

Clinical study of symptoms recovering from Covid-19 for different segments of Iraqi society*

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ABSTRACT

An outbreak of pneumonia of unknown origin was reported in Wuhan, Hubei Province, China, in December 2019. It was identified as SARS-CoV-2, which was previously called 2019-nCoV. They are grouped into four genera: alpha, beta, gamma, and delta coronaviruses. SARS-CoV-2 symptoms vary from mild to severe. Fever, cough, and shortness of breath are the most common symptoms. This epidemic has spread throughout various countries of the world, and the number of infected people has increased very rapidly. Among these countries is Iraq, which recorded the first Corona virus in the Najaf Governorate, on February 24, 2020 and thereafter, as the number of infections began to rise steadily, specifically in the third month of 2021. In this study, questionnaire forms were used, and the cases showed those infected with the Corona virus from several governorates in Iraq (Wasit, Diyala, Karbala). Then the health problems that continued to occur after recovery were discussed. The infected cases were analyzed statistically, which were related to some of the symptoms that appeared among males and females.

Keywords: SARS-CoV-2, Covid-19, pneumonia, chronic disease and Covid-19, SARS-CoV-2 symptoms, transmission Covid-19.

1. Introduction

1.1. Gene description

An unidentified pneumonia outbreak emerged in Wuhan, located in Hubei Province, China, in December 2019. The major of these cases were associated with the Hunan Seafood Whole sale market, extraction of a distinctive cDNA was accomplished by introducing bronchoalveolar lavage of fluid from patients with unexplained pneumonia into the epithelial cells of human airways, as well as Vero-E6 and Huh-7 cell lining. This process resulted in identification of a new coronavirus, initially designated as 2019-nCoV and later named SARS_CoV_2 [1]. The Corona-virus, which are with positive Single Stranded RNA virus, are classified within Coronaviridae family. They can be classified into genera of four groups, Alpha-corona-virus, Beta-coronavirus, Gamma-coronavirus, and the Delta-corona virus. Among these genera, the Alpha- and Beta-coronavirus has been known to cause infection in humans, and currently, seven of human coronaviruses [HCoVs] have been identified. Alpha-corona virus included (HCoV-NL63) and (HCoV-229E) as well as (HCoV-OC43) and (HCoV-HKU1), which represent beta coronaviruses, are commonly associated with causing mild upper infections of respiratory tract , such as common cold. However, it is important to note that these viruses can also lead to severe infections in the lower part of respiratory tract, especially among vulnerable populations such as the elderly and children [8], The human coronaviruses identified

include HCoV_OC43, HCoV_HKU1, SARS_CoV (corona virus with severe acute respiratory syndrome), MERS_ CoV (Middle East respiratory syndrome Corona Virus), and SARS_CoV-2 (Severe Acute Respiratory Syndrom_Corona Virus_2) are all members of the Betacoronavirus genus [2-7]. HCoV-NL63 infection shown to be correlated with appearance of croup, which is a condition characterized by larynx and trachea inflammation [9, 10] HCoV-OC43 has been implicated in cases of severe lower respiratory tract infections (LRTIs) in children [11]. The two dangerous viruses, SARS-CoV and MERS-CoV, are not native to humans, they originate from animals, making them zoonotic - capable of jumping from species to species once they infect humans, they can cause (LRTIs), sometimes with fatal consequences [12].

1.2. Clinical Symptoms

A global spreading of corona virus at 2019 declaring an emergent worldwide due to its quick spreading and high mortality rates that enrolled serious disruptions. Most common trio of symptoms included fever (83%), cough (82%), and shortness of breath (31%), act as the virus' calling card. But for those swept into the pneumonia, chest X-rays reveal a grimmer story. Multiple mottled shadows and hazy ground-glass opacities paint a picture of lung tissue, acute respiratory distress syndrome (ARDS) can be a very serious condition with potentially life-threatening complications [13]. Gastrointestinal symptoms such as abdominal pain, diarrhea and vomiting were also reported in around (2–10%) of COVID-19 individuals. Preceding the onset of respiratory symptoms with fever, approximately ten percent of patients experienced diarrhea and nausea [14]. (SARS_CoV) and (MERS_CoV) considered as zoonotic virus that can cause severe respiratory symptoms and, in some cases, be fatal [12]. Since the initial outbreak in December 2019, SARS-CoV-2 has been disseminated to the all continents, as of June 18th, 2021, when WHO reported approximately 177 million confirmed cases of COVID-19 globally. These cases include individuals who have tested positive for the virus through laboratory testing. It's important to note that this number represents only the reported cases, and the actual number of infections may be higher due to limited testing capacity and asymptomatic cases. Patients infected with SARS-CoV-2 can exhibit many symptoms, varied in degree of intensity from mild to severe. The most common symptoms reported included breath shortness, cough and fever. These symptoms are prevalent, with approximately 83% of patients experiencing fever, 82% reporting cough, and 31% experiencing shortness of breath. Chest X-ray findings have shown the presence of multiple mottling and ground-glass opacity in patients who develop pneumonia [11-13]. Patients with acute respiratory distress syndrome suffer from complications associated with the disease, which can lead to multi-organ failure, the Gastrointestinal symptoms like abdominal pain, vomiting and diarrhea were also reported in around (2–10%) of COVID-19 patients [13, 14]. Before the onset of fever and respiratory symptoms, approximately ten percent individuals experienced diarrhea and nausea as early signs [13].

2. The Viral Transmission

Transmission path of SARS-CoV-2 is not yet known. The main causes of transmission from one person to another are coughing and sneezing droplets, which are considered the most common methods of transmission among susceptible people. Among a population susceptible to the virus, the specific method of transmission remains unknown. The most common mode of SARS-CoV-2 infection is through human-to-human transmitted ways, primarily via respiratory droplets. The potential for transmission by individuals who showed no symptoms cannot be dismissed or ruled out [15]. The oral-fecal pathway is another probable viral transmission mechanism. (SARS-CoV) and (MERS-CoV) obviously stayed active in environmental circumstances enhancing oral and fecal transmission. The presence of SARSCoV-2 was identified in both respiratory and stool samples of individuals diagnosed with COVID-19 pneumonia. Therefore, there is a likelihood of (SARS_CoV-2) transmission through both the oral-fecal route and contact with contaminated surfaces and fomites [16, 17].

2.1. The incubation period

Understanding the period of incubation of infection by SARS-CoV-2 is essential to obtain disease control and monitoring. The incubation period median is approximately 5.1 days (as 95% of the confidence interval in 4.5 to 5.8 days), and major of 97.5% of infected people revealing symptoms during 11.5 days (95 percent of 8.2 to 15.6 days as confidence interval) after being infected. According to these estimates, approximately 101 out of every 10,000 cases are projected to exhibit symptoms after a 14 days of quarantine period [17]. Other studies have shown that 6.4 days were estimated as incubated period for SARS-CoV-2 as 95 percent credible intervals of 5.6 to 7.7 days. This range indicates that most individuals will develop symptoms within this timeframe. It was noticed that incubation period showed variations, with the shortest recorded period being 2.1 days and the longest being 11.1 days, encompassing 5.2 days or the 2.5th to 97.5th percentile.[18] ,(95 percent credible interval: 4.1–7.0), with the 95th percentile of distribution for 12.5 days [19]. It is advisable to carefully observe individuals for a duration of 14 days following their exposure to a suspected or confirmed SARS-CoV-2 patients [19,20].

3.The Molecular Diagnostic approach of SARS-CoV-2

Reverse real-time PCR (rRT-PCR), a nucleic acid amplification technique, is utilized to confirm cases of probable SARS-CoV-2 by identification of unique viral sequence. On January 7th, 2020, the authorities of Chinese health declaring that novel coronavirus considered the cause of the pneumonia outbreak in Wuhan city. The European academic and public laboratories created (rRT_PCR) methodology by comparing and aligning genome sequences from previously known SARS-CoV and bat-related coronaviruses [21]. Three distinct assays were conducted, with one targeting the E-gene, which encodes the enveloped protein found in all subgenus of Sarbecovirus.

Another assay focused on the RdRp gene, which plays a crucial role in viral replication, A second assay specified to target (RdRp) gene, which is responsible for encoding the enzyme of RNA_dependent RNA

polymerases, this assay particularly includes two probes. First one is designed to detect the (RdRp) gene of both (SARS_CoV) & (SARS_CoV-2), while the third probe specifically identifies the RdRp gene unique to SARS-CoV-2 (RdRP SARSr-P2) [21,22]. A newly developed rRT-PCR assay was designed to target a distinct region of the SARS-CoV-2 RdRp/Hel gene. This assay demonstrated superior sensitivity and specificity compared to the RdRp-P2 assay [23]. diagnostic assay with high sensitivity and specificity were essential in for accurate identification with tracing contacts and identification of animal source if present the control and measure implementation. During the performance of nucleic acid amplification test assays, it is crucial to bear in mind that a negative result in an infected patient can be influenced by various factors. These factors may include inadequate specimen quality, specimen collection timing (collecting the specimen too early or too late in the course of infection), improper handled or shipment of specimen, as well as the technical reasons [24–26].

Materials and Method

Patient data were collected through questionnaire forms in three public hospitals in Diyala, Karbala, and Kut governorates in Iraq . The Cases were collected from three governorates (Diyala , Karbala , Kut) , they were 137 cases between adults 20 _80 years old (males , females), the period of collecting patients samples with COVID-19 was between November 2020 and April 2021. The questionnaire form included (age, gender, chronic diseases ,health problems after recovery like fatigue after a slight effort ,Cough accompanied by sputum, gasping, hair loss ,loss smell and taste. Then data were analyzed statistically with histograms using (IBM SPSS Statistics software).

Results and Discussion

The study was administered on 137 Covid-19 patients, their ages grazing from 20 to 80 years. The results showed, **Figuer1**, that patients aged 20-30 have higher rates of infection with Covid-19 in

comparison to patients aged 70-80.

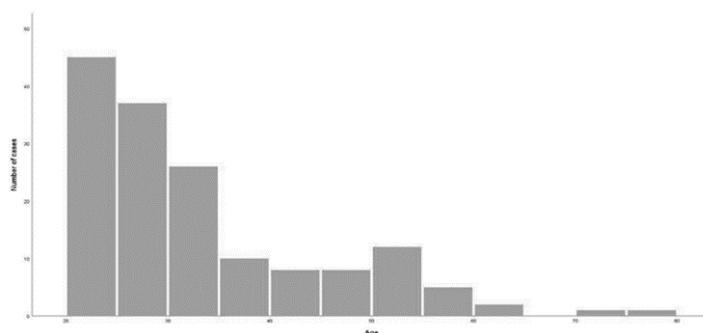


Figure1. Relationship between number of cases and range of ages.

The present study showed a similarity concerning the increase of infected cases for the ages between 18 - 29 with other previous reported study [27] that referred to this augment by 610 times higher than that of adults aged ≥ 80 years old . These higher rates is probably related to the social and behavioural differences such as lack of masking and social distances in adolescents and young adults age groups. According to another study on 29th October 2020, the adults aged 20 to 34 and 35 to 49 were the only age groups that had a sustained SARS-CoV-2 transmission with reproduction numbers consistently >1 . That was associated to rebounding mobility during summer and increasing the transmission risks per visit among adults aged 20 to 49, while fewer infections appeared for people between the ages of 40-60 and less than them in the ages from 60 to 80, and the biggest reason for this may be due to the warnings of the World Health Organization of the danger of Corona virus in elderly people and their more commitment to these instructions [28].

The 3 governorates showed higher COVID-19 infection rates for males compared to females, 78 males (56.9%), 59 females (43.1%). The infection data in each city appeared clearly the excess infected cases in males relative to females, and this difference was clearly visible in Al-Kut city and less than that in Karbala and Diyala respectively, **Figure 2**, this increase may be due to the:

- Occupational differences: Men might be more likely to hold occupations with higher exposure risks, such as construction, transportation, or healthcare.
- Behavioral differences: Men might be less likely to engage in preventative behaviors like mask-wearing or social distancing [29]

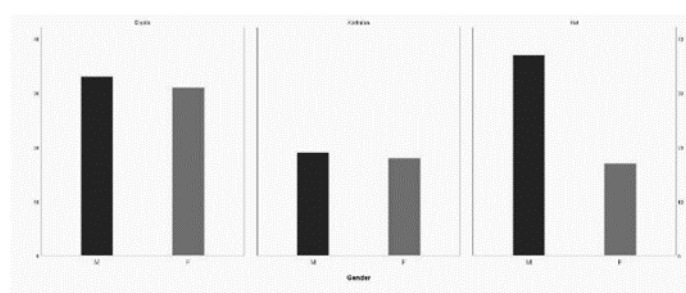


Figure 2. Relationship between Gender & Number of cases

There were many studies confirmed the data that the present study has obtained [30,31] and conflicted with others, especially in Western societies. This disparity in opinions may be due to the nature of society in mixing with the basics, customs and traditions in Arab countries, and also in African countries, in terms of other sites and research, have explained the difference in the infection [32], as well as with regard to its severity in males and females, and according to what was mentioned by the Nature Public Health Emergency Collection, which spoke according to the World Health Organiza-

tion and the most recorded sites of infections that the severity and number of infections in males, it was higher than the female ,focusing was on the different percentages in the infected numbers and their difference between males and females, and the analysis of this difference, in fact the clinical results showed a clear difference in the severity of infection between the two, with more seriousness for males than females[33].

After more research to find out the reasons, researchers found that this difference is due to the success invasion of SARS-CoV-2 into the body cells which depends on receptor of Angiotensin-Converting Enzyme2 (ACE-2) and Transmembrane Protease Serine-2 (TMPRSS2). In addition, the sex-based differences associated with the receptor expression of ACE-2 and TMPRSS2 might declare the disparities that associated with COVID-19 severity and fatality [34]. Also, these differences in clinical outcomes of COVID-19 infections correlated to behavioral gendered differences, like smokers, and the prevalence to comorbidities. Identifying the sex and gender sensitivity of this viral infection is a vital factor towards the creation of effective treatment options and management for this virus. It was reported that elderly infected patients [33], as being males was also another factor linked to the frequency and severity of infection. The epidemiological findings recorded worldwide indicated higher morbidity and mortality in male than female. The higher expression for receptors of ACE-2 (as a receptor for the coronavirus) in male more than female, the sex based immunological differences associated with sex hormone and X chromosome explained these differences in number of deaths. Lifestyle, ie, higher levels of smoking and drinking among men compared to women with behavior responsible attitude toward the viral pandemic. The irresponsible attitudes among men reversibly affects the preventive measures like frequent hand washing, wearing the face mask, and staying at home [35]. On these bases, in the previous research and publications above, the explanation of the increasing number of males over females, as well as the increase in the risk of infection in males were always more than females [36].

Our results showed also the relations between chronic diseases like (diabetes, asthma, hyperlipidaemia, arthritis, pharyngitis and renal failure) and the increased rates of Covid-19 infection, **Figure 3**, the hypertensive infected patients were more than other infected patients with other chronic diseases like (diabetes, asthma, hyperlipidaemia, arthritis, pharyngitis and renal failure).

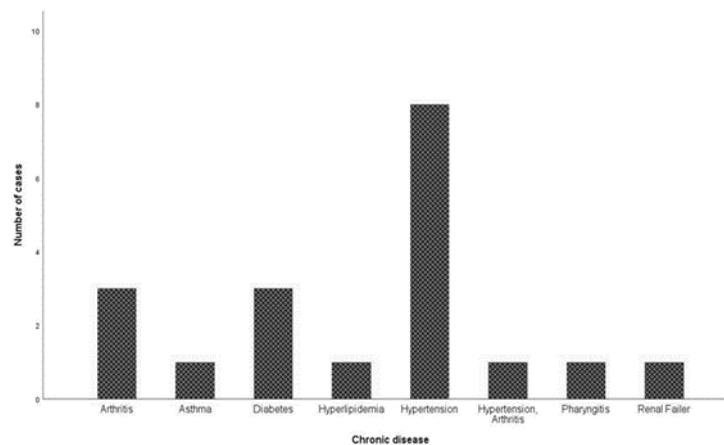


Figure 3. Relationship between number of cases and chronic disease.

The studies reported that the individuals with hypertension are at higher risk for severe illness, hospitalization, and mortality caused by COVID-19 [37] . This could be due to various factors, including:

- Weakened immune system: Hypertension can damage the blood vessels and organs, potentially affecting immune function.
- Increased inflammation: Both conditions involve chronic inflammation, which can worsen during a COVID-19 infection.
- Blood vessel damage: The damage caused by hypertension can make it easier for the virus to attack and damage other organs.

A study conducted by the World Health Organization on more than 155 countries, it was found that people who suffer from non-communicable diseases or chronic diseases are more likely to be infected with this epidemic [37,38], on the other hand, the chronic stress has the ability to weaken the immunological system, making individuals more susceptible to infections such as COVID-19. Stress can also lead to unhealthy behaviors like smoking, poor diet, and lack of exercise, which further increase the risk of COVID-19 complications [39]. Particularly, Iraq faces several ongoing challenges, including economic instability, political unrest, and conflict. These factors can contribute to chronic stress and create barriers to healthcare access, potentially influencing COVID-19 infection rates and outcomes. From another side it was confirmed that Diabetes information explained the increasing cases of Covid-19 scientifically and, it was mentioned that these numbers belong to the increasing data indicating that the COVID-19 presents in a severe form in diabetic persons type 1 and 2 [40] where, our results shown by the questionnaire forms and samples collected for those infected with Covid-19 showed that the percentages of people suffering from chronic diseases such as diabetes and arthritis were approximately similar **Figure3**. This denotes that those with no comorbid conditions. It is true that the percentage of hypertensives patient in this study constituted 8% of the total cases infected with Covid-19 for both men and women, that is higher than the percentages of infected patients with other chronic diseases, but remains one of the important factors in the deterioration of the health condition of those infected with Covid-19.

Many attributed factors can be associated with the heightened susceptibility and fatal findings of COVID-19 in those patients, for example, the enhanced expression of Angiotensin-Converting Enzyme-2 (ACE2) in specific organs, the cytokine storm, and drug-drug interactions contributed to elevated morbidity rate, also it was reported that COVID-19 has the ability to induce chronic diseases in healthy patients. Therefore, focusing on the interlinked relationship between COVID-19 and chronic diseases can improve and optimize the management process of the susceptible patients [38].

This study comes to examine more symptoms that have become known as the symptoms of “long-term Covid-19, that accompanied by fatigue, anxiety, depression, shortness of breath and insomnia that could be later analyzed in another similar study. Stressful events, like illnesses such as COVID-19, can temporarily trigger hair loss, which is a normal physiological response. This hair loss can be reversed, unlike Alopecia Areata which causes irreversible hair loss. According to the American Academy of Dermatology, the main cause of hair loss related to COVID-19 is Telogen Effluvium (TE), a condition where the hair growth cycle is disrupted [41]. Interestingly, specialists from the Belgravia Center in London observed a significant increase in TE cases since the pandemic started, with 64% in men and 38% in women [42]. This aligns with our findings when the group with hair loss only was 18% from the total infected cases, as TE typically manifests about three months after experiencing stressful events, illness, or trauma. Loss of taste and smell is a powerful indicator of having been infected by the COVID-19 virus, a study involving 1,702 participants who underwent RT-PCR COVID-19 testing and reported their symptoms, including smell and taste loss, revealed a significant difference. Individuals who tested positive exhibited these symptoms at a much higher rate (59%) compared to those who tested negative [43,44]. Our remarkable results showed that loss smell and taste continued several months after recovery from covid-19 ,(the group that experienced loss both sense of smell and taste was 25%) and (group with loss of smell only was 21%) so the group

that suffered from loss smell and taste sense was the most group comparing to other groups, **Figure 4.**

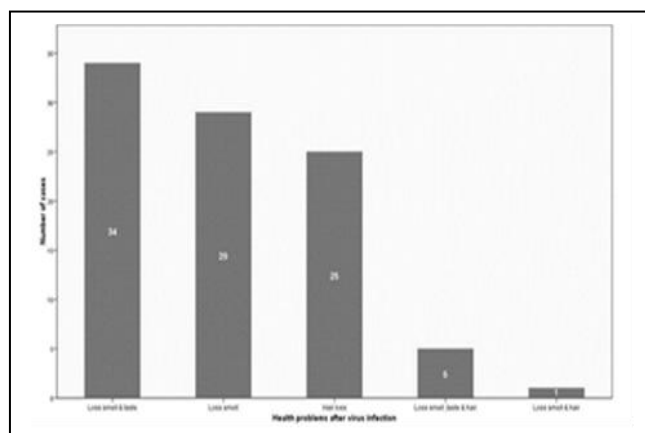


Figure 4. Relationship between number of cases and health problem after recovery.

On the other hand, amongst individuals who recovered from Covid, 48.7% of males and 54.2% of females experienced persistent cough after 3 months later while 32.1% of recovered males and 64.4% of recovered females, Table-2- experienced persistent gasping 3 months after their initial Covid-19 infection, that is mean 51% for cough and 46 % for gasping from the total collected cases, **Table 1.** The data indicate that females appear to experience these symptoms at a higher rate than males, **Table 2, Figure 5.**

Table 1. Data on persistent cough and gasping from the total whole cases.

Parameter	N (%)
Male	78 (56.9)
Female	59 (43.1)
No Cough	67 (48.9)
Yes	70 (51.1)
No Gasping	74 (54.0)
Yes	63 (46.0)

Table 2. Data on persistent gasping and cough showing higher prevalence in females.

Parameter				
Gender N (137)	Cough N (%)		Gasping N (%)	
	No	Yes	No	Yes

Male 78	40 (51.3)	38 (48.7)	53 (67.9)	25 (32.1)
Female 59	27 (45.8)	32 (54.2)	21 (35.6)	38 (64.4)

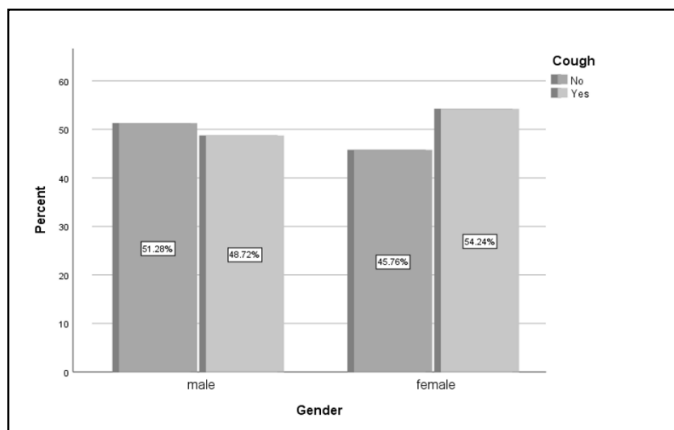


Figure 5. The presence of long-term symptoms after recovery when females showed higher rate

Symptoms of lung fibrosis, at the closest level, can also cause regular breathing problems and affect the blood oxygen levels in the body hence, some patients are required to continue using oxygen support machines for a period after recovery to regain their regular strength[45].So, persistent symptoms and the reasons behind them are still being investigated, but they could be related to microscopic damage to the lungs, affecting their ability to transfer oxygen efficiently or prolonged viral load when people with pre-existing chronic disease like asthma, heart disease, or diabetes might be more eligible to long-term effects due to increased sensitivity to the virus and its potential to exacerbate current problems [46,47]. We discussed herein the relationship between the number of cases and health problems after recovery like cough and gasping. The questionnaires analysis showed a significance difference with p-value = 0.041 via using SPSS software, so the gender could have an effect for continuous symptoms of Covid-19 after healing period, **Table 3**. We can conclude that covid-19 can undoubtedly affect cellular function and contribute to various symptoms, attributing all problems just to reduced energy and oxygen levels within specific cells is an oversimplification. The underlying processes are intricate and involve numerous interacting factors. Other causes that helped spread the virus are the changes in season, pollution and air quality levels that accelerate the complications of respiratory health problems [48, 49]. The same atmospheric conditions that create weather air pressure, temperature, and humidity, also affect air quality. Regarding the weather in Iraq, it is characterized by high temperatures in summer, increased use of electricity generators, and high levels of pollution in summer and winter, which leads to poor air quality. From another side COVID-19 vaccines can sometimes lead to complications or symptoms, the risks associated with contracting COVID-19 are often more severe. This focuses on the comparative risk between vaccination and the disease. Anti-vaccination groups raise concerns about potential complications from COVID-19 vaccines, however, the disease itself can also cause complications and symptoms. This acknowledges the arguments against vaccination while emphasizing the risks of the actual illness [50].

Table 3. Bonferroni Confidence intervals of Standard Deviations for coughing and gasping after recovery.

95% Bonferroni Confidence Intervals for Standard Deviation

Method	Test Statistic	P-Value
Multiple comparisons		0.000
Levene	2.16	0.041

Individual confidence level = 99.375%

Coupling after infection	Gasping after infection	Gander	N	StDev	CI
No	No	F	18	44.5738	(32.1610,72.843)
No	No	M	41	49.8686	(41.5832,64.078)
No	Yes	F	10	43.7218	(13.4191,196.065)
No	Yes	M	6	47.7385	(8.1009,516.882)
Yes	No	F	4	25.6710	(2.4530,849.068)
Yes	No	M	18	52.7478	(42.1797,77.779)
Yes	Yes	F	34	30.3722	(23.4907,42.704)
Yes	Yes	M	24	43.2162	(34.3876,61.295)

Author Contribution Statement

Urjwan ALALI: Supervision, Conceptualization, Writing-Reviewing and Editing, Methodology, Investigation, Data curation, original draft preparation. Noor Hadi Farhan: Reviewing and Editing, Original draft preparation. Ali Hameed Majeed: Reviewing and Editing.

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Conflict of interest

The authors declare that they have no conflict of interests

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