



PESQUISA SOROLÓGICA COVID-19 DO ANTICORPO SARS-COV2 REALIZADA EM TRABALHADORES DE UM COMÉRCIO BRASILEIRO

COVID-19 SEROLOGICAL SURVEY ON SARS-COV2 ANTIBODY CONDUCTED ON WORKERS FROM A BRAZILIAN TRADE

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RESUMO

O COVID-19 é causado por um coronavírus chamado SARS-CoV-2 com transmissão por aerossol. Estudos indicam que indivíduos infectados, sintomáticos ou assintomáticos contribuem para a rápida disseminação da doença. O objetivo é estimar a soropositividade da COVID-19 em funcionários de empresas associadas ao SINCADES. Esta pesquisa é um estudo observacional descritivo e transversal seguido de um inquérito sorológico. Foi realizado um inquérito sorológico em empresas associadas ao SINCADES, que aderiram ao projeto. O levantamento sorológico trouxe uma abordagem positiva aos associados e auxiliou as empresas a tomarem providências para garantir o funcionamento do comércio capixaba e garantir a segurança dos colaboradores.

Palavras- Chave: Covid19; não vacinação; sorológico; SINCADES

ABSTRACT

COVID-19 is caused by a coronavirus called SARS- CoV-2 with the aerosol transmission. Studies indicate that infected, symptomatic, or asymptomatic individuals contribute to the rapid spread of the disease. The aim to estimate the seropositivity of COVID-19 in employees of companies associated with SINCADES. This research is a descriptive and cross-sectional observational study followed by a serological survey. A serological survey was conducted in companies associated with SINCADES, which joined the project. The serological survey brought a positive approach to the associates and helped the companies take steps to ensure the operation of the commerce of Espírito Santo and ensure the safety of employees.

Keywords: COVID-19; no-vaccination; serological; SINCADES

INTRODUCTION

Coronaviridae is an RNA virus family which can host humans and numerous animals (GHAEBI et al., 2020). Among the members of this family, there were six viruses known to infect humans: 229E, OC43, NL63, HKU1, SARS - CoV e MERS-CoV (GHAEBI et al., 2020). This year, a new family member, SARS-CoV2, COVID-19, was identified. All coronaviruses identified, including SARS-CoV2, and COVID-19, have a zoonotic origin, with many originating in bat hosts (LATINNE et al., 2020). Several health-impact diseases, such as severe acute respiratory syndrome (SARS), originated from a virus adapted from wildlife hosts switching to humans through binding to the ACE2 receptor in humans (ANDERSEN et al., 2020).

The new member of the Coronaviridae family SARS-CoV2 had its first human infection case reported officially in the City of Wuhan, China, in December 2019, being named COVID-19. This seventh human Coronavirus causes a severe acute respiratory syndrome and is spread by coughing aerosol particles, sneezing, or contact with contaminated secretions (KOH, 2020, RIMMER, 2020, W.U. et al., 2020). Coronavirus is deadly and highly contagious, rapidly spreading to more than 150 countries. Therefore, on March 11th, 2020, WHO declared a pandemic outbreak (WHO (A), 2020).

In Brazil, the first case of COVID-19 was confirmed on February 26th, 2020 (BRASIL, 2020 a), with continuous evolution achieving large Brazilian centers, with clinical conditions ranging from asymptomatic patients to severe respiratory failure (MACHHI et al., 2020). Mathematical models indicate that infected, symptomatic, or asymptomatic individuals contribute to the rapid spread of the disease (ZEB et al., 2020). One of the strategies to monitor the contamination was the so-called flattening of the curve, where epidemiological data were collected and registered to preserve the hospital capacity and to avoid exceeding the availability of medical assistance resources (BRASIL, 2020b).

The follow-up of the infected patients was used as a control program for tracking individuals who maintained contact with non-infected and to offer telemedicine monitoring to those infected with mild symptoms to guarantee timely treatment in case of worsening symptoms (KUCHARSKI et al., 2020, KYHLSTEDT; WAMALA, 2020).

The real-time polymerase chain reaction (RT-PCR) method is considered the gold standard for confirming the diagnosis of COVID-19 (ORTIZ-PRADO et al., 2020).

The National Agency of Sanitary Monitoring in Brazil (ANVISA) registered 16 tests for the detection of COVID-19, of which the majority (11) are tested for the identification of SARS-CoV-2 N-Protein IgM and/or IgG antibodies using human serum, plasma, and whole blood. Three tests detect nucleic acid (RNA) by RT-PCR, and two detect the SARS-CoV-2 antigen in nasopharyngeal and/or oropharyngeal samples (BRASIL, 2020c).

Before the vaccination, viral immunoglobulins (IgM) and (IgG) were used to diagnose infection of the new COVID-19. Those tests were used to monitor the disease's

transmission in the community (KUCHARSKI et al., 2020, KIM; SEO; JUNG, 2020). Serum prevalence studies using serological markers are beneficial for detecting viral infections that induce the formation of antibodies (SATTLER et al., 2020). Furthermore, serological data, self-administered questionnaires, and interviews are common ways of obtaining information on morbidity, frequency of symptoms, and variables of interest in prevalence surveys (SATTLER et al., 2020). Although serological tests and self-administered questionnaires and interviews are not recommended as the only form of diagnosis, they can be considered an alternative to the population's initial screening and mass testing. In this way, these data, with carefully recorded information, are valid to help understand the spread of infection by the new Coronavirus (SATTLER et al., 2020).

In this study, we analyze the field-collected data of seropositivity for COVID-19 in employees of companies associated with the Trade Union and Distributor of Espírito Santo, SINCADES. SINCADES is a union entity considered a reference in the wholesale and distributor sector in Espírito Santo that started in 1997 and was founded by a group of 20 entrepreneurs. Sindcade has a fundamental role in generating jobs, income, and tax collection, one of the driving forces of the Espírito Santo economy (SINCADES, 2022).

At the timeframe of this study, the main goal was to correlate serum positivity with the presence or absence of symptoms characteristic of the disease. As an outcome, the study aimed to map the prominent companies and regions with the highest number of infected individuals in the SINCADES trade. These analyses aimed to improve our understanding of how COVID-19 was circulating/transmitted among the SINCADES employees.

MATERIAL AND METHODS

STUDY DESIGN

A descriptive and cross-sectional observational study was realized by a serological survey on SARS-CoV-2 antibodies conducted on the workers of a Trade Union and Distributor of Espírito Santo, SINCADES. The study used serological survey tests and self-administered questionnaires, and interviews application. The period for

conducting the serological survey was divided into two phases, phase 1, the data collected during the 28th to 30th epidemiological week (July 7th to July 23rd, 2020); phase 2, serological surveys were carried out between the 33rd and 34th epidemiological weeks, August 10th to 17, 2020. In both phases, no vaccination was available in Brazil.

DATA SETTINGS

The sample size of employees of SINCADES was calculated using the open-source database for public health statistics (SULLIVAN K.M., 2020). Serum positive for the Sars-Cov2 virus antibodies in a population of approximately 1 000 000 hab. was an expected prevalence as 30% (p), with a CI amplitude of 95% (d), and a design effect of 1 (EDFF), using the formula $n = [EDFF * Np (1-p)] / [(d^2 / Z_{1-\alpha}^2 * (N-1) + p * (1-p)]$. Thus, the number of people to be investigated should be $n = 323$ (SULLIVAN K.M., 2020). The sample was calculated, and the resulting value is still considered a sample loss of around 10%, totaling 388 (SULLIVAN K.M., 2020). The sampling was stratified proportionally among the companies associated with SINCADES.

DETECTION TEST

The detection of SARS-CoV-2 was performed using the colloidal gold immunochromatography method for SARS-CoV-2 antibodies, IgG / IgM, CORONAVIRUS (Beijing Lepu medical technology CO-LTD, Lot 20CG2518X, valid 01/04/2021). The healthy Brazilian department registers the test under number 81210150002 (BRASIL, 2020g). For serotyping, an immunochromatographic assay was used. The test device contains recombinant protein, SARS-CoV-2 labeled with colloidal gold, and mouse anti-human IgG antibody, immobilized in the test area G. Human anti-mouse IgM antibody, immobilized in the test area M. Corresponding antibody in the area of quality control (C). The test is based on the principle of antigen-antibody reaction and immunoassay technique. The test device contains colloidal gold-labeled COVID-19 recombinant protein, mouse-anti human IgG antibody immobilized in G test area, mouse-anti human IgM antibody immobilized in M test area, and the corresponding antibody in the quality control area (C). During

the test, when the COVID-19 IgM antibody level in the sample is at or above the limit of detection of the test, the COVID-19 IgM antibody in the sample binds to the colloidal gold-labeled COVID-19 recombinant protein, which is pre-coated on a gold label pad. The conjugates migrate upward through the capillary effect. They are captured by mouse-anti human IgM antibody, immobilized in the M test area subsequently, producing a purple-red band appearing in the M test area. When the COVID-19 IgG antibody level in the sample is at or above the limit of detection of the test, the COVID-19 IgG antibody in the sample binds to the colloidal gold-labeled COVID-19 recombinant protein, which is pre-coated on a gold label pad. The conjugates migrate upward through capillary effect and would be captured by mouse-anti-human IgG antibody immobilized in the G test area, producing a purple-red band in the G test area.

If it is a negative sample, no purple-red band appeared in the M and G test area. Regardless of the presence or absence of the COVID-19 antibody in the sample, a purple-red band will appear in the quality control area (C).

The purple-red band in the quality control area (C) is a criterion for judging whether there is enough sample and whether the chromatography process is normal. It also serves as the internal control standard for reagents.

Positive (+): Purple streaks appear in the quality control and M or G areas. Negative (-): There is only one purple stripe in the quality control area (C) and no purple stripe in the M and test areas. In area G.

Invalid: No purple bands in the quality control area (C) indicate incorrect operating procedures or that the test strip has already deteriorated. As for the detection limit, the positive detection rate should not be less than 90% for the detection of sensitivity reference material.

Immunoglobulin M (IgM) comes out first, acting as an early sign of infection. Immunoglobulin G (IgG) comes out later, creating a more specific and substantial reaction against the virus. Antibodies will be secreted after virus invasion.

DATA COLLECTION

A digital puncture painless lancing device made sampling. For blood collection, biosafety criteria were applied, and trained personnel using Personal Protective Equipment (PPE) cleaned the area of the finger before puncturing using ethanol. Lancet Pen Sterile used a sterile lancet for drilling. The blood was drawn from the blood capillaries. The first drop was discarded, and the blood was collected until the volume of 10 μ L was completed using the disposable dropper. Capillary blood samples were analyzed immediately.

The volume of 10 μ L of blood was transferred into the sample well of the cassette, followed by the addition of 2 ~ 3 drops (80 μ l) of the buffer solution. After 15 minutes, the result was read and recorded. The test cassette, all kit components, and samples were maintained at room temperature (30°C).

The study also used self-administered questionnaires and interviews application. The forms included evaluation questions for symptomatology, comorbidities, and demographic evaluation.

All employees associated with SINCADES were eligible for the serological survey, with the age of majority 18 years old minimum and an active employment contract. All employees who were not showing positive for SARS-CoV-2 infection, suspended from work, and those doing home-office were excluded.

Exclusion in the second phase considered those employees who tested positive in the first phase of the serological survey.

The risk refers to the personal issues related to the researchers. However, it was minimized using adequate EPIs. Besides, all biosafety rules were observed by researchers and collaborators during the collection of biological material. All participants received the Term of Free and Informed Clarification and were free to adhere to the project. The confidentiality of the data was guaranteed, as well as the possibility of suppressing their participation.

Another risk to be highlighted is the exposure of volunteers during blood collection to perform serological tests. The volunteers had the direct benefit of being tested for antibodies, which would indicate contact with COVID-19. Indirectly, it will contribute to identifying and mapping companies with the highest number of infected individuals

in the trade and the States where the companies were located. In turn, it would agree on knowledge to better elaborate protocols and measures to contain the disease.

DATA ANALYSIS

The data analysis was composed of a descriptive study, where the categorical variables were expressed by their absolute and relative frequencies. The difference was assessed by the student's t-test, considering $p > 0.05$. The distribution of metric variables was assessed by median, mean, and standard deviation. The categorical variables were compared using the Chi-square test, except for results smaller than five. In this case, Fisher's exact test or likelihood ratio was used if the exposure variable admitted more than two categories. Statistics were performed using GraphPad Prism version 4.00 for Windows, GraphPad Software, San Diego California USA®.

RESULTS

For the serological survey of the employees associated with SINCADES, 81 companies were analyzed in phase 1, and 80 companies were analyzed in phase 2. A total of 401 employees were recruited for phase 1 and 387 in phase 2. A total of two people in phase 1 and two in phase 2 were excluded, and they abandoned the study. Therefore, 399 patients participated in phase 1 and 385 in phase 2. Considering Immunoglobulin M (IgM) for Coronavirus 2 (SARS-CoV-2), the exact prevalence was found in Phases 1 and 2. Workplace absenteeism among workers was 5.2% in both phases (Table 1). Considering the companies that joined the serological survey study, 53.2% did not present positive cases for Covid-19 in both phases of data collection (Table 2).

Table 1: General prevalence data observed in the serological survey

cases between the segments is decapitated in table 3. Segments whose service maintained public contact during

	Prevalência geral	% IgM	Total de empregados	Possíveis contamina dos geral	Impacto possível no absenteísmo
Fase1	10,7%	48,8%	5683	393	192 (5,2%)
Fase2	10,7%	48,8%	5683	393	192 (5,2%)

Table 2: List of participating companies and total positive cases in each serological phase.

SEGMENT	Positive Cases PHASE 1 and 2
FOODS	18
ALUMINIUMS, GLASSES AND ACCESSORIES	1
HABERDASHERY	14
AUTO PARTS	9
BEVERAGES	5
BAGS, BAGS AND ACCESSORS	0
FUEL	0
COSMETICS AND PERFUMERY	0
STEEL DERIVATIVES	2
ELECTRONIC	0
PACKAGING	2
COMPUTER EQUIPMENT	1
SAFETY EQUIPMENT	0
HARDWARE AND TOOLS	4
HYGIENE AND CLEANING	0
HYGIENE, PERFUMERY AND CLEANING	0

SEGMENT	Positive Cases PHASE 1 and 2
LOGISTICS	6
MACHINERY AND EQUIPMENT	0
ELECTRICAL MATERIALS	2
BUILDING MATERIAL	3
MEDICINES AND DRUGS	4
MERCEARIL	11
CHEMICALS AND PETROCHEMICALS	0
REFRIGERATION AND EQUIPMENT	1
METAL WASTE AND SCRAP	0
PAINTS	0
GLASSES	0

In both phases of the serological survey, the companies that presented positive cases in absolute numbers, in both phases of the serological survey were 38 (Table 2). Of this total, we highlight that the companies that had positive patients in both phases totalized 21 companies, having nine positive patients for phase 1 and 8 for phase 2.

The stratification of positive the early COVID-19 pandemic presented the highest numbers of positive cases. Sorting out in descending order as for food> retail> grocery store > car parts> logistics> beverage departments.

Table 3: List of local cities of the participating companies and the list of total positive cases declared.

Cities	Positive Cases					Total City in the
	Step 1	City in period^A	Step 2	City in period^A	Total	

	period					
ARACRUZ	0	980	0	369	0	1349
ITAPEMIRIM'S Bunch	0	1237	0	483	0	1720
CARIACICA	4	1996	5	737	9	2733
COLATINE	0	1376	1	826	1	2202
DINUBA	0	84	0	68	0	152
LINHARES	2	1784	3	817	5	2601
SAW	16	2475	14	827	30	3302
VIANA	2	227	1	103	3	330
OLD VILLAGE	10	3161	11	1079	21	4240
VICTORY	8	2271	6	881	14	3152

^A<https://coronavirus.es.gov.br/painel-covid-19-es> Data consulted in 22/09/2020.²

Regarding the municipalities where the companies were localized, the total of positive cases registered is demonstrated in table 3, compared to the total number of positive cases declared by the Government of Espírito Santo in the epidemiological weeks of the present study (Panel Covid-19 of the Espírito Santo State, Brazil, 2020). For the relation between the geographic distribution of the employees associated with SINCADES, it was observed that positive cases were distributed throughout Espírito Santo, among the cities of the greater Vitória, Guarapari, Colatina, Linhares, São Mateus, and Cachoeiro de Itapemiri - Piúma ES, Brazil (Table 3).

Analyzing the companies that had positive employees in phase 1, there was a concentration of these workers in the greater Vitória, mainly workers who live close to the companies. However, when companies with positive employees in phase 2 were studied, it was possible to observe internalization of the disease due to positive cases in Colatina Linhares and Aracruz.

In the qualitative assessment, about 90% of all employees who participated in the survey declared to be aware of the Safety Protocols. During phase 1, 350 employees

reported knowing the security protocol. However, within these, 25 % declared being confused about how the safety guidelines should be used. In phase 2, 344 employees declared they knew the safety protocols, and nine declared they did not know how to utilize the protection protocols. Despite this, there was no impact on transmission within SINCADES since, in phase 2, there was no increase in the number of cases, table 3.

Regarding the stratification of the number of positive and negative cases distributed by gender, it was observed that in the first phase there was a higher prevalence in the female gender, while in the second phase, the positive case slightly increased for the male gender.

Regarding the distribution of the number of positive cases related to marital status, it was observed that in the first phase, positive cases had a prevalence of 16.2%, with the lowest prevalence related to those who declared themselves separated. In phase 2, there was an increase of about 60% of the positive cases in the employees who declared themselves separated, jumping from 5.7 to 14.7, with a reduction in the prevalence among singles.

The distribution of the number of positive and negative cases compared to the prevalence of the disease. We observed that in phase 1, the most extensive distribution was among employees aged 20 to 29 and 30 to 39. The lowest distribution was in the age range from 50 to 59 in phase 2. However, there is a more normalized prevalence of around 10%, in all analyzed groups, with an increase of the positive cases in the age range from 50 to 59, around 50%.

Regarding skin color, the distribution of positive cases and prevalence was equal between the races. However, in the first phase, only two people declared themselves yellow, and in the second phase, only four people declared being yellow. Among the four self-declared yellow people, two were positive for COVID-19. This fact allows the calculation of a prevalence of 50% positive among people with yellow skin in the study's second phase.

The workers' symptoms during phases 1 and 2 of the serological survey inquiries in the questionnaire were applied. Some employees had direct contact with relatives diagnosed as positive for COVID-19—reporting in the questionnaire, "I had direct contact with a person who was confirmed for COVID-19 infection". A greater variety

of symptoms was observed for workers assessed in phase 1, while patients were positive for Covid-19.

Of the employees identified as positive for COVID-19 in phase 1, less than 40% declared themselves asymptomatic. In phase 2, about 50% of the positives declared themselves asymptomatic. Regarding the experiences in the last 14 days related to symptoms, it is essential to note that patients who tested negative for COVID-19 had a higher frequency of symptoms, such as chest pain, sore throat, and cough, than patients for whom they tested positive.

The associated comorbidities were mainly kidney stones, vesicular stones, duodenal ulcers, diabetes, high cholesterol, and gastritis. However, 60% of employees stated that they have no clinical changes.

DISCUSSION

This study carried out a serological survey on Sars-cov2 COVID-19 antibody IgM, IgG, conducted on workers from companies associated with SINCADES Trade. The serological data collected indicated that about 5.2% of absences from work were related to the cause of Covid infection 19 (Table I).

Social isolation was advised by the WHO, which recommended it as a public health measure, therefore being adopted worldwide to contain the spread of the Coronavirus (WHO, 2020a). The data collected by the present investigation are unprecedented, taking into account the factor of abstaining from work versus the impact of the spread of the virus within a company. At the time of writing this report, no records provided this data.

However, social isolation is known to increase stress, depression, and anxiety levels, and these symptoms are more significant for women than men (FILGUEIRAS; STULTS-KOLEHMAINEN, 2020). Several Brazilian institutional documents are being constructed to relate the psychological effects of isolation, the prescriptions of conduct to contain the spread of the virus, and the real effects of attenuation of contamination and the improvement of quality of life (LIMA, 2020; FREIRE, 2022). Among the institutions participating in this research, we can mention the Center for Studies and Research in Emergencies and Disasters in Health (CEPEDES /

FIOCRUZ), the Brazilian Mental Health Association (ABRASME), the Federal Council of Psychology (CFP).

In the present survey inquiry, 53.2% of the participants were not positive for COVID-19 in the two phases of the study (Table 2). Regarding the sectors affected by COVID-19, the main sectors presenting seropositive workers were food, retail, grocery store, car parts sales, logistics, and beverage, respectively (Table 2). Brazil's Ministry of Public Economy listed the sectors most affected by the pandemic. Among them are food services (7th position), the manufacture of machinery and equipment, installations, and maintenance (29th position). (BRASIL, 2020d).

For the data related to the demographic distribution, there was a greater concentration of COVID-19 positive patients in the region called greater Vitória, and mainly workers who live close to the SINCADES companies (Table 3). However, it is impossible to relate proximity to the company with positive serum since contamination spreads by contact with contaminated secretions and is also related to personal hygiene habits (KOH, 2020, RIMMER, 2020, W.U. et al., 2020). In phase 2, there was an internalization of the disease spreading to most inland states, such as Colatina, Linhares, and Aracruz (Table 3). Espírito Santo was in the ^{eighth} position among the Brazilian states, having for every 100 thousand inhabitants 2.000. A total of 412 people were infected by COVID-19 during the serological survey period considered for this work (Brasil, 2020e). The demographic analysis demonstrated that COVID-19 prevalence for the Espírito Santo State was 9.6%. In the municipalities around the capital Vitória, Brazil, was of 11.5% (Official data of the results of the 4th phase of the Serological Survey of the State of Espírito Santo - 30th week (Brasil 2020b). The data found in this serological survey study indicate that the employees of SINCADES were one point below the contamination statistics officially found for the Espírito Santo State.

In the qualitative assessment, it can be seen that about 90% of all employees who participated in the serological study declared to know the safety protocols. However, there was difficulty in understanding them by 10% of the workers. It did not negatively impact transmission within SINCADES, since in phase 2 there was no increase in the number of cases. The community seems to have managed to insert the protocols into daily practice. However, considering the epidemiological importance of the disease,

we suggest that safety protocols should be more evident within companies, using visual, colored information in places of good visibility. This adaptation would avoid employees' misunderstanding of the subject and protect the employees' families, generating a positive social impact.

Regarding gender, there was a higher prevalence in the female gender in the first phase, while in the second phase, for the male gender. In phase 2, there was an inversion in these data. In the applied serological survey, there is a question to verify if the proband had contact with identified positive COVID-19 people. Although the employee's activities were not addressed, we can infer that positivity for COVID-19 within SINCADES is related to the habits of each one, as it is a respiratory disease of high contamination by sneezing and saliva droplets (KOH, 2020, RIMMER, 2020, W.U. et al., 2020).

Considering the number of positive cases and prevalence distributed by marital status, it was observed that in the first phase, singles had the highest prevalence of 16.2%, while the lowest prevalence was of those who declared themselves separated.

The distribution of the disease grew in the age group of 50 to 59, of about 50% within SINCADES. This is according to WHO the age group risk for COVID-19 (WHO, 2020b).

Besides, in the present investigation, there was an increase of 50% for COVID-19 prevalence of positive serum for yellow skin color, between phases 1 and 2. This criterion cannot be taken isolated into account, since the social situation did not is considered in the study, and the skin color was self-declared.

Individuals who declared themselves to be white predominated among those hospitalized for COVID-19 (47.5%) in Brazil until the 21st Epidemiological Week of 2020 (NIQUINI et al., 2020). The Foundation of the Brazilian Institute for Geography and Statistics (IBGE), demonstrated that of a total of 21. 000 077 Brazilians interviewed in the fourth quarter of 2019, 88.724 declared themselves to have white skin, 19. 880 to have black skin, 99. 355 to have brown skin. These were the most recent data updated by the institute in 2020 (IBGE, 2020).

Also, the Ministry of Health points out that 87 million Brazilians depend exclusively on the Brazilian health care model - SUS (Sistema Único de Saúde - Unified Health System) with full coverage to every citizen (BRASIL, 2020f). The actual Brazilian population is 212.271.942 inhabitants (IBGE, 2020).

For the seropositivity criterion and the presence or absence of symptoms characteristic of the disease, a greater variety of symptoms was observed for workers evaluated in phase 1, during serological positivity for COVID-19. In phase 1, less than 40% were declared to be asymptomatic. In phase 2, about 50% of the positives declared themselves asymptomatic. About experiences in the last 14 days, patients who tested negative for COVID-19 had a higher frequency of characteristic symptoms of the disease, such as chest pain, sore throat, and cough, than patients where they were tested positive. Although the associated comorbidities are mainly renal calculus, vesicular calculus, ulcer in the duodenum, diabetes, high cholesterol, and gastritis, 60% of employees stated that they have no clinical changes. Male individuals, elderly or 40 to 59 years old, diabetes mellitus comorbidities, cardiovascular disease, chronic kidney disease, and chronic lung diseases, and pregnant/postpartum women were registered as a prevalent population among those hospitalized by COVID-19 in Brazil (NIQUINI et al., 2020).

For the detection of sensitivity reference material, the positive detection rate should not be less than 90%. This means that this type of test has a 10% margin of error. Besides real-time, RT-PCR, is considered the gold standard for detecting the presence of RNA viruses, such as COVID-19, in patients with suspicion. The viral load may peak one day before symptom onset or 5-6 days later, with a median viral load of $5.2 \log^{10}$ copies mL^{-1} , being this test is more specific than serological tests (SINHA; BALAYLA, 2020). However, the great race for PCR-RT reagents in the world market resulted in their unavailability and elevated prices during this study.

The immune response is vital for the control and resolution of infectious diseases, and the antibody response is the main indicator of the disease state and provides immunity. The IgM antibody usually indicates acute illness, while the IgG antibody indicates chronic or recovered illness. However, the kinetics of the immune response to COVID-19 infection is still not well understood (L.U. et al., 2020).

CONCLUSION

The present study identified the prevalence of COVID-19 disease by SINCADES employees considered in two study phases. The serological survey brings a positive approach to the associate's companies. The workers could identify if they were positive for COVID-19, and it generated a positive impact on their family in terms of protection and care. The demographic data observed for positive distribution of cases guided the trade to guarantee the functioning of the SINCADES, and the safety of employees in the production/service chain. Considering the epidemiological data of this study, it did not differ from the official data for COVID-19 prevalence in the Espírito Santo State.

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