Original Article

Epidemiological analysis of COVID-19 and dengue amidst a pandemic scenario in Palmas-TO

Análise epidemiológica da COVID-19 e da dengue em meio a cenário pandêmico em Palmas-TO

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ABSTRACT: INTRODUCTION: COVID-19 is caused by the novel coronavirus SARS-CoV-2. Dengue is an arbovirosis with symptoms similar to those of COVID-19, and these diseases are therefore confusing and may be overlooked. OBJECTIVES: To analyze cases of Dengue virus and COVID-19 infections in Palmas-TO. METHODOLOGY: We conducted a descriptive quantitative study with secondary data on Dengue and COVID-19 in Palmas-TO, in 2020 and 2021. RESULT: The incidence of COVID-19 was 130 cases/1000 inhabitants and that of dengue was 3,28 cases/1000 inhabitants. The incidence was higher in the age group 20 to 59 years. The mortality for COVID-19 was 1.6 deaths/1000 inhabitants and the lethality was 0.98%. DISCUSSION: The highest number of confirmed cases of COVID-19 in Palmas-TO occurred in August 2020 and March 2021, despite six months of difference and policies adopted to contain the pandemic. In the period of higher incidence of COVID-19, there was a lower number of cases of dengue, probably due to underreporting, which is in line with studies conducted in other municipalities. The analysis of concomitant cases of the two diseases is important to understand the correlation between them. FINAL CONSIDERATIONS: The findings allow an evaluation of the endemic profile of dengue amidst the COVID-19 pandemic, as well as an analysis of the circulation of the two viruses, diagnoses, and reports.

Keywords: SARS-COV-2; Coronavirus; *Aedes aegypti*.

RESUMO: INTRODUÇÃO: A COVID-19 é causada pelo novo coronavírus SARS-CoV-2. A dengue é uma arbovirose com sintomas semelhantes à COVID-19 e, portanto, são doenças que geram confusão e podem ser negligenciadas. OBJETIVOS: analisar casos de infecções pelos vírus da Dengue e de COVID-19, em Palmas-TO. METODOLOGIA: Realizou-se um estudo quantitativo descritivo com dados secundários de Dengue e COVID-19, em Palmas-TO, em 2020 e 2021. RESULTADO: A incidência de COVID-19 foi de 130 casos/1000 habitantes e a de dengue foi de 3,28 casos/1000 habitantes, maior na faixa etária de 20 a 59 anos. A mortalidade por COVID-19 foi de 1,6 óbitos/1000 habitantes e, a letalidade, 0,98 %. DISCUSSÃO: Os maiores números de casos confirmados de COVID-19 em Palmas-TO ocorreram em agosto de 2020 e em março de 2021, mesmo com seis meses de diferença e políticas adotadas para contenção da pandemia. No período de maior incidência de COVID-19, a dengue teve registro de menor número de casos, provavelmente por subnotificação de casos da dengue, que corrobora com estudos em outros municípios. A análise de casos concomitantes das duas doenças é importante para entender a correlação entre elas. CONSIDERAÇÕES FINAIS: Os achados do estudo permitem avaliar o perfil endêmico de dengue em meio à pandemia por COVID-19, bem como analisar a circulação dos dois vírus, diagnósticos e notificações.

Palavras-chave: SARS-COV-2; Coronavírus; *Aedes aegypti*.

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INTRODUCTION

COVID-19 is a disease caused by the new coronavirus called SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2)[1]. Among the symptoms of the pathology, there are cough, fever, runny nose, difficulty breathing, and sore throat. Transmission occurs through direct or indirect contact between a sick person and an uninfected person through sneezing, and droplets of saliva, among other secretions[1,2]. The new coronavirus was detected on December 31, 2019, in Wuhan, China, and on January 30, 2020, the WHO declared the epidemic an international emergency[3].

Coronaviruses are enveloped positive-stranded RNA viruses. They cause respiratory infections in a wide variety of animal species, including humans, monkeys, domestic cats, ferrets, hamsters, dogs, raccoons, and bats. Bats are believed to harbor the precursors of SARS-CoV and therefore are the natural reservoir of the virus[1,4,5].

Dengue is an arbovirus and one of the main public health challenges in the world. It is transmitted by the bite of Aedes aegypti and Aedes albopictus mosquitoes and its etiological agent is the virus of the Flavivirus genus and the Flaviviridae family, which is a single-stranded enveloped RNA virus with four serotypes: DENV-1, DENV-2, DENV-3, and DENV-4[6].

In Brazil, the first recorded dengue epidemic was confirmed in the laboratory and clinically, occurred in 1981-1982 in the state of Roraima[7]. Since then, this pathology has spread throughout the national territory, so that, in 2008, its incidence was approximately 800 cases per 100,000 inhabitants. In 2020, 10,525,795 cases were recorded in Brazil[7].

In Palmas, the capital of the state of Tocantins, there is a high prevalence of dengue, 522.2 cases per 100 thousand inhabitants, while in Brazil, the prevalence is 26.3 cases per 100 thousand inhabitants, which makes evident the need for attention and studies on the epidemiology of the disease, in addition to causes and consequences in the population and in the municipal health system[8].

Thus, the objective was to evaluate cases of infections by the Dengue virus and SARS-CoV-2 in the midst of the COVID-19 pandemic in Palmasl, the capital of Tocantins, focusing on the prevalence of cases in relation to sex, deaths and prevention strategies adopted from March 2020 to May 2021.

METHODS

A descriptive quantitative study was carried out with secondary data of records of COVID 19 and dengue from 2020 to 2021 and the municipality of Palmas, state of Tocantins, was the unit of analysis. The study was carried out at the Tocantins State Department of Health (SES-TO), specifically through data collection using the Computerized System of Epidemiological Surveillance of Communicable Diseases of the Ministry of Health and information provided by the Management of Surveillance of Arboviruses, as well as data provided by the Municipal Department of Health (SEMUS) from information stored in the spreadsheets generated through the collection of data in the Computerized System of Epidemiological Surveillance of Communicable Diseases of the Ministry of Health.

The estimated population for the municipality of Palmas was used as the denominator to calculate the incidence coefficient. This estimate was obtained from the Brazilian Institute of Geography and Statistics (IBGE).

As for the data included, they were analyzed in a comparative way, having, as a reference, the national and international context. In addition, proposals aimed at mitigating these cases were discussed, for example, which preventive measures should be taken in each situation. The total number of cases of COVID-19 and Dengue infection from March 2020 to May 2021 was analyzed, considering sex and age group and the number of deaths for this period.

The project was authorized by the Human Research Ethics Committee, CAAE: 39867920.0.0000.5519.

Statistics

The Graph Pad Prism 7® software was used. The Shapiro-Wilk test was used to check normality and comparisons were made between three independent variables by means of analysis of variance (ANOVA). For normally distributed data, the Tukey's posthoc test was used to detect differences between age groups. The level of statistical significance adopted was $p < 0.05$.

RESULTS

In Palmas-TO, the total number of confirmed cases of COVID-19 in the period between March 19, 2020, and January 2021, was 21,430, of which 17,204 occurred in the 20-59 age group and 11,533 were female. In the period from January 2021 to May 18, 2021, there were 18,579 cases, of which 14,317 affected the 20-59 age group and 9,940 were female. Thus, the confirmed cases of COVID-19 in the city of Palmas-TO were predominantly in the age group of 20 to 59 years and affected significantly the female sex (Figure 1; Figure 2).
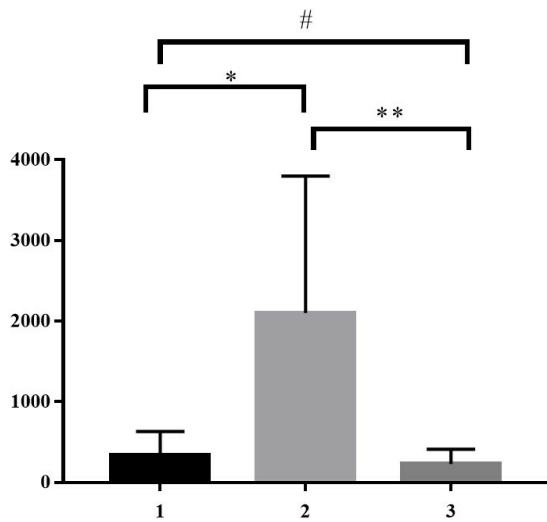
It is important to note that, during this period, in Palmas-TO, there were only cases of dengue caused by the DENV1 virus.

Thus, considering the stipulated period, the incidence of COVID-19 was 130 cases per 1000 inhabitants and the incidence of dengue was 3,28 cases per 1000 inhabitants. The total number of inhabitants of the municipality of Palmas-TO estimated by the IBGE in the year 2020 was used for this calculation, totaling 306,296 inhabitants.

Figure 1- Number of confirmed cases of COVID-19 by age group in Palmas-TO. Age group 1: 0-19 (average of 339,1); Age group 2 (average of 2.101): 20-59; Age group 3: 60 or more (average of 226,8) *; **; # significant differences between groups.
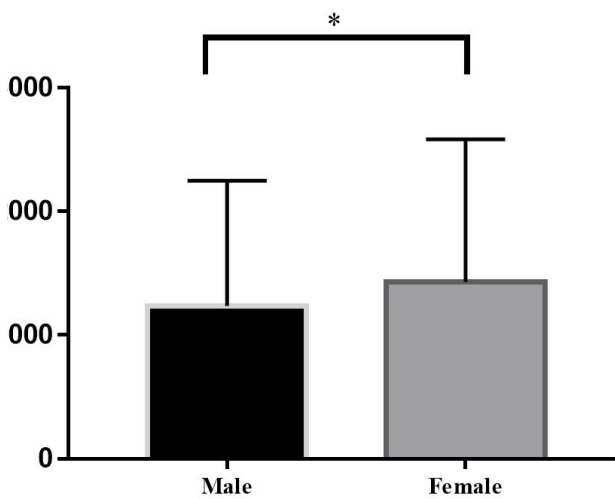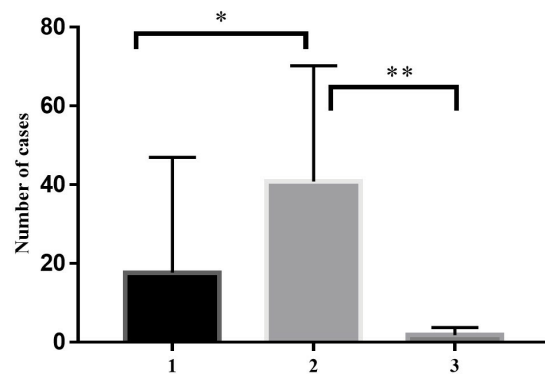

Figure 3- Number of confirmed cases of dengue by age group in Palmas-TO, from March 19, 2020, to May 2021. Age group 1: 0-19 years (average of 17,67 years); Age group 2: 20-59 years (average of 40,80 years); Age group 3: 60 years or older (average of 1,80). *; ** significant difference between groups.
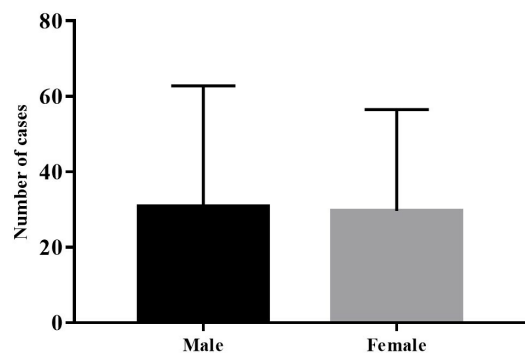

Figure 2- Number of confirmed cases of COVID-19 by sex in Palmas-TO, from March 19, 2020, to May 18, 2021. * significant difference between the sexes (average of 1236 and 1432 respectively).

Figure 4- Number of confirmed cases of dengue by sex in Palmas-TO, from March 19, 2020, to May 2021 (average of 30,67 and 29,6 respectively).

The total number of confirmed cases of dengue in the municipality from March 2020 to December 2020 was 400, of which 303 occurred in the 20-59 age group and 255 in females. From January 2021 to May 2021, 504 cases were recorded, of which 303 occurred in the age group of 20-59 years and 237 in females, and 267 in males. Thus, the cases of dengue predominated in the age group from 20 to 59 years (Figure 3), similarly to the cases of COVID-19, and no significant differences were found between cases in females and males (Figure 4).

The number of deaths from COVID-19 between March 19, 2020, and May 18, 2021, in Palmas-TO was 505 in total, with a mortality of 1.6 deaths per 1000 inhabitants and a fatality rate of 0.98%. For dengue, no deaths were recorded in this period.

It is important to emphasize that the number of confirmed cases of dengue increased considerably from 2020 to 2021, since from March 2020 to December 2020,

400 cases were registered, while from January 2021 to May 2021, the total was 504 cases. That is, analyzing the time period of 10 months in 2020 and the period of 5 months in 2021, there was an increase of 26% in the number of cases.

Finally, it was noted that the month with the highest number of confirmed cases of COVID-19, in the analyzed period, was August 2020 with 6,989 cases, while dengue had the highest number of cases in May 2021 with 243 cases (Figure 5).
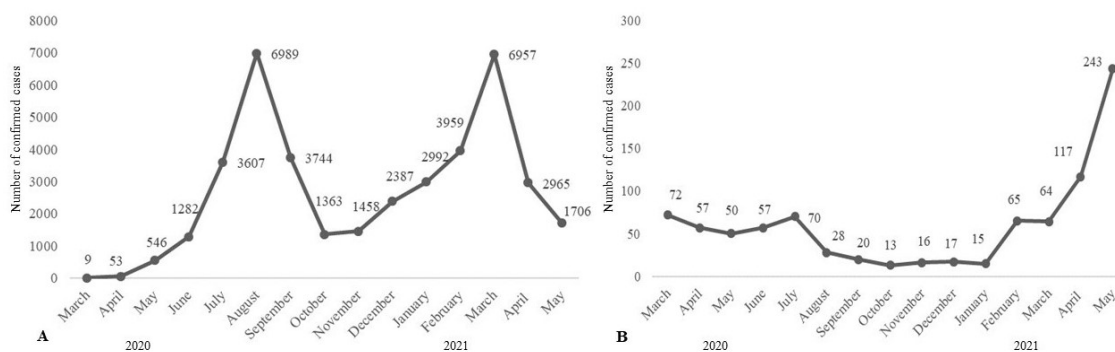

Figure 5- Comparison of the number of confirmed cases of COVID-19 and dengue in Palmas-TO, from March 19, 2020, to May 2021. A) Number of confirmed cases of COVID-19. B) Number of Confirmed Dengue Cases.

DISCUSSION

The concomitant study of COVID-19 and dengue is necessary as they are diseases with similar clinical characteristics and similar laboratory results that need immediate care, depending on the severity. For example, both diseases share clinical signs, such as fever - temperatures greater than 38 ºC -, cough, muscle pain, headache, odynophagia, diarrhea, nausea, and emesis, in addition to laboratory alterations, such as lymphopenia and elevation of transaminases[9]. Another essential point of this research is that, by bringing the study of a capital located in the North of Brazil, several situations can contribute as examples in strategies and interventions for other municipalities in this region.

In addition to this difficulty in differentiating diagnoses, it is believed that preventive actions against dengue, to combat possible breeding sites of the vector, may have been neglected due to the health situation in the country during the COVID-19 pandemic, which restricts the movement and entry of surveillance agents into homes.

In Palmas, the number of dengue cases in the period from March 2020 to May 2021 was 904 cases, with peaks at a time of higher rainfall and a high number of COVID-19

cases (7000 cases), which favors the overload of the public and private health system in the capital, which assists patients in the municipalities of the state of the Tocantins and neighboring states.

In 2020 and 2021, Palmas was adapting to the new pandemic situation, which could overload the health system. In this way, the city had a structure aimed at alleviating the serious situation in the municipality, such as Public Hospitals and Health Units with sentinel units, which were in full activity for hospitalization and collection of biological material, mainly for COVID-19. In addition, vaccination against COVID-19 in Palmas began on January 20, 2021, with the AstraZeneca and Coronavac vaccines and took place in four phases, as determined by the preliminary version of the National Vaccination Plan against Covid-19 (released on 12/01/2020), the first being composed of the main priority groups: health workers, elderly people over 75 years of age, people aged 60 years or older living in long-stay institutions and the indigenous population[10].

An important point to be discussed is that, based on the results presented in Figure 5, it is noted that, in the period of the highest incidence of COVID-19 in 2020, dengue had a lower number of cases, which may

be explained by the lack of rain in this period, as well as more time spent at home and, perhaps, greater care with reservoirs that accumulate water. However, the explanation may also be related to the fact that the two diseases have a lot of similarities in the initial symptoms, which may be generating underreporting of dengue cases by COVID-19. In addition, corroborating the hypothesis of difficulty in the differential diagnosis of these diseases and possible underreporting or error in the diagnosis of these pathologies, there is the fact that cough is confirmed in 1 out of 4 patients with dengue, while 1 out of 4 patients with COVID-19 may have fever and muscle pain in the absence of respiratory symptoms[11].

From March to December 2020, the municipality had a mean of 40% of dengue cases, with the highest number of cases in March and July and this is closer to the reality of households, which even with little or no rain, can present breeding sites, since, during the pandemic, in 2020, home visits by endemic agents were suspended, paralyzing prevention actions to combat the vector.

In line with the data from this research carried out in Palmas, a study carried out in Brazil showed a change in the behavior of dengue in 2020 compared to previous years, making a noticeable reduction in the number of reported cases of dengue since the beginning of actions against COVID-19, which led the authors to conclude that there was probably no decrease in the incidence of dengue in Brazil, but underreporting of cases, due to changes in the Control Program and lack of access to care services[12].

Thus, Palmas has presented a situation that is repeated in other municipalities and also outside Brazil. Therefore, observing similar cases helps to understand the correlation between COVID-19 and dengue. In Piauí, for example, a considerable reduction in dengue cases was observed from the first case of COVID-19 and, together with the observation of this abrupt change, emphasis is given to the hypothesis of underreporting of cases in that state, the which was also noticed in the city of Palmas, added to the need for knowledge about co-infection, in which the two pathologies manifest at the same time[13].

In a study by Cardona-Ospina[13], Colombia, two hypotheses were put forward to understand why dengue cases had declined amid the COVID-19 pandemic in the country: (a) coincidence in the seasonal reduction of reports of dengue concomitantly with the growth of COVID-19 cases and (b) viral interference, which is SARS-CoV-2 preventing the entry and replication of DENV (dengue virus), which can be explained due to the high virulence and pathogenicity seen in SARS-CoV-2 infection and the affinity of both viruses for endothelial cells, which may generate competitive inhibition. In addition, the study focused on the possibility of co-infection between them.

Therefore, to solve this challenge, it is necessary to make the differential diagnosis between COVID-19 and dengue in order to reduce the risk of underreporting and to have an idea of the real scenario of dengue[12], which can be done using effective serological techniques. This is essential, as it was found that patients with COVID-19, but with false-positive results for dengue through a rapid test, presented the infection in a more severe way, causing specific therapeutic care for the patient to be delayed[13].

Thus, as shown in Figure 5, in May 2021, Palmas-TO had the highest number of confirmed cases of dengue within the analyzed period, which was in line with what occurs in the national territory, since, in Brazil, it is common there is an increase in the number of dengue cases in the months of April and May, as a result of high temperatures and increased rainfall, providing a suitable environment for the vector to reproduce[13,14]. Another problem in Palmas is that many outbreaks of the *A. aegypti* mosquito are inside homes in places such as water tanks, plant pots, swimming pools, and even animal drinking fountains. Therefore, attention needs to be paid in these months, both in terms of controlling dengue and differentiating it from COVID-19 cases or evaluating co-infection.

The highest numbers of confirmed cases of COVID-19 in Palmas during the period evaluated occurred in August 2020 and March 2021, that is: even with six months of difference and policies adopted to contain the pandemic, the number of cases remains approximately the same in these two months, with 6,989 cases in May 2020 and 6,957 cases in March 2021. In view of this and in line with other studies, it is suggested that the main causes are: the emergence of virus variants; the inability of the population living in poverty to follow prevention recommendations due to lack of resources; the decrease in Brazilian vaccination coverage in recent years; and the lack of preventive measures[15,16].

It is necessary to pay attention to the fact that several regions of Palmas are economically vulnerable, which means that, due to the precarious conditions in which the residents of these locations live, it is often not possible to wash hands and clean and sanitize the residence ideally due to lack of access to clean water and optimal disinfectants and basic sanitation conditions. In addition, in an overcrowded house, it is difficult to maintain a safe distance between residents[15]. In turn, the decrease in vaccine coverage against COVID-19 occurs due to the reduction of knowledge of risk of diseases; an increase in political, social, and economic imbalances; logistics problems; and increase in the number of people who refuse to vaccinate, since false information about vaccines is being spread, resulting in the decrease of demand for immunization in the basic network of SUS due to the pandemic[16].

Palmas-TO had the highest number of COVID-19 cases in the 20-59 age group, as it is a group with the largest number of people who frequent bars, malls and may have greater face-to-face work commitments, in accordance with the study carried out by FIOCruz, which, when comparing data from epidemiological week 1 (January 3 to 9) and

epidemiological week 20 (May 16 to 22), showed an increase of 172.22% in the number of COVID cases -19 among people aged between 20 and 29 years[17]. Still, in relation to dengue, the reality of the municipality of Palmas also reflects the reality of Brazil when it comes to the age group and sex with the highest incidence of dengue, since, according to the Ministry of Health, it is concentrated in 20-59 years group, being predominant between 20-29 years, between epidemiological weeks 1 and 53[17,18].

In addition, it is important to understand and evaluate the correlation between COVID-19 and dengue and its symptoms and to observe studies that show how these diseases are related to the extent that one interferes with the symptomatology and mortality of the other. Two studies demonstrate this hypothesis: one, carried out by the University of São Paulo, which concluded that a person who has already had a previous dengue infection is twice as likely to be symptomatic of COVID-19[19]; and another, carried out in the Amazon region, which analyzed 2,351 people in order to correlate dengue and mortality from COVID-19 and which presented, as a conclusion, the fact that patients who had symptomatic dengue before COVID-19 had a lower risk of death from COVID-19[19].

To analyze globally, a study on dengue and COVID-19 in Asian countries, dengue-endemic regions, found the existence of simultaneous outbreaks of COVID-19 and dengue, which has also challenged the health systems of these places due to the difficulty of diagnosis and specific treatments at this time of the pandemic, as well as the effectiveness of serological tests as a differential diagnosis, since cross-reactivity between DENV and SARS-CoV-2[20] serology tests has been documented.

Consequently, it is important to develop strategies that promote the control and elimination of dengue vector foci. In Brazil, in addition to eliminating sources of standing water, it is essential to keep sealed containers, in addition to health education and population awareness through educational programs that are carried out in the country[21]. Another issue is that the control of this pathology cannot be effectively carried out through vertical programs, since it involves issues related to the conditions and life experiences of the communities, which commonly translate into social exclusion and, therefore, it needs to add to qualitative studies that address the beliefs, attitudes, and representations of the population[21].

Examples contrary to these measures occurred in French Guiana, where the only mosquito control measure was sprayed deltamethrin insecticide using vehicles in the neighborhoods (even in a scenario of generalized resistance to insecticides); interventions in households to destroy larvae and to detect breeding sites or to carry out indoor spraying no longer takes place in this region. Added to this, there was a very large reduction in the maintenance of public spaces and gardens and in the collection of water containers [20,21].

All of this undoubtedly has the potential to favor the dengue vector, *A. aegypti*. This situation deserved attention, because, in order to reduce the outbreak of dengue in the time of a pandemic by COVID-19 and coinfection, these precautions should be resumed, since dengue should not be neglected in times of a pandemic.

LIMITATIONS OF THE STUDY

The requested data on deaths from dengue, by sex and age group, were inaccurate in the database of the Tocantins State Department of Health and, therefore, they were not compared.

CONCLUSION

The findings of the study allow us to assess the endemic profile of dengue amidst the COVID-19 pandemic, as well as analyze the circulation of the two viruses, the diagnoses, and the reports. In view of this, control and prevention actions, as well as the development of outbreak investigation strategies are essential to avoid false information and poor adherence to prevention processes. It is, thus, necessary to encourage the differential diagnosis, the continuation of the studies on the correlation between them to verify if there is a viral intervention, and the intensification of prophylactic measures against dengue and COVID-19, paying attention to the possibility of co-infection.

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