

Comparative analysis of the incidence of enteroparasitosis and the COVID-19 pandemic profile in the city of Bananeiras - PB

Análise comparativa da incidência de enteroparasitoses e do perfil pandêmico da COVID-19 na cidade de Bananeiras - PB

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Abstract

Enteroparasitosis are diseases caused by parasitic agents present in the environment and in the gastrointestinal tract of living beings. In addition, they are still considered neglected diseases, but of great importance for public health, especially when they are related to secondary infections and currently their co-infection profile with COVID-19. The interaction of protozoa and/or helminths with the SARS-CoV-2 virus is timely and its signs and symptoms are confused with other pathogen relationships. In this way, this study aims to correlate the incidence of enteroparasitosis and COVID-19, in the pandemic period from 2020 to April 2022. This is a documentary and exploratory study of secondary data from laboratory tests of patients who were treated and diagnosed with COVID-19 and enteroparasitosis at Hospital Doutor Cloves Bezerra Cavalcante, Municipal Hospital of Bananeiras, Paraíba, Brazil. In the analysis of the database, a significant increase of approximately 48.85% in the incidence of COVID-19 cases from 2020 to 2021 stands out, remaining high until 2022. In contrast, cases of enteroparasites peaked at 48.74% in 2021, followed by an average reduction of 23.12%, with a deviation of 1.49%, in relation to the years 2020 and 2022. It was concluded that COVID-19 is predominantly associated with an increase in secondary infections, highlighting the crucial need to promote health education, improve basic sanitation and guarantee access to health services as essential components in combating the increase in parasitic infections, especially those related to viral pathologies.

Keywords: Protozoa; Helminths; Host-parasite; Infections secondary; Public health.

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Resumo

As enteroparasitoses são enfermidades originadas por agentes parasitários presentes no meio ambiente e no trato gastrointestinal dos seres vivos. Ademais, ainda são consideradas doenças negligenciadas, porém de grande importância para a saúde pública, em especial, quando estão relacionadas com infecções secundárias e atualmente seu perfil de coinfeção com a COVID-19. A interação de protozoários e/ou helmintos com o vírus SARS-CoV-2 é oportuna e seus sinais e sintomas são confundidos com outras relações de patógenos. Desta maneira, este estudo visa correlacionar a incidência de enteroparasitoses e COVID-19, no período pandêmico de 2020 a abril de 2022. Trata-se de uma pesquisa documental e exploratória, de dados secundários dos exames laboratoriais de pacientes que foram atendidos e diagnosticados com COVID-19 e enteroparasitoses no Hospital Doutor Cloves Bezerra Cavalcante, Hospital Municipal de Bananeiras, Paraíba, Brasil. Na análise da base de dados, destaca-se um aumento significativo de aproximadamente 48,85% na incidência de casos de COVID-19 de 2020 a 2021, mantendo-se elevado até 2022. Em contraste, os casos de enteroparasitoses atingiram um pico de 48,74% em 2021, seguido por uma redução média de 23,12%, com um desvio de 1,49%, em relação aos anos de 2020 e 2022. Conclui-se que a COVID-19 está predominantemente associada ao aumento de infecções secundárias, destacando a necessidade crucial de promover a educação em saúde, melhorar o saneamento básico e garantir o acesso aos serviços de saúde como componentes essenciais no combate ao aumento de infecções parasitárias, especialmente aquelas relacionadas a patologias virais.

Palavras-chave: Protozoários; Helmintos; Parasito-hospedeiro; Infecções secundárias; Saúde pública.

Introduction

Intestinal parasites are one of the biggest public health problems worldwide, with Brazil being one of the underdeveloped countries with the highest rates of human beings diagnosed with enteroparasitosis.⁽¹⁾ In this sense, the main intestinal parasites reported in epidemiological surveys in general are: *Giardia lamblia*, *Entamoeba histolytica/Entamoeba dispar*, *Ascaris lumbricoides*, *Trichuris trichiura*, *Enterobius vermicularis* and hookworms.⁽²⁾

Helminth parasites share a long coevolutionary history with mammalian hosts, and published studies suggest that helminth infections can be beneficial or harmful during viral infection.⁽¹⁾ Helminth infections are associated with an increase in the diversity of the intestinal microbiota and changes in its composition, these changes can increase the susceptibility of humans to acquire some diseases, such as asthma, colitis, viral, bacterial, fungal infections and metabolic conditions.⁽³⁻⁴⁾

Thus, when enteroparasitosis is associated with other infections, it can offer various ways of

trying to clarify parasite mechanisms of action and the escape of the immune system. Currently, this profile of interaction between microorganisms has been reported in COVID-19, especially among the elderly population with chronic chagasic cardiomyopathy.⁽⁴⁾ Thus, this study aims to correlate the incidence of enteroparasitosis and COVID-19, in the pre- and post-pandemic periods (2020 to April 2022) at the Municipal Hospital of Bananeiras, Paraíba (PB), Brazil.

Material and Methods

Type of study

This is a non-probabilistic documentary study carried out in the context of the Doutor Clovis Bezerra Cavalcanti Municipal Hospital, located in the municipality of Bananeiras - PB. The research adopted a descriptive approach, combining quantitative and qualitative methods to analyze data from the medical records of patients who underwent parasitological tests before and after the COVID-19 outbreak.

Data extraction

Data collection took place between July 2020 and December 2022, encompassing all individuals diagnosed as positive for parasites and treated at the hospital during this period. The variables analyzed included parasitological test results and the specific types of parasites identified in the patients.

Statistical analysis

The data was analyzed using tables and graphs drawn up in Microsoft® Office® 2019 and Power BI® software. In the context of descriptive statistics, categorical data was summarized using microscopy, providing a detailed understanding of the characteristics observed in the patients.

Ethical aspects

This study was conducted in accordance with Resolution 510/2016 of the National Health Council, especially Article 1, sole paragraph, Item V, which establishes guidelines for research in the humanities and social sciences. As outlined in this resolution, research based on aggregated databases, in which information is anonymized and impossible

to trace back to specific individuals, was not considered within the scope of the CEP/Conep system, thus minimizing any potential risk to participants.

Results and Discussion

During the field research, which took place between 2020 and 2022, coinciding with the COVID-19 pandemic, the analysis of the data in Table 1 provided revealing insights into the reporting of enteroparasite cases. Routine tests conducted in a clinical laboratory, with emphasis on stool parasitology, highlighted significant variations over these years.

Over the years 2020 and 2022, the analysis of enteroparasite case notifications revealed a consistent trend. In 2020 (n=382), representing of all positive enteroparasite cases, and this proportion remained similar in 2022 (n=250). Both years showed lower incidences only than 2021 (n=696), during which there was a notable peak of cases, equivalent to 48.74% of overall notifications, as detailed in Table 1. This temporal analysis suggests stability in notifications over these years, with notable variations in 2021, indicating the importance of considering factors specific to this period for a more comprehensive understanding of the dynamics of enteroparasite infections.

Table 1 - Statistics of positive and negative parasitological tests between 2020-2022.

Year of notification	Parasitological tests	Positives	Negatives
2020	1037	382	655
2021	1955	696	1259
2022	2500	350	2150
Total	5492	1428	4064

Source: research data, 2023.

Based on the analysis in Table 1, a remarkable phenomenon stands out in the context of the pandemic, revealing an increase of approximately 22% in the parasite positivity rate from 2020 to 2021. This highlights the persistence of these

infections in the midst of the public health crisis. The year 2021 was characterized by a significant variation compared to previous years, returning to constancy around in 2020 (n=350), similar recorded in 2020 (n=382). This observation highlights

the resilience of parasite infections in challenging periods, such as the pandemic, and emphasizes the importance of considering year-specific factors for a more accurate understanding of the dynamics of these infections.

Based on the aforementioned demonstration, it is possible to correlate that the spread of these pathologies is favored by the disorderly growth of urban centers, mainly due to the agglomeration of people and the lack of adequate sanitary resources.⁽⁵⁾ In addition to climate and geographical distribution, the transmissibility of enteroparasitosis depends on human activity and behavior, the

social, cultural and ethnic differences of individuals, as well as the precariousness of water, sewage and food treatment.⁽⁶⁻⁷⁾

The global emergency of the COVID-19 pandemic underlines the crucial importance of international cooperation, adequate preparation of health systems and the essential role played by science during periods of health crises.⁽⁸⁾ When analyzing the relationship between the start of COVID-19 notifications and parasitosis in the city of Bananeiras - PB, a higher positivity was found in the months of July, August, September and December, as shown in Table 2.

Table 2 - Annual notification of COVID-19 in Bananeiras - PB in 2020.

Month of notification	Notifications	%
January	0	0.00%
February	0	0.00%
March	0	0.00%
April	0	0.00%
May	8	2.30%
June	42	12.10%
July	65	18.73%
August	75	21.61%
September	52	15.00%
October	14	4.03%
November	23	6.63%
December	68	19.60%
Total	347	100.00%

Source: research data, 2023.

Table 2, focused on the year 2020, provides a meticulous and in-depth analysis of the data and statistics linked to this specific period of the COVID-19 pandemic. A steady increase in the number of COVID-19 case notifications in the municipality of Bananeiras - PB was unequivocally observed from the start of the second quarter of 2020, according to the records detailed in Table 2. It was noteworthy that in January, at the beginning of the time series, the number of notifications was 0, in

contrast to December (n=68), representing 19.6% of the total notifications of COVID-19 (n=347) cases recorded over the period analyzed, with its highest peak in August (n=75).

In Paraíba (PB), there has been a notable increase in COVID-19 infection rates, particularly among the female population. This contrast highlights the need to assess the underlying factors that may influence these public health trends in different regions.⁽⁹⁾

Table 3 below shows notifications of COVID-19 cases in 2021, providing additional data on the evolution of the pandemic. It was possible to observe an average increase of 8.33% each month, with a variable deviation of 8.5% and the significant presence of COVID-19 in almost every month of 2021, with the exception of February, when no notifications were recorded.

Table 3 - Annual notification of COVID-19 in Bananeiras - PB in 2021.

Month of notification	Notifications	%
January	57	9.76%
February	0	0.00%
March	165	28.25%
April	123	21.06%
May	63	10.80%
June	74	12.67%
July	45	7.70%
August	28	4.80%
September	8	1.36%
October	8	1.36%
November	9	1.54%
December	4	0.70%
Total	584	100.00%

Source: research data, 2023.

Overall, in 2021, the municipality of Bananeiras - PB was marked by the significant presence of COVID-19 case notifications. This period stood out as one of the years with the highest number of cases compared to previous years, totaling 584 records. One of the most pronounced peaks occurred in March, when 165 cases were reported, indicating intense viral activity during this specific period.

According to the research conducted by Araújo (2023), the analysis of parasite rates during the years 2020 to 2022 revealed a notable positive incidence among children and adolescents. In particular, the 2020 data indicated (n=343) positive

cases, a lower number than those observed in this study. However, when we moved on to 2022, there was a significant increase, reaching (n=659) positive cases in the state of Sergipe. It is interesting to note that, although the figures for this study carried out in Bananeiras were lower, both studies report some similar prevalence rates.⁽¹⁰⁻¹¹⁾

The comparison between data from previous years and the period under analysis offers an in-depth view of trends and patterns related to parasitism and COVID-19, which are fundamental for understanding the epidemiological scenario and for formulating effective control and prevention strategies.

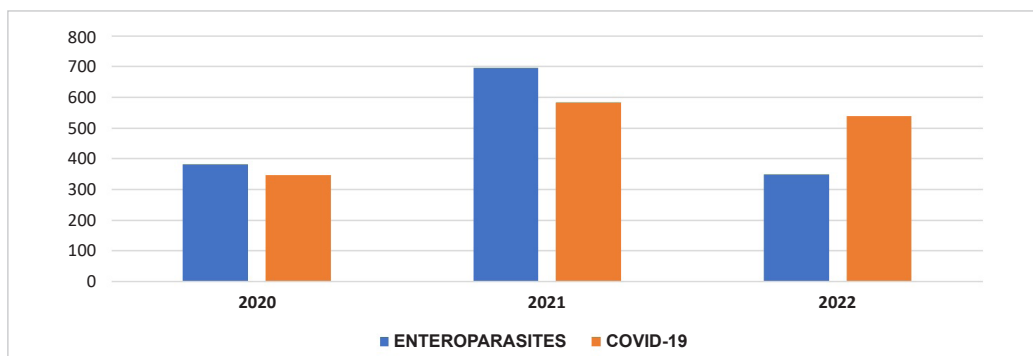
Table 4 - Annual notification of COVID-19 in Bananeiras - PB in 2022.

Month of notification	Notifications	%
January	267	49.44%
February	30	5.55%
March	1	0.18%
April	0	0.00%
May	0	0.00%
June	30	5.55%
July	0	0.00%
August	0	0.00%
September	1	0.18%
October	0	0.00%
November	110	20.40%
December	101	18.70%
Total	540	100.00%

Source: research data, 2023.

Table 4 shows one of the highest rates of COVID-19 notifications, particularly in January, when the municipality of Bananeiras - PB breaks record for number of cases (n=267), representing 49.44% of the total of (n=540) cases recorded in 2022. This significant increase is evident when compared to data from previous years. In 2020, a few cases were recorded (n=347), while in 2021 there was an increase cases (n=584), and in 2022, although there was a decrease compared to the previous year, (n=540) cases were still recorded.

Briefly, a comparative analysis was carried out in relation to 2020 to 2022, focusing specifically on parasitism and COVID-19 notifications. This meticulous evaluation provided crucial data, the results of which are presented in detail in Figure 1. The comparison between data from these years and the period under analysis offers an in-depth view of trends and patterns related to parasitism and COVID-19, which are fundamental to understanding the epidemiological scenario and formulating effective control and prevention strategies.

Figure 1 - Notifications of parasitic infections and COVID-19 in the years 2020 to 2022 in the municipality of Bananeiras - PB.

Source: research data, 2023.

In the scientific context presented in Figure 1, a comparison is made between COVID-19 case notifications and enteroparasite infections during the periods 2020 to 2022. It is noteworthy that, during 2021, there was a notable incidence of enteroparasite cases (n=696). These cases represent approximately 48.73% of all records related to enteroparasites. At the same time, COVID-19 cases amounted to 584 notifications in the same period, corresponding to around 39.70% of all COVID-19-related occurrences. These data suggest a significant incidence of enteroparasites compared to COVID-19 cases during the year under review.

The analysis in Figure 1 shows temporal trends in COVID-19 notifications and cases of enteroparasitosis over the years in Bananeiras. At the start of the pandemic in 2020, there was a significant increase in COVID-19 cases (n=347), representing 23.55% of all occurrences recorded during that year. In comparison, there were (n=382) cases of enteroparasites, corresponding to 26.75% of all notifications.

However, when we move on to 2022, we see a reversal in the figures. COVID-19 had (n=540) notifications, representing 36.66% of all cases, indicating an increase and continuation of the high incidence seen in 2021. On the other hand, enteroparasitosis registered (n=350) notifications, representing 24.51% of cases, showing a decline in relation to the peak observed in 2021, but still remaining at relatively high levels.

This temporal analysis suggests that, from 2020 onwards, COVID-19 cases and enteropara-

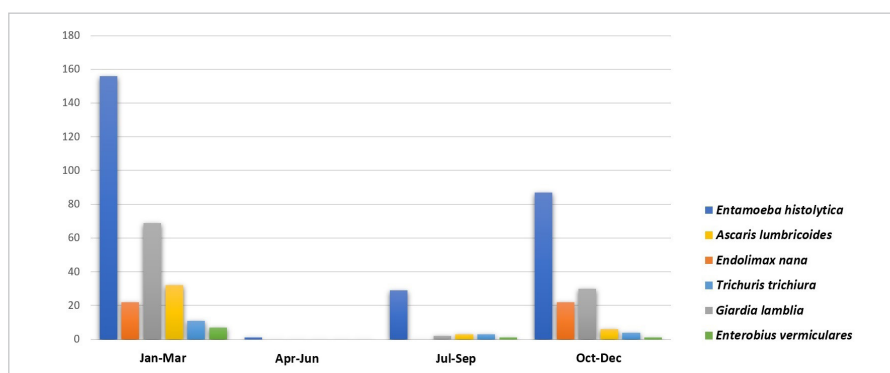
sitosis were correlated, showing a joint evolution. However, in 2022, there was a persistent increase in COVID-19 cases, while enteroparasitosis experienced a decline and followed a similar metric to that observed in 2020. This dynamic underscores the importance of understanding the temporal variations and interactions between different pathologies for a more effective public health approach.

Epidemiological studies of intestinal parasitosis in Brazil suggest that the number of infected people remains high, taking into account research carried out between 2010 and 2020 to 371,371,000 cases and hospitalizations for parasitic diseases throughout the Brazilian territory by DATASUS, comparing the cases of COVID-19 from 2019 to 2023 reached 37,487,971 by the Ministry of Health by the data of the single health system -SUS.⁽¹²⁻¹³⁾

In this study, common parasitoses were found from a group of diseases caused by parasites that affect a large number of people around the world. Infections are common and can negatively affect public health. Among the types of parasites are protozoa: *Entamoeba histolytica*, *Endolimax nana*, *Giardia lamblia*, as well as helminths: *Ascaris lumbricoides*, *Trichuris trichiura*, *Enterobius vermiculares* (Figure 1).

Figure 2 shows the rates of spread of enteroparasites in Bananeiras - PB throughout 2020. This graph provides a detailed analysis of the spread of these parasites, offering crucial information about their prevalence and dynamics in the region during this specific period.

Figure 2 - Propagation rate of protozoa and helminths in 2020 every 3 months in Bananeiras - PB.

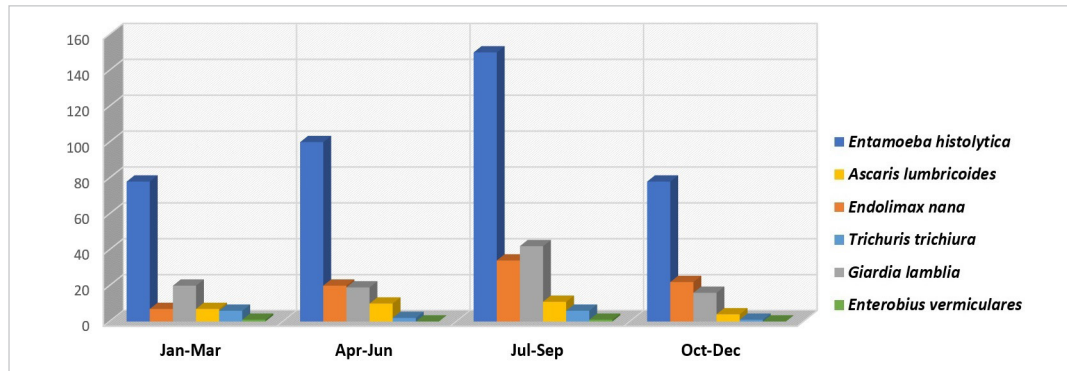


Source: the authors.

When analyzing the year 2020 in Figure 2, it is possible to identify in the graph the representation of the species *Entamoeba histolytica* (31.89%). This highlights the continued need to monitor and address these parasites, as they represent a significant concern for the health and well-being of the population of Bananeiras.

In the analysis, Figure 3 shows the parasite profile for the year 2021. The data shows a significant increase in the presence and notification of parasitic cases compared to the previous year. This substantial increase highlights an increase in the incidence of parasitosis during 2021, indicating an important change in the epidemiological scenario.

Figure 3 - Graph of the spread of protozoa and helminths in 2021 every 3 months in Bananeiras - PB.

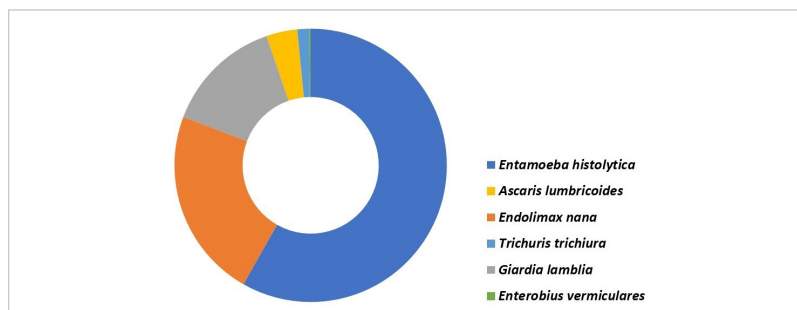


Source: the authors.

Figure 3 shows a investigation into the increase in parasitic cases, revealing an increase in the occurrences of *Entamoeba histolytica*. Particularly notable is the significant increase when comparing the incidences of *Endolimax nana* and *Giardia lamblia* with the previous table. With regard to helminths, there was a notable increase in cases related to *Ascaris lumbricoides*. *A. lumbricoides* is one of the most common parasitic worm species affecting humans, with a significant global distribution. This organism parasitizes the human gastrointestinal tract and can cause various health complications.⁽¹⁴⁾

Next, as shown below, Figure 4 provides a detailed analysis of the presence of protozoa in samples collected from individuals in the geographical region, covering various time periods. This graph provides essential information on the prevalence of various intestinal protozoa, highlighting notable species. The visual representation allows for the identification and understanding of fluctuations in the presence of these protozoa over time, offering valuable data on seasonal patterns, possible outbreaks, or changes in geographical distribution.

Figure 4 - Spread of protozoa and helminths in 2022 in the municipality of Bananeiras - PB.



Source: the authors.

Figure 4 highlights crucial information on the prevalence of various intestinal protozoa, providing a detailed perspective on the distribution of these microorganisms in the population. Notably, there is a significant incidence of *Entamoeba histolytica* (n=333). *Giardia lamblia* is also mentioned, with 80 notifications, while *Trichuris trichiura* has 8 notifications, among other species.

The most common parasites in the COVID-19 co-infection group were protozoa, such as *Giardia* spp. and intestinal worms, and helminths, such as dwarf tapeworms, schistosomes and roundworms.⁽¹⁵⁻¹⁶⁾ The relationship between the parasite and the COVID-19 virus is related to the parasite's ability to interfere with the body's immune system, favoring the modulation of the immune response.⁽¹⁷⁾ In this way, co-infection will provide the body's tolerance to invaders through a balance between pro-inflammatory and anti-inflammatory responses.⁽¹⁸⁻¹⁹⁾

Thus, the pathophysiology of infectious diseases caused by protozoa and viruses involves an unregulated production of cytokines during the inflammatory process.⁽²⁰⁾ The cytokines released will generally come from both Th1 and Th2 immune responses. IL-2 released by Th1 lymphocytes promotes the activation of B lymphocytes and the proliferation of T cells, a mechanism seen in both parasites. The IL-4 and IL-5 produced by Th2 lymphocytes induce the production of IgE, which in turn allows the degranulation of mast cells and basophils, with the release of histamine, chemotactic factors for eosinophils and neutrophils, as well as inducing immediate hypersensitivity reactions, which favors the manifestation of parasites.⁽²¹⁾

The specific quantification of notifications for each species of protozoan allows for a more detailed understanding of the distribution of these microorganisms in the population studied. In addition, the emphasis on specific species highlights parasite diversity, contributing to a more refined understanding of the epidemiological and clinical characteristics of these infections during the year 2022.

An important approach to understanding the dynamics of parasitic infections is the annual analysis of the prevalence of parasites in human stool samples. As this data provides important information about the distribution of these microorganisms, it helps researchers and public health professionals to create better methods of prevention, diagnosis and treatment. Furthermore, the identification of epidemiological trends depends on this scientific contextualization. This allows for a more effective response to the control of parasitic diseases and, as a result, improves the health of the community studied.

The research highlighted the need for an integrated approach to health, considering the general context of parasitic infections and their impact on the health of the population. In doing so, it is possible to improve the prevention, diagnosis and treatment of enteroparasitosis, contributing to a healthier and more resilient society.⁽¹³⁾

Conclusion

Analysis of prevalence trends over the study period revealed significant variations, with peaks at certain times and in certain regions, indicating that enteroparasitosis is not an underestimated public health problem. In the period from 2020 to 2021, there was a steady increase, representing 23.12%, with a deviation of 1.49%, of the total positive notifications of enteroparasitosis in the Bananeiras - PB region. The predominant presence of *Entamoeba histolytica* stood out, suggesting a possible relationship with local basic sanitation conditions. It therefore emphasizes the need for a more in-depth analysis of local sanitary and environmental conditions in order to guide effective control and prevention measures for both health conditions.

This highlights the importance of constant surveillance of enteroparasitosis and the implementation of control measures, even in crisis situations such as pandemics. Promoting health education, improving basic sanitation and access to health services are essential components in the

fight against these infections, especially in relation to the profile of parasite neglect in Brazil.

Conflicts of interest

None.

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