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Research Article

Impact of COVID-19 Pandemic on Haemoparasites Prevalence

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Abstract

This study has been done to propose the cause of shift regarding prevalence of haemoparasite infections. Overall,15.2% of samples were parasites positives; 17% before and 8% during the pandemic, with 60% reduction. Most of parasitic cases were in males ($p < 0.001$) showing a significant difference regarding gender between the two periods. The frequency of Infections were in patients aged 15-44 years before (15.5%) and during (8%) the Covid -19 pandemic, with significant difference observed ($p < 0.002$). Moreover, a significant difference in nationality reported, ($p = 0.024$) as the majority of patients with parasitism were non-Saudi (89.5%). *Plasmodium falciparum* was identified in 24(63.2%)) out of positive samples, *Plasmodium vivax* in 13(34.2%), *Plasmodium ovale* 1(2.6%). In coordinate with our research hypothesis, a considerable decrease in the load of haemoparasitic infections was documented with the quarantine measures taken during the Covid-19 pandemic.

Keywords: Malaria; Covid -19 Pandemic; Blood Film

Introduction

Coronaviruses (CoV) belong to the beta-coronavirus with its high mutation rate in the family Coronaviridae causing illnesses with variable severity. Severe acute respiratory syndrome (SARS) was the first known severe one in China in 2003. A second outbreak began in 2012 in Saudi Arabia. An outbreak of a novel strain of coronavirus started on December 31 of 2019, leading to severe illness, known as SARS-CoV-2 or nCOVID-19and killing many people with very rapid and easy spread with high infectivity rate by many routes [1]. The WHO announced COVID-19 illnessto be a global pandemic On 11 March [2].

Haemoparasites generally cause destruction of the red blood cells leading to anorexia, anaemia, jaundice, loss of weight high morbidity, ending to mortality [3,4].

From the fear of infections epidemics to the challenge of emerging pathogens, these mandate continuous studies for parasitic diseases detection, epidemiology description, and to devise effective case treatment and infection control [5]. In this study haemoparasitic diseases were be sought for in Saudi population with symptoms related to blood diseases, as two-year hospital-based studies. The objective of this study was to carry out a retrospective investigation of the haemoparasitic infections prevalence in the Saudi population form January to December period in 2019 and their corresponding 12 months in 2020.

Material and Methods

Ethical considerations

Ethical clearance was obtained from the King Faisal Medical Complex Committee (Ref: KFMC-02-T-067 to conduct this study). Informed Consents from participants were not needed.

The study area

The investigation was conducted at KFMC in Taif at Western Saudi Arabia, one of the largest hospital in Taif Governorate. It is a referral center for tertiary specialist care serving approximately one million resident, with a capacity of 500 beds.

Data collection

In this retrospective search, we collected data through patient medical records of Blood sample results received in the parasitology section at KFMC within the two time-periods: The first one before the pandemic (from January 2019 to December 2019) and the second was during the pandemic (from January 2020 to December 2020). Total Samples number was 250 from hospitalized and non-hospitalized patients having fever >38°C and clinically diagnosed as malaria infection symptoms. The datasets of samples used were demographic features of patients (age, sex, and nationality) and their test results. They were tabulated, investigated, compared and endly discussion done.

The patients were 210 (84%) males and 40 (16%) females, with an average age of 15 - 44 years. Blood collected by vein puncture on EDTA tubes tested for malaria shortly to prevent morphological alteration of malaria parasites. Both thick and thin blood films were done, examined for the presence of *Plasmodium* spp. Parasites and CareStart™ Malaria RDTs were done together with the blood film which were stained with fresh 10% Giemsa's solution and examined using X l00 oil immersion magnification. If no parasites detected in 300 fields of each thick film the slides were reported negative, stained thin film preparations from positive thick films were examined for malaria species: *P. falciparum*, *Pl. vivax*, *Pl. malariae*, *Pl. ovale* or mixed infection. Finally parasitaemia was estimated in 100 fields of thin films against the leucocytes counts of the patients to check the density of infection, using the equation: number of parasites/microliter = Total parasite count/WBC count X The total leucocyte count/microliter.

Data analysis

Infection prevalences in proportions and relative frequencies between group (sex and age) compared by using Chi-square test (X^2). data analysis is conducted using SPSS version 20 (SPSS Inc, Chicago, Illinois). P-value <0.05 was considered significant.

Results

In the current study, datasets were obtained, extracted, and analysed using 250 blood samples. Table 1 describes the demographic features and patients results, both before and after the pandemic periods. Out of 200 blood samples submitted to the laboratory before the pandemic period, 175 were for male and 25 for female. Out of them, 130 were Saudi and 70 were non-Saudi residents. On the other hand, out of 50 patients samples received during the pandemic time period, 35 were males patient and 15 were females. Of them, 30 were Saudi and 20 were non-Saudi. The ages ranged between 15 and >45 years distributed into one of three groups.

Demographic character	Pre-COVID-19 n = 200,34 positives and 166 negatives								During COVID -19 n = 50,4 positives and 46 negatives								P-value
	<15y		15-44y		>45y		Total		<15y		15-44y		>45y		Total		
	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	
Gender																	
Male	0	0	30	87	3	55	33	142	0	0	3	32	0	0	3	32	P < 0.001
	0%	0%	15%	43.5%	1.5%	27.5%	16-5%	71%	0%	0%	6%	64%	0%	0%	6%	64%	
Female	0	0	1	14	0	10	1	24	0	0	1	9	0	5	1	14	
	0%	0%	0.5%	7%	0%	5%	0.5%	12%	0%	0%	2%	18%	0%	10%	2%	28%	
Nationality																	
Saudi	0	0	2	98	0	30	2	128	0	0	2	18	0	10	2	28	P = 0.0024
	0%	0%	1%	49%	0%	15%	1%	64%	0%	0%	4%	36%	0%	20%	4%	56%	
Non saudi	0	0	29	21	3	17	32	38	0	0	2	13	0	5	2	18	
	0%	0%	14.5%	10.5%	1.5%	8.5%	16%	19%	0%	0%	4%	26%	0%	10%	4%	36%	
Total	0	0	31	119	3	50	34	166	0	0	4	31	0	15	4	46	
	0%	0%	15.5%	60.5%	1.5%	11.5%	17%	83%	0%	0%	8%	62%	0%	30%	8%	92%	

Table 1: Patients demographic and descriptive malaria results, both pre - and during the pandemic.

Out of 250 clinically suspected cases, 38 (15.2%) were positive for Plasmodium infection using microscopy, and of this *Pl. falciparum* was present in 24(63.2%)), *Pl. vivax* was in 13(34.2%), *Pl. ovale* 1(2.6%).

Before the pandemic out of 200 samples examined, 34 (17%) were positive for one or more malaria parasites species compared to 50 specimens tested during the pandemic, 4 (8%) were positive for one or more malaria parasite species indicating 60% reduction in the number and proportion of parasitism between the two cohorts. In addition, the majority of positive samples were for males with a highly significant parasitism- gender relationship between the two cohorts ($p < 0.001$). Before the pandemic, malaria parasites were identified in 16.5% of male patients and in 0.5% of female patients compared 6% and 2% respectively during the pandemic.

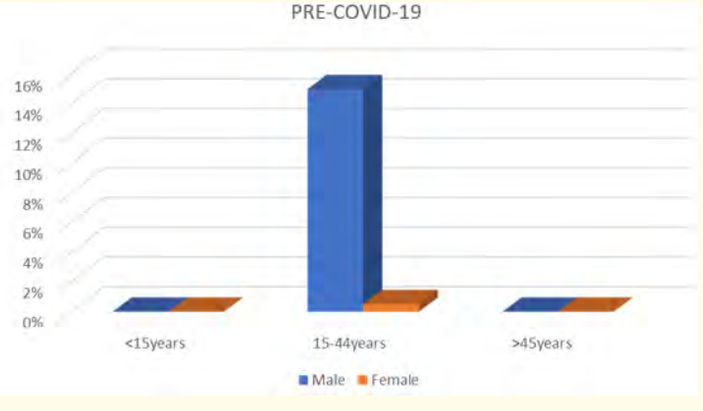

Figure 1 shows age and sex distribution of the positive patients for both pre and during the COVID-19 pandemic period. Most of parasitic infection

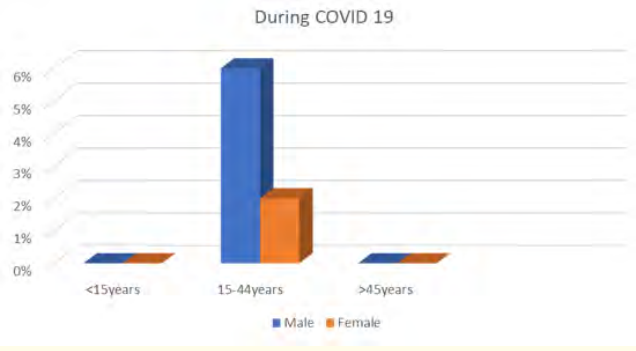

Figure 1: Age and gender distribution of parasites-positive patients before (right) and during (left) the COVID-19 pandemic time periods.

was reported for patients aged 15-44 years both before (15.5%) and during (8%) the pandemic compared to 1.5% and 0.0% pre and during pandemic respectively among age group >45 years.

Moreover, as shown in figure 2, most of patients were non-Saudi residents found infected by parasites; (89.5%), showing a significant difference in nationality reported, (p = 0.024). Out of 70 non-Saudi patients tested, 32 (16.5%) were found positives for malaria parasites. Compared to 2(4%) out of 30 Saudi patients during the pandemic period (Table 1).

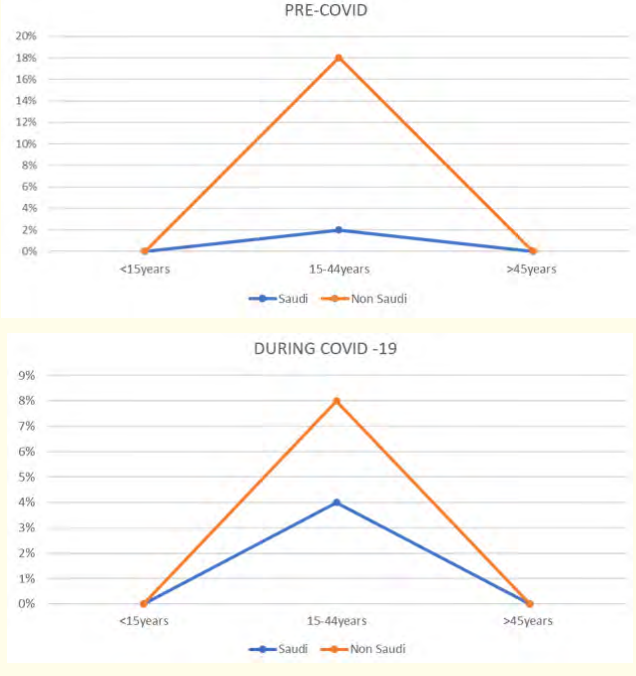

Figure 2: Distribution of age and nationality of parasites-positive patients before (right) and during (left) the COVID-19 pandemic time periods.

All malaria species, were detected more frequently in the 15-40 years age group, followed by the >40 years age group, and less <15 of age, showing highly significant difference recorded (p < 0.001).

Table 1 shows the prevalence of malaria parasites species in the blood specimen of patients according to their ages and genders, for pre-and during the pandemic time periods.

As shown in table 1 Before the Corona, malaria parasites were found in 16.5% of male patients and 0.5% of female patients. While during the Corona pandemic, male patients were positives in 6% of samples compared to 2% in females with highly significant difference observed between the two cohorts for all the species, (p < 0.05).

As shown in table 2 A highly significant difference observed, (p < 0.001) for malaria parasite identified in samples before the pandemic.

Applied test	Direct microscopy			P-value
	+ve (%)	-ve (%)	Total (%)	
Prepandemic	34(13.6%)	166 (66.4 %)	200 (80%)	P < 0.001
During pandemic	4 (1.6%)	46 (18.4 %)	50 (20%)	
Total	38 (15.2%)	212 (84.8%)	250 (100%)	

Table 2: Descriptive results of Malaria pre - and during pandemic.

Out of 200 clinically suspected malaria cases before the pandemic, 34(17%) were positive for *Plasmodium* infection out of these 22 (11%) were *P. falciparum*, 11(5.5%) *P. vivax*, 1 (0.5%) *P. ovale*.

On the contrary, Out of 50 clinically suspected cases during the pandemic, 4(8%) were positive for *Plasmodium* infection out of these 2 (4%) *P. falciparum*, 2 (4%) *P. vivax*, (0%) *P. ovale*.

Discussion

Our Present study confirm the effect of the Corona pandemic and impact of lockdown measures on the prevalence of blood parasites in Kingdom Saudi Arabia. To prove the significance of the study, results obtained for blood samples received during the pandemic were compared with those of the same time-period before the pandemic. Taking in consideration that same months of the preceding year were choosen to do this comparison in order to avoid seasonal and climate change effects on the distribution of such parasitic agents.

Malaria is one of the most widespread infectious diseases in tropical and sub-tropical countries. There are four countries certified by The World Health Organization (WHO) as malaria free, Kingdom of Saudi Arabia is among 34 countries actively attempting to eradicate malaria. The Arabian American Oil Company (ARAMCO) in the Eastern province started malaria control in 1948, to protect employees living around this area [6]. A national malaria programs in 1952 was started by the Saudi Arabian government targeting malarious districts present across the kingdom planning to protect pilgrims while visiting Mecca and Medina. Transmission was arrested in the Eastern and Northern provinces in 1963 and, by the early 1970s, when Saudi Arabia joined the WHO global malaria eradication program. Malaria still persists in the provinces of Aseer and Jazan, bordering the Republic of Yemen, where a series of outbreaks the worst of them was in 1998 [7].

Our study results shows that during the pandemic, a marked decrease in the total number and proportion blood parasites positive cases compared to the previous year's compared cohort. This reduction may be due to the precautions taken by the local health authority in order to decrease the spread of the Corona virus same due time may be due to the unwillingness of patients to go to hospitals avoiding to catch the virus. Travel interdiction, washing of hands daily, and frequent use of disinfectants also may play a role in helping the reduction of infections catching.

The malaria parasites were found in 15.2% of all specimens submitted during the two periods in the our present study. In consistent with this result, Community-based studies done in various geographical areas in Saudi Arabia, have recorded higher prevalence estimates malaria parasite infection which is a major public health problem [8,9]. This higher rates can be explained by lack of hygiene and presence of unsuitable agricultural backgrounds in these areas.

Furthermore, in the present research, a highly significant patient-gender relationship between the 2 cohorts was noticed, where most of parasitic infection was observed in males, this was in coincidence with the study done by [8]. In the current study, males were more predisposed to infection compared to females. This disparity may be explained by behavior and culture variability between the both them in Saudi Arabia.

The sex distribution in this study demonstrated that males are more affected with malaria than females in figure 1, this shows agreement with the study done by Ismail., *et al*. [10], it can explained the presence greater occupational risk for male in contracting malaria than women being exposed to moquito bites when working in mines, fields or forests at biting peak times, or migration to places where there is high endemicity, adding to this leisure activities, also sleeping habits may affect malaria transmission [10]. Also, study done by Cotter., *et al*. [11] prove that men may be more exposed while women may be more committed than men to apply malaria-prevention measures such as insecticide-treated bed nets.

As shown in table 3 our study showed *Pl. falciparum* 63.2% of diagnosed cases with malaria this is in contrast to result reached by Abdel-Wahab., *et al*. [12] as most of our patients were from Africa where *Pl. falciparum* is endemic noting that resulted cases in this study where non- Saudi and may be presented as relapse of previous malaria infection.

Direct microscopy	Malaria species				Total
	P. vivax	***P. falciparum***	***P. malariae***	***P. ovale***	
Prepandemic	11 (28.9%)	22 (57.9%)	0 (0%)	1 (2.6%)	34 (89.5%)
During pandemic	2 (5.3%)	2 (5.3%)	0 (0%)	0 (0%)	4 (10.5%)
Total	13 (34.2%)	24 (63.2%)	0 (0%)	1 (2.6%)	38 (100%)

Table 3: Results of microscopy for detection of malaria species.

The present study was not free of constraints. The reason is that our study is considered the first study focused on investigation of blood parasite infections in humans during the Covid-19 pandemic, so it was strenuous for us to compare our data with those of others. In addition that our study was relied on medical datal depending on clinical symptoms and the socio-demographic differences, while patient's residence, education, drinking, water supply and waste water disposal, work, income were not available

in patients records. Such data, could provide an explanation about the distribution of blood parasites throughout the population. So the true prevalence in the country cant be estimated by hospital based study findings. Meanwhile our study depend on routine diagnostic methods in hospital having a low sensitivity for parasite detection that may under- estimate the true prevalence of parasites in addition to many other factors.

Conclusion

Infections with blood parasites remain an important problem for the studied population. A significant decrease in the distribution of these parasites was detected during the COVID-19 pandemic time period, in comparison to the corresponding pre-pandemic one. Measures of lock-down taken by the Saudi government to repress the pandemic could has a role helping this reduction. Invaluable data provided by this study will be needed for meaningful public control programs targeting reduction of the prevalence and morbidity of parasitic infections in population study.

Conflict of Interests

The authors declare that they have no conflict of interests.

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