serum sex hormone concentration. *Front Immunol*. 2019;9, 3167.
- [22] Kollmann, T. R., Levy, O., Montgomery, R. R. & Goriely, S. Innate immune function by Toll-like receptors: distinct responses in newborns and the elderly. *Immunity*.2012; 37, 771–783.
- [23] Lagunas-Rangel, F. A. Neutrophil-to-lymphocyte ratio and lymphocyte-to-C-reactive protein ratio in patients with severe coronavirus disease 2019 (COVID-19): a meta-analysis. *J. Med. Virol*. 2020;92, 1733–1734.
- [24] Brodin P. Immune determinants of COVID-19 disease presentation and severity. *Nat Med*. 2021;27(1):28-33. doi:10.1038/s41591-020-01202-8
- [25] Wang F, et al. Epidemiological characteristics of patients with severe COVID-19 infection inWuhan, China: evidence from a retrospective observational study. *Int J Epidemiol*. 2020;49(6):1940–50.
- [26] Sama IE, et al. Circulating plasma concentrations of ACE2 in men and women with heart failure and effects of renin-angiotensin-aldosterone- inhibitors. *Eur Heart J*. 2020;41(19):1810–7.
- [27] Mohamed MS, Moulin TC, Schiöth HB. Sex differences in COVID-19: the role of androgens in disease severity and progression. *Endocrine*. 2021;71(1):3-8. doi:10.1007/s12020-020-02536-6
- [28] Mohammed IA, Ali AH, Al shenaty JN. Clinical course and disease outcomes in hospitalized patients with 2019 novel corona virus disease at Ibn- Al Khateeb Hospital in Baghdad, Iraq. *JFacMedBagdad*. 2020;62(3). <https://iqjmc.uobaghdad.edu.iq/index.php/19JFacMedBaghdad36/article/view/1775>.