INFLUENCE OF CLIMATIC VARIABLES ON COVID 19: how might the proximity of summer affect the pandemic results?

ABSTRACT: The beginning of the summer in the south hemisphere has caused some optimism in the population about the flattening in the curve of new cases of COVID-19, resulting in a population behavior of relaxing the prevention measures against the SARS-CoV-2 outbreak. The present study aims to investigate the relationship among climatic and sociodemographic elements over the pandemic data in a subtropical countryside municipality where the temperatures are becoming high by the proximity of the summer. Data about confirmed cases of COVID-19 were obtained in the daily bulletins from the Municipal Health Secretariat and climatic data were obtained from the local meteorological station. Spearman correlation analyses were performed for verifying the relationship between daily average values of temperature, relative air humidity and wind speed with recorded cases of COVID-19. Most of infected people (41.8%) live in the downtown, which is the main trade area and presents high movement of people in the municipality, being it classified as a super spread region of SAR-CoV-2. The statistical correlations between daily cases of COVID-19 and the climatic variables were revealed as not significant. Thus, the summer climatic conditions probably will not flatten the pandemic curve as it has been waited for many people.
KEYWORDS: Coronavirus; climatic correlation; SARS-CoV-2

INFLUÊNCIA DAS VARIÁVEIS CLIMÁTICAS SOBRE A COVID 19: como a proximidade do verão pode afetar os resultados da pandemia?

RESUMO: O início do verão no hemisfério sul tem causado certo otimismo na população quanto ao achatamento da curva de novos casos de COVID-19, resultando em um comportamento populacional de relaxamento das medidas de prevenção ao surto de SARS-CoV-2. O presente estudo tem como objetivo investigar a relação entre elementos climáticos e sociodemográficos sobre os dados pandêmicos em um município interiorano subtropical onde as temperaturas estão aumentando com a proximidade do verão. Os dados sobre o número de casos confirmados de COVID-19 foram obtidos nos boletins diários da Secretaria Municipal de Saúde e os dados climáticos foram obtidos na estação meteorológica local. Análises de correlação de Spearman foram realizadas para verificar a relação entre os valores médios diários de temperatura, umidade relativa do ar e velocidade do vento com os casos registrados de COVID-19. A maioria dos infectados (41,8%) mora no centro da cidade, principal área de comércio e com grande movimentação de pessoas no município, sendo classificado como região de super dispersão do SAR-CoV-2. As correlações estatísticas entre os casos diários de COVID-19 e as variáveis climáticas revelaram-se não significativas. Portanto, as condições climáticas do verão provavelmente não irão achatar a curva pandêmica como tem sido esperado por muitas pessoas.
PALAVRAS-CHAVE: Coronavírus; correlação climática; SARS-CoV-2

INFLUENCIA DE LAS VARIABLES CLIMÁTICAS EM COVID-19: ¿cómo podría afectar la proximidad del verano a los resultados de la pandemia?

RESUMEN: El inicio del verano en el hemisferio sur ha provocado cierto optimismo en la población sobre el aplanamiento en la curva de nuevos casos de COVID-19, resultando en un comportamiento poblacional de relajar las medidas de prevención frente al brote de SARS-CoV-2. El presente estudio tiene como objetivo investigar la relación entre los elementos climáticos y sociodemográficos sobre los datos pandémicos en un municipio de campo subtropical donde las temperaturas se están volviendo altas por la proximidad del verano. Los datos sobre casos confirmados de COVID-19 se obtuvieron en los boletines diarios de la Secretaría Municipal de Salud y los datos climáticos se obtuvieron de la estación meteorológica local. Se realizaron análisis de correlación de Spearman para verificar la relación entre los valores medios diarios de temperatura, humedad relativa del aire y velocidad del viento con los casos registrados de COVID-19. La mayoría de las personas infectadas (41,8%) vive en el centro de la ciudad, que es la principal zona comercial y presenta un alto movimiento de personas en el municipio, siendo catalogado como una región de superdifusión de SAR-CoV-2. Las correlaciones estadísticas entre los casos diarios de COVID-19 y las variables climáticas se revelaron como no significativas. Por lo tanto, las condiciones climáticas del verano probablemente no aplanarán la curva pandémica como se ha esperado por muchas personas.
PALABRAS CLAVE: Coronavirus; correlación climática; SARS-CoV-2

INTRODUCTION

The probable origin of SARS-CoV-2 is from the wild fauna negotiated in the Huanan market in Wuhan, southeast of China, where the first cases of COVID-19 were recorded in November of 2019[1,2], since then the virus has been spread worldwide[3, 4].

International efforts have been promoted for investigating the biological characteristics of the SARS-CoV-2 and the influence of social and environmental traits on its spread[5, 6]. Many researchers have investigated the influence of gender[7], climate conditions[8, 9], people agglomeration rates and social classes[10,11] over the COVID-19 pandemic, thus social and environmental investigations about the pandemic in different localities contribute for evaluating the previous results about it and presenting how they can be applied in other regions with particular sociodemographic and climatic traits.

The non-pharmacological interventions, such as the use of face masks, the right sanitation of hands and surfaces and the compliance with distance and social isolation measures seems to be the best manner for avoiding the virus dissemination and prevent the pandemic of COVID-19[12]. However, the beginning of the summer in the south hemisphere has caused some optimism in the population about the flattening in the curve of new cases of COVID-19, resulting in a population behavior of relaxing the prevention measures against the SARS-CoV-2 outbreak. Thus, there is the need of investigating the relationship among climatic and sociodemographic elements over the pandemic data in a subtropical countryside municipality where the temperatures are becoming high by the proximity of the summer. Here are presented the local pattern of geographic distribution of confirmed cases of COVID-19 and data about the correlation between climatic variables (temperature, relative air humidity and wind speed) and daily records of COVID-19 in a subtropical Brazilian municipality in a period of 168 days, since the first record of a local patient infected by SARS-CoV-2.

MATERIAL AND METHOD

Study locality

The study was performed in São Luiz Gonzaga (28º24'30"S, 54º57'39"W), south of Brazil. The city presents the Human Development Index of 0.741, around 35,000 habitants, 15% of them are more than 60 years old[13,14]. According to Köppen classification, the region climatic characteristics are *cfa*: hot and dry summers and cold and wet winters. The downtown area is where the biggest supermarkets and churches are located, as well as the banks, stores, drugstores, hospital and schools, which are pointed as super spreading places[15].

Data collection

Data about the numbers of confirmed cases of COVID-19 in the municipality were obtained in the daily bulletins from the Municipal Health Secretariat and climatic data were obtained from the local meteorological station.

Statistical analysis

Statistical analysis were performed in the software Past v. 3.14[16]. Spearman correlation analyses were performed for verifying the relationship between average values of temperature, relative air humidity and wind speed (independent variables) with daily cases of COVID-19 recorded in the municipality (dependent variables). For the climatic data employed in the statistical analyses were considered the daily averages of the seventh day before each recorded case of COVID-19 due to viral incubation period[17], which can delay the diagnose. Weekly average values of temperature were also calculated and correlated with the total number of COVID-19 cases recorded in the period. It was considerate a confidence level of 95% ($p<0.05$).

RESULTS

The first case of COVID-19 in the municipality was recorded in May 4th, since then there was a daily average of three new cases, totalizing 331 in October 19th. However, in three moments 13 or more patients were daily diagnosed with COVID-19, at those moments the average temperatures were between 19.5 and 29.5°C, air relative humidity levels between 45 and 64.5% and the wind speed between 15.8 and 19.8 km/h. The most of infected people (41.8%) live in downtown, which is the main trade and crowded area in the municipality where dozens of people walk around every day. The remaining 58.2% of COVID-19 cases are homogeneously recorded in 23 other municipal districts.

The statistical correlations between daily cases of COVID-19 and the average values of temperature, relative air humidity and wind speed (FIG. 1a-c) were revealed as not significant, as noticed for the weekly values measured (FIG. 2).

FIGURE 1: Spearman correlation analyses between average values of temperature (a), air relative humidity (b) and wind speed (c) – grey area – with daily cases of COVID-19 – black line. *: 27 cases of COVID-19 daily recorded. Data recorded for 168 consecutive days.

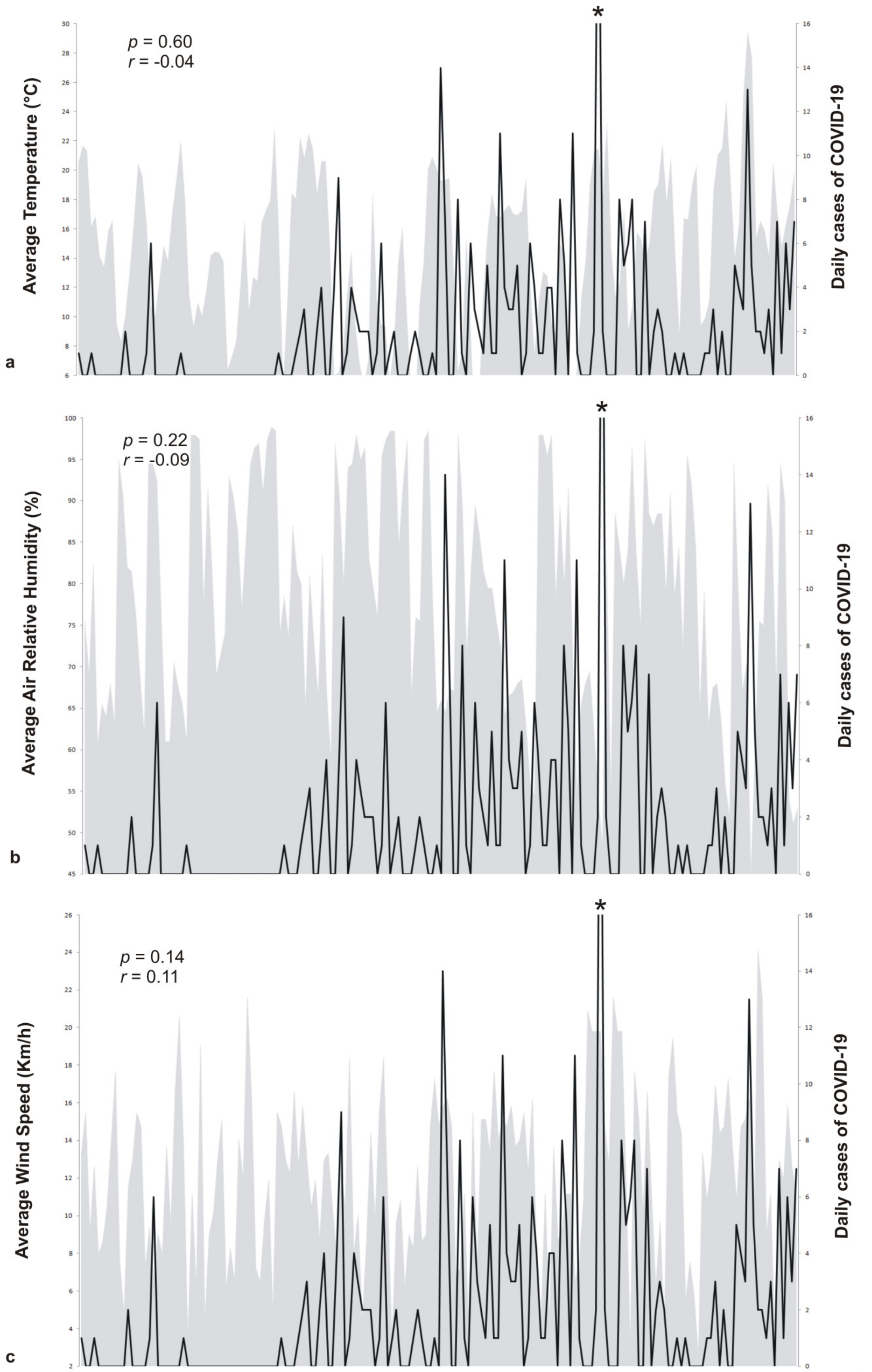
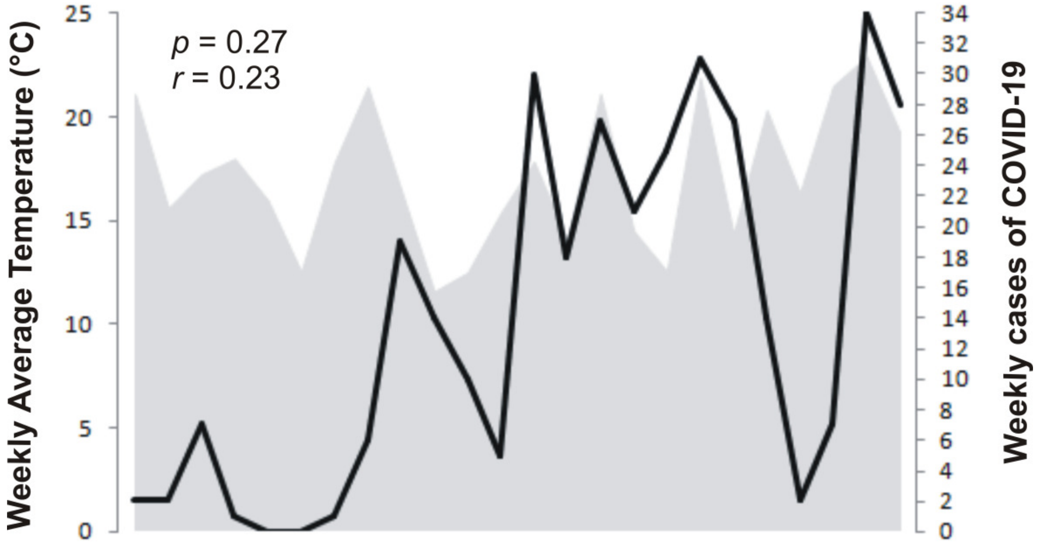

p = 0.60
r = -0.04
Average Temperature (°C)
Daily cases of COVID-19
a
p = 0.22
r = -0.09
Average Air Relative Humidity (%)
Daily cases of COVID-19
b
p = 0.14
r = 0.11
Average Wind Speed (Km/h)
Daily cases of COVID-19
c

FIGURE 2: Spearman correlation analyses between weekly average values of temperature (grey area) with the total number of COVID-19 cases recorded in the period (black line).



DISCUSSION

The influence of climatic variables such as temperature and air relative humidity is widely known over the respiratory viruses[18, 19, 20]. Nevertheless, it is almost impossible to standardize the influence level of different variables, such as climate and people behavior, over the SARS-CoV-2 spread, once the process health-disease is a complex interaction among many factors[21], that is, the number of recorded daily cases of COVID-19 is a multifactorial interaction among individual and collective traits including environmental, economical, behavioral, physiological and immunological aspects[22, 23, 24], which makes hard to standardize the data about COVID-19 pandemic for comparisons among localities worldwide[15].

Social agglomerations and climatic conditions are among the factors that can contribute for spreading the SARS-CoV-2 and increasing the number of infected people[8, 9, 25, 26]. However, the compliance of non-pharmacological interventions seems to be the main factor contributing for flattening the epidemic curve and mitigating the viral impacts on public health[27,28]. Considering that SARS-CoV-2 is transmitted by air along with aerosol particles[29,30], agglomeration in closed and poorly ventilated places increases the contamination indexes in some localities[31], as in trading areas similar to the downtown region in the investigated municipality. In countries like China where the populational isolating was strictly adopted, the viral spread rates have been significantly reduced[17].

Some authors indicate a relationship between climatic variables, especially low temperatures, and the increase in the number of people infected by coronavirus[32,33,34,35]. On the other hand, climatic conditions also can affect the social behavior, that is, while the high temperatures favor crowds at fairs and pubs, the low temperatures can keep people in close and sometimes also poorly ventilated spaces, as it has been noticed in several Brazilian cities. In some Brazilian northern warm cities the population contamination rates were also high[36,37,38], which may reflect social behavior, such as agglomeration or other sociodemographic indicators in the SARS-Cov-2 outbreak. However, the incubation period of coronavirus can hide the climatic variables influence on the pandemic data, since the symptoms of COVID-19 have been revealed as diverse and some people can also be asymptomatic[17], which can cause some delay for updating the local statistics of COVID-19, consequently it is able to cause some interference in the results about association between the climate conditions and the spread levels of SAR-CoV-2, furthermore, some results just can be noticed in datasets larger than one employed in the present study.

CONCLUSIONS

The summer high temperatures, as well as the air relative humidity levels and the wind speed, are not able to flatten the curve of COVID-19 cases as many people are waiting for, since the correlations among climatic variables and the numbers of recorded cases of COVID-19 were not significant. Highlighting the importance of non-pharmacological interventions being maintained by people, such as the use of face masks, the right sanitation of hands and surfaces and the social distance measures, once the most cases of COVID-19 were recorded in the downtown area where there are most people daily walking and working, being it identified as a super spreading region of SARS-CoV-2 in the investigated municipality.

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