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# Effects of Environmental Factors on COVID-19 in the Telmetha rural Region of Libya

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## Abstract

Corona virus disease 2019 (COVID-19) is an infectious disease caused by the severe acute respiratory syndrome corona virus 2 (SARS-CoV-2), which has resulted in a devastating pandemic since December 2019. It is unclear how weather conditions influence transmission. So that was the goal of this study. Reevaluate the impact of weather on COVID-19, focusing on local climate effects. We analyzed daily COVID-19 case data and weather factors such as temperature, rain amount This work will cover a diurnal temperature range from March 3 to December 31, 2021 in Telmetha, a coastal rural area in northeastern Libya. This study was conducted over ten months under various climatic conditions. 167 Nasal swab samples were tested for COVID-19 from at Telmetha rural hospital were collected under aseptic conditions. The COVID-19 infections in the samples were found using the Panbio™ COVID-19 Ag Rapid Test Device. The findings revealed that 36.5% of the samples were infected with COVD-19. The study found that more than 65.6% of COVID19 infections were in male samples. As rainfall increased, the number of infections slightly increased as well, and temperature was a limiting factor for COVID19 in Telmetha Rural. The infections were peaked during November and December and October and lowered in spring and autumn . These findings are agreed with different results from temperate zones. while they differed with others from the tropics.

**Keywords:** SARS-CoV-2, COVID-19, Environmental factors, transmission.

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# تأثير العوامل البيئية على فيروس كورونا المستجد فى منطقة طلميثة بليبيا

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**الملخص**

مرض فيروس كورونا 2019 هو مرض معدٍ يسببه فيروس كورونا المسبب للمتلازمة التنفسية الحادة الوخيمة 2، والذي أدى إلى جائحة فى ديسمبر2019. ومن غير الواضح كيف تؤثر الظروف الجوية على انتقال العدوى لذلك كان هذا هو الهدف من هذه الدراسة إعادة تقييم تأثير الطقس على فيروس كورونا 2019، مع التركيز على التأثيرات المناخية المحلية. قمنا بتحليل بيانات الحالات المصابة فيروس كورونا 2019 اليومية وعوامل الطقس مثل درجة الحرارة وكمية الأمطار. وغطت هذه الدراسة نطاق درجات الحرارة النهاري من 3 مارس إلى 31 ديسمبر 2021 في طلميثة، وهي منطقة قروية ساحلية في شمال شرق ليبيا. وقد أجريت هذه الدراسة على مدى عشرة أشهر في ظل ظروف مناخية مختلفة. تم اختبار 167 عينة من مسحة الأنف للكشف عن فيروس كورونا 2019 في مستشفى طلميثة القروي وتم جمعها في ظروف معقمة. وتم الكشف على فيروس كورونا2019 في العينات باستخدام جهاز الاختبار السريع (Panbio™ COVID-19 Ag). وكشفت النتائج أن 36.5% من العينات كانت مصابة بفيروس كورونا 2019. ووجدت الدراسة أن أكثر من 65.6%من حالات الإصابة بفيروس كورونا 2019 كانت في عينات من الذكور. ومع زيادة هطول الأمطار ارتفع عدد الإصابات بشكل طفيف أيضًا، وكانت درجة الحرارة عاملاً مقيدًا لفيروس كورونا 2019 في منطقة طلميثة. وبلغت الإصابات ذروتها خلال أشهر نوفمبر وديسمبر وأكتوبر ثم انخفضت في الربيع والخريف. اتفقت نتائج دراستنا مع

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نتائج مختلفة من المناطق المعتدلة، بينما اختلفت مع غيرها من نتائج المناطق الاستوائية.

**الكلمات المفتاحية:** فيروس كورونا المسبب للمتلازمة التنفسية الحادة الوخيمة 2، مرض فيروس كورونا 2019، العوامل البيئية، الانتقال .

## 1. Introduction

SARS-CoV-2, a single positive-strand RNA virus, leads to acute respiratory illnesses in humans [Holmes., 2003]. A number of cases of a novel corona virus known as COVID-19 emerged throughout China in early 2020 [Stratton et al,2020 & Chen et a., l2020]. The disease rapidly spread to other areas because of its highly transferable nature [Bogoch et al., 2020]. The World Health Organization declared it a pandemic on March 11, 2020, due to increased global mobility [WHO. 2020a]. claiming more than 0.8 million lives globally between December 2019 and August 2020 [Huang et al.,2020]. Africa, which has over 1 billion people, has been tracking COVID-19 cases [Islam et al,2021& Dzinamarira et al .,2020]. The first case from Sub-Saharan Africa was reported in Nigeria on February 27, 2020, in an Italian patient who arrived by plane from Italy on February 25, 2020. Since then, the continent has seen an increase in the number of cases. Since March 23, 2020, there were 4,116,102 confirmed COVID-19 cases in 55 African countries, the first case of COVID-19 in Libya was officially declared on March 24, 2020, when the patient visited Saudi Arabia before coming back to Libya on March 5. The official diagnosis came 19 days later, following the return [Aisha et al., 2020]. Since then, the WHO has received reports of 507,266 confirmed cases of COVID-19 and 6,437 deaths in Libya [WHO.,2020]. There were 110,163 deaths reported from Africa, but 5,599,955 immunizations were administered, and 3,690,639 people recovered completely [Mutombo et al.,2021] Environmental and climatic factors including evaporation, humidity, gravity, wind speed, wind direction, and particulate matter have been shown to significantly

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influence the spread of respiratory droplets and aerosols [Shao et al.,2021]

Some studies have found that climatic factors such as temperature, humidity, and rainfall, wind speed influence the new COVID-19 disease's transmission, whereas other infectious diseases, such as Middle East respiratory syndrome corona virus (SARS), have seasonal differences in infection rates and deaths [Vall et al.,2021& Paraschivu et al., 2021]. The majority of the highest peaks of respiratory virus infections have occurred during the winter season [Mecenas et al., 2020]. COVID-19 spreads through close direct communication among individuals [Goedel., 2021], Understanding the common environmental factor [Ochani et al.,2021] that affect the spread of COVID-19 is crucial[Eslami et al.,2020]. This study is a trial evaluation to determine the effect of environmental factors on COVID-19 activity in the Telmetha rural region of Libya.

## 2. Materials and Methods

**2.1.** Sample collection: Between 3nd march and 31th December 2021 this prospective study enrolled 167 patients with clinical suspicion of COVID-19. ranged from 28–60 years were collected under aseptic conditions at Telmetha rural hospital.

**2.2.** Panbio™ COVID-19 Ag Rapid Test Device: The COVID-19 infections in the samples were identified using the PanbioTM COVID-19 antigen Rapid Test Device method test procedure. At room temperature (between 15 and 30°C), 300µl of buffer fluid is added to the extraction tube. The swab is gently rotated and carefully inserted about 2 cm into the nostril. While touching the nasal wall, the swab is rotated five times. The swab is then slowly withdrawn from the nostril. The sample collected on the swab is placed in the extraction tube. The extraction tube is gently squeezed with the fingers to remove the swab. After removing the cap, five drops of the extracted sample are carefully added to the specimen well (S) of the device. After waiting fifteen minutes, the results are inspected. (Abbot Germany).

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**2.3.** Data collection: Patients' health and clinical information were obtained from their record files. Climate data for the Telmetha region, including temperature and rainfall, were obtained from the AL Marj meteorological station. The data was analyzed according to the contribution of climatic factors to increasing and decreasing corona virus 2019 disease (COVID-19) infections.

**2.4**.Statistical analysis: Descriptive statistics including mean, median, standard deviations, percentiles, minimum and maximum were used to summarize exposure variables such as rainfall (mm), minimum and maximum temperature (°C), as well as dependent variables (i.e., COVID-19 daily confirmed cases). Also The Spearman correlation coefficient was used to estimate the relationship between rainfall (mm), minimum and maximum temperature (°C), with daily confirmed COVID-19 cases.

## 3. Results

During the study period, 167 patients visited Telmetha Rural Hospital's outpatient clinics and had their nasal swab samples tested for COVID 19. There were 61 cases infected with COVID-19 (36.5%). A total of 59% of those aged 28 to 40 with 29.5% of those aged 41 to 50, and 36.2% of those aged 51 to 60 (Table 1). Males were infected with COVID-19 at a higher rate than females at 65.6% and 34.4%, respectively (Table 2). COVID-19 infection rates increased slightly from October to December a major peak was recorded in December (winter) at 31%, coinciding with a drop in temperature. The highest temperatures are in August (26.7 C). While, the lower is in December (15.5 C)( Figure 1). A long drought period lasted from April to October. The highest temperatures occur in August (26.7 degrees Celsius). While the lowest is in December (15.5°C). (Figure 1). The occurrence of COVID-19 infections in nosal swab samples, however, declined from March to September. A significant amount of precipitation was recorded in March and December, with 26.6 and 23.2ml, respectively. In addition, our findings showed that increasing temperature reduced infection, whereas there were no cases of COVID19 at high temperatures in August (26.7°C) (Figure 2).

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**Table 1: distribution of COVID 19 by age**

| Age(years ) | NO cases | Percentage % |
|---|---|---|
| 28 -40 | 36 | 59 |
| 41-50 | 18 | 29.5 |
| 51-6 | 7 | 11.5 |
| Total | 61 | 100% |

**Table 2: distribution of COVID-19 by sex**

| Sex | percentage % | No: of infection cases |
|---|---|---|
| Male | 65.6% | 40 |
| Female | 34.4 % | 21 |
| Total | 100% | 61 |

Figure 1 shows that the peak temperatures recorded in August, reaching 26.7 degrees Celsius In contrast, the lowest temperature recorded is 15.5 degrees Celsius in December The infection increased in October and November and December ,The month of December recorded both the maximum rainfall and the highest number of infections, which was 19, at a temperature of 15.5°C figure 2.

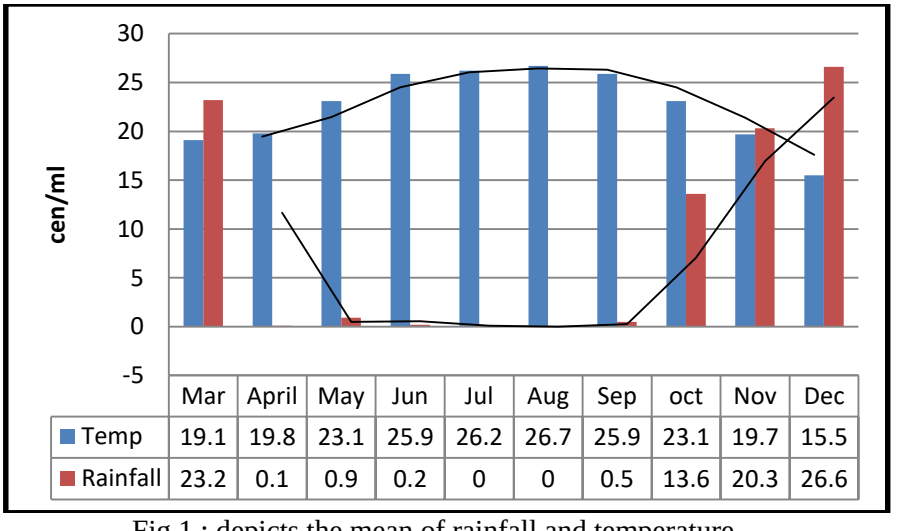


Fig.1.: depicts the mean of rainfall and temperature.

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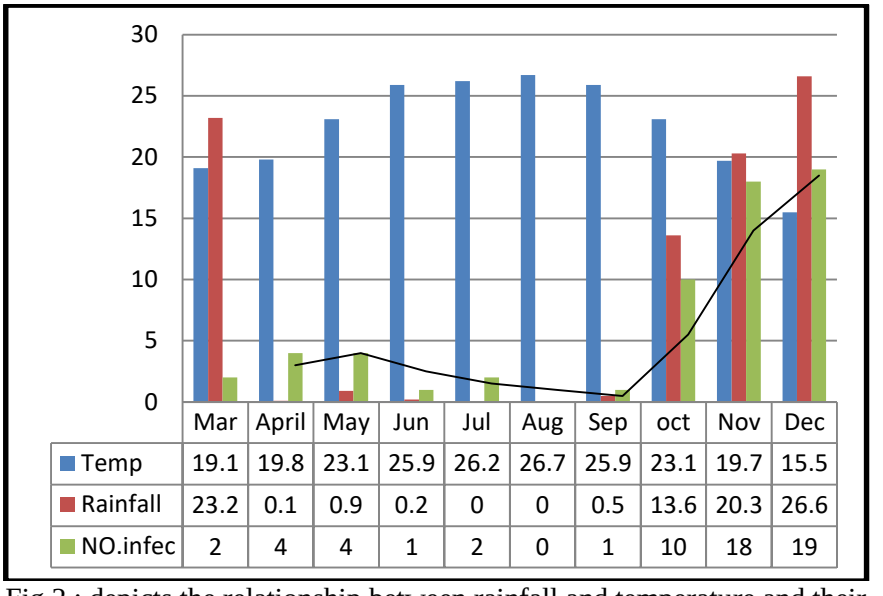


| | Mar | April | May | Jun | Jul | Aug | Sep | oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|
| Temp | 19.1 | 19.8 | 23.1 | 25.9 | 26.2 | 26.7 | 25.9 | 23.1 | 19.7 | 15.5 |
| Rainfall | 23.2 | 0.1 | 0.9 | 0.2 | 0 | 0 | 0.5 | 13.6 | 20.3 | 26.6 |
| NO.infec | 2 | 4 | 4 | 1 | 2 | 0 | 1 | 10 | 18 | 19 |

Fig.2.: depicts the relationship between rainfall and temperature and their effects on increasing COVID-19 infections in the Telmetha rural region.

## 4. Discussion

In our research, we discovered that the infection rate of COVID-19 was higher in males than in females, with percentages of 65.6% and 34.4%, respectively. The findings from our study are consistent with those of another research [Bwire et al.,2020], which also indicated that the incidence rate was greater in males than in females. Another study [Elgendy et al.,2020] supported this observation, noting that differences in immunity based on sex that impact vulnerability to infectious diseases could explain the elevated COVID-19 incidence in males. Our findings align with those reported in the study referenced as [Chaturvedi et al.,2020].

Males tend to have a higher likelihood of contracting the virus, potentially due to factors such as genetic predispositions, hormonal differences, immune system responses, as well as non-biological elements that play a role in the differing COVID-19 outcomes observed between the sexes, Based on our study, young people exhibited the highest incidence rates, with 59% of individuals aged

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28 to 40 affected. Our findings align with studies [Finelli et al.,2021& Manivannan et al.,2021], which report a rise in new infections among youth. Furthermore, we concur with study [Zhang et al .,2022], which identified young people as having the highest incidence rates. It is concerning to note that young individuals are experiencing an increasing mortality rate, which presents an enigma, as this demographic is generally believed to possess a stronger immune system and fewer comorbiditie, Temperature was identified as a key factor in the global spread of viral diseases such as COVID-19[Green et al .,2020] According to our findings, infections increased by COVID-19 occurred at low temperatures 15.5 °C with 26.5 milliliters of precipitation in December(Fig 1). our study agreed with [Oliveiros et al.,2020]found that The decrease in temperature may increase the risk of virus transmission .also agreed with[Health.,1992] low temperatures give corona viruses favorable conditions for survival and reproduction, found [Zhou et al .,2004] cold air weakens the immune system by causing vasoconstriction of the respiratory tract, and dry cold air makes the nasal mucosa vulnerable to tiny ruptures, which opens the door for virus invasion. Additionally, our findings no COVID-19 cases were observed at high temperatures (August 26.7°C) (Figure 2). Our study agreed with [Rajgor et al.,2020& Chetty et al.,2020] showed an inverse relationship between the confirmed of COVID-19 cases and temperature.

## 5. Conclusions

Temperature was a limiting factor for COVID19 in Telmetha rural, and the number of infections increased slightly as rainfall increased, Our results showed that infection increased as temperature decreased, with the highest infections appearing at low temperatures. COVID-19 cases show seasonal variations, with the highest number of cases reported during the rainy season and the lowest number reported during the dry season, these results are consistent with those of other temperate zone studies. While they were distinct from those from the tropics. These findings could

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help the Ministry of Health develop COVID-19 prevention and control strategies before the rainy season begins. More nationwide studies are needed to understand the relationship between climatic factors and COVID-19 transmission across all parts of the country.

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