Research Article

Effect of Covid-19 Pandemic on Haemoparasites Distribution

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Abstract

The Corona pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) calls on the Saudi government to take action to control the infection. The government closed borders, prohibited travel, limited outdoor movements, and told primary and secondary

care facilities to reduce all regular non-urgent health services. It is not known whether these measures have impacted the prevalence of haemoparasite infections. This study has therefore been carried out to investigate this issue. Dataset of (250) blood samples submitted to the King Faisal Medical Complex (KFMC) Parasitology Laboratory in Taif, Saudi Arabia for p examination during the pandemic (January-december 2020) and 200 samples submitted during the corresponding months of the previous year (January-december 2019) were extracted and analyzed. Overall, 15.2% (38/250 of samples were parasites positives;17% (34/200) before and 8% (4/50) during the pandemic, with 60% reduction.There was a significant difference in gender-parasitism between the two periods where the majority of parasitism were for males ($p<0.001$). Infections were frequent in patients aged 15-44 years both before (31/200; 15.5%) and during (4/50; 8%) the pandemic, with significant difference observed between the two cohorts ($p<0.002$). Moreover, the majority of infected patients were non-Saudi (89.5%; 34/38), with a significant difference in nationality reported,($p=0.024$). Plasmodium falciparum was identified in 24(63.2%)) of all positive samplesPlasmodium vivax was identified in 13(34.2%),Plasmodium ovale 1(2.6%).In parallel with our research hypothesis, a substantial decrease in the burden of haemoparasitic infections was recorded with the lock-down measures taken during the Corona pandemic.

Keywords: King Faisal Medical Complex (KFMC); Coronaviruses; MERS

Introduction

Coronaviruses (CoV) belong to the beta-coronavirus with its high mutation rate in the family Coronaviridae. It can cause illnesses ranging in severity. The first known severe illness is Severe Acute Respiratory Syndrome (SARS) epidemic in China in 2003. A second outbreak of severe illness began in 2012 in Saudi Arabia with the Middle East Respiratory Syndrome (MERS).On December 31 of 2019, an outbreak of a novel strain of coronavirus causing severe illness, which was subsequently named SARS-CoV-2 or COVID-19. The virus has killed over people and has very rapid and easy spread and infectivity rate by many routes [1].On 11 March, the COVID 19 illness was declared a global pandemic by the WHO [2].

Haemoparasites generally are known to cause damage to the red blood cells resulting in anaemia, anorexia, jaundice, reduced weight gain, loss of production and reproduction, high morbidity, and even 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 aim of this study was to perform a retrospective analysis of the haemoparasitic infections prevalence in the Saudi population form January to December period in 2019 and their corresponding12 months in 2020.

Material and Methods

The study area

The study was conducted at King Faisal Medical Complex (KFMC) located in Al-Taif district, Western Saudi Arabia. The hospital serves as a referral center for tertiary specialist care for a catchment population of approximately one million people. With a capacity of 500 beds, this hospital is considered one of the largest government hospitals in the

Al-Taif Governorate. Both medical and remedial specializations are included, along with advanced medical cadres working at this big hospital.

Data collection

In this retrospective study, we relied on medical records of Blood samples submitted to the parasitology laboratory at KFMC within two given time-periods: one during the Corona pandemic

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(from January 2020 to December 2020) and one long before the pandemic (from January 2019 to December 2019). 250 Samples belonged to hospitalized or non-hospitalized patients presenting with fever >38°C and were clinically diagnosed as malaria infection complaints. The datasets of samples included basic demographic features of patients (age, sex, and nationality) and the parasitological tests results. Data were extracted, tabulated, evaluated, compared and discussed.

The patients were 210 (84%) males and 40 (16%) females, with an average age of 15-44 years. Blood obtained by vein puncture collected on EDTA tubes when patients required to be tested for malaria. Shortly after being drawn to prevent alteration in the morphology of blood cells and / or malaria parasites both thick and thin blood films were prepared and examined for the presence of Plasmodium spp. parasites, CareStart™ Malaria RDTs were done together with microscopic examination of blood smears: Thick and thin blood films were prepared, stained with fresh 10% Giemsa's solution and examined using X l000 oil immersion magnification. The slides were reported negative only when no parasites were detected in 200 fields of each thick film. Stained thin film preparations of positive thick films were examined to determine the species: P. falciparum, P. vivax,P. malariae, P.ovale or mixed infection. Parasitaemia was evaluated in 100 fields of thin films against the leucocytes counts taken from records of the patients to check the density of infectionbased on the equation: number of parasites/µl= total parasite count/WBC count X the total leucocyte count/µl.

Data analysis

Variations in distribution patterns of positive blood samples between sex and age were determined. The prevalence of infections was reported in proportions. Chi-square test (X2) was used to compare relative frequencies between groups (sex and age). Data analysis was conducted using SPSS version 20 (SPSS Inc, Chicago, Illinois). P-value <0.05 was considered as significant.

Ethical considerations

Ethical clearance to conduct this study was obtained from the KFMC Ethical Committee (Ref: KFMC-02-T-067). Informed consents from the study participants was not necessary for the purposes of this study.

Results

In the current study, datasets of 250 blood samples were obtained, extracted, tabulated and analyzed. Table 1 describes the demographic characters and the descriptive results of patients, both pre- and during the pandemic time periods. Out of 200 blood samples submitted to the laboratory prior the pandemic time period, 175 were for male patients and 25 were for female patients. Of these patients, 130 were Saudi and 70 were non-Saudi residents. On the other hand, out of 50 patients submitted their blood during the pandemic time period, 35 were males and 15 were females. Of these patients, 30 were Saudi and 20 were non-Saudi. The patients' ages ranged between 15 and 70 years, each was allocated into one of three age groups.

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

Out of 200 samples examined before the pandemic, 34 (17%) were found to be positive for one or more malaria parasites species. In comparison to 50 specimens tested during the pandemic, 4 (8%) were positive for one or more malaria parasite species. In other mean, there was a reduction in the number and proportion of positive samples "parasitism or parasitosis" between the two cohorts, calculated to be 60%. In addition, there was a highly significant parasitism- gender relationship between the two cohorts ($p<0.001$), where the majority of positive samples were for males. Before the Corona, malaria parasites were identified in 16.5% (33 /200) of male patients and in 0.5% (1/200) of female patients. In contrast, during the Corona pandemic, male patients were found to be positives in 6% (3/50) of samples while the female patients were positives in 2% (1/50) of samples.

Figure 1 shows the age and sex distribution of the positive patients, both pre and during the COVID-19 pandemic time period. The majority of parasitosis was recorded for patients aged 15-44 years both before (31/200;15.5%) and during (4/50 8%) the pandemic time periods compared to 1.5% (3/200)&0.0%

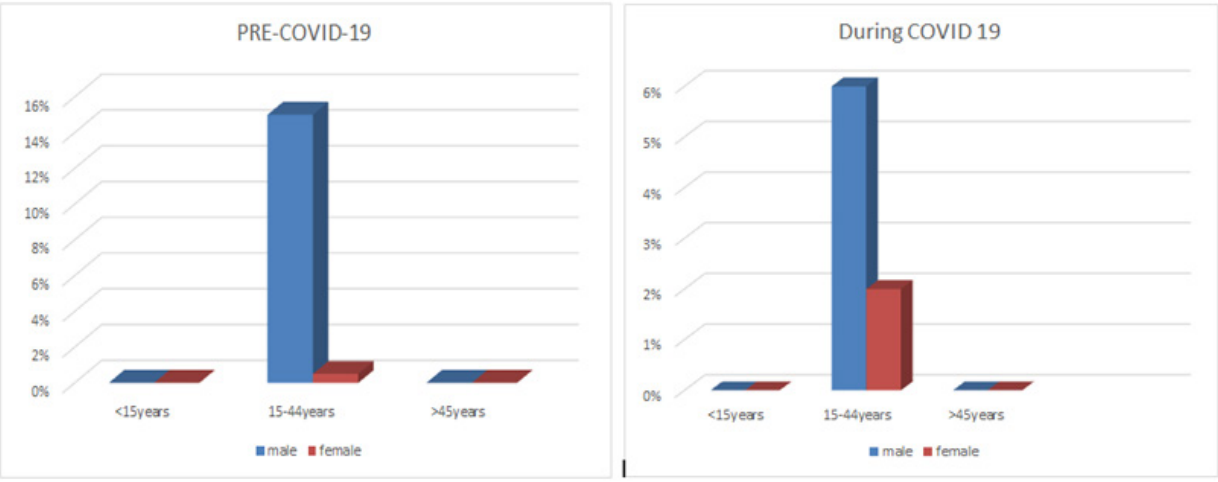

Figure 1: Age and gender distribution of parasites-positive patients before (right) and during (left) the COVID-19 pandemic time periods.

(0/50) pre & during pandemic respectively among age group >45 years.

Moreover, as shown in Figure 2, the majority of patients found infected by parasites were non-Saudi residents ;(89.5%; 34/38), with a significant difference in nationality reported,(p=0.024). In the pre-pandemic time period, out of 70 non-Saudi patients tested, 32 (16.5%) were found positives for malaria parasites. On the other hand, 2(4%) out of 30 Saudi patients, submitted their blood during the pandemic period, were positives for malaria parasite(s) (Table 1).

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

Table 1 shows the distribution of malaria parasites species, identified in the blood specimen of patients based on their ages and genders, both pre-and during the pandemic time periods.

As seen in Table 1 Before the Corona, malaria parasites were identified in 16.5% (33 /200) of male patients and in 0.5% (1/200) of female patients. In contrast, during the Corona

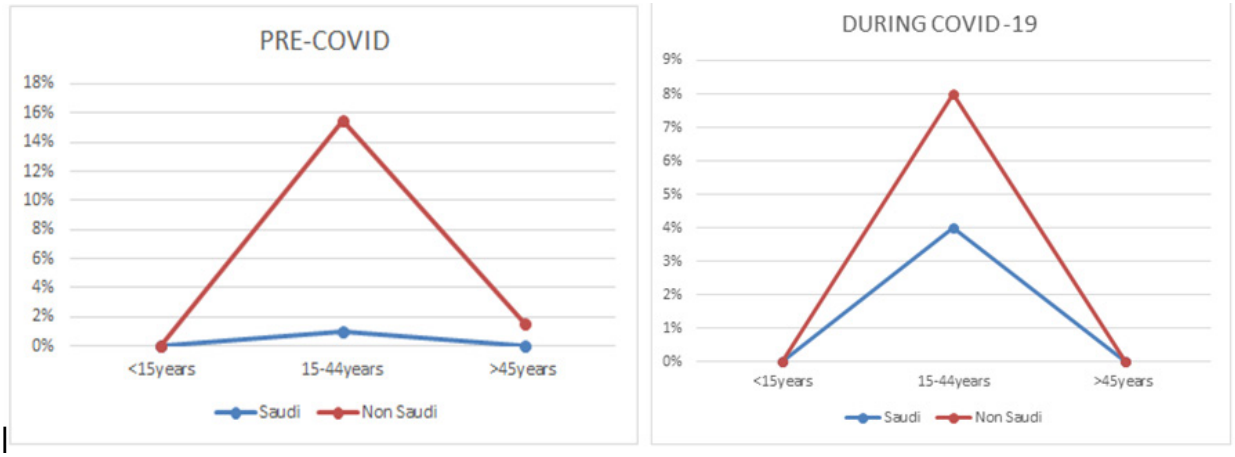

Figure 2: Distribution of age and nationality of parasites-positive patients before (right) and during (left) the COVID-19 pandemic time periods.

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

Demographic character	Pre-Covid-19 (n=200,34 positive and 166 negatives)						During Covid-19 (n=50;4 positives and 46 negatives)								p-value
	<15y		15-44y		>45y		<15y		15-44y		>45y		Total		
	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	
Gender															
Males	0	0	30	87	3	55	0	0	3	32	0	0	3	32	P<0.001
	0	0	15%	43.50%	1.50%	27.50%	0%	0%	6%	64%	0%	0%	6.00%	64%	
Females	0	0	1	14	0	10	0	0	1	9	0	5	1	14	
	0%	0%	0.50%	7%	0%	5%	0%	0%	2%	18%	0%	10%	2%	28%	
Nationality															
Saudi	0	0	2	98	0	30	0	0	2	18	0	10	2	28	P=0.024
	0%	0%	1%	49%	0%	15%	0	0%	4%	36%	0%	20%	4%	56%	
Non-saudi	0	0	29	21	3	17	0	0	2	13	0	5	2	18	
	0%	0%	14.50%	10.50%	1.50%	8.50%	0%	0%	4%	26%	0%	10%	4%	36%	
Total	0	0	31	119	3	50	0	0	4	31	0	15	4	46	
	0%	0%	15.50%	60.50%	1.50%	11.50%	0%	0%	8%	62%	0%	30%	8%	92%	

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

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

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

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%)	1 (0%)	1 (2.6%)	38(100%)

pandemic, male patients were found to be positives in 6% (3/50) of samples while the female patients were positives in 2% (1/50) of samples.

As shown in Table 2 Malaria parasite were identified more in samples submitted before the pandemic than during the pandemic, with a highly significant difference observed, ($p<0.001$).

Similarly, were detected more in pre-pandemic samples than in the pandemic samples as absolute numbers, without statistically-reported significant difference ($p=0.798$).

Malaria species were predominant in males, for both pre-and during the pandemic time periods, with highly significant difference observed between the two cohorts for all the species, ($p<0.05$).

Out of 200 clinically suspected cases, 34(17%) were positive for Plasmodium infection by using microscopy, and of these 22 (11%) were infected by P. falciparum, 11(5.5%) by P. vivax, 1 (0.5%) by P. ovale .

On the contrary, Out of 50 clinically suspected cases,4(8%) were positive for Plasmodium infection by using microscopy, and of these 2 (4%) were infected by P. falciparum, 2 (4%) by P. vivax, (0%) by P.ovale).

Discussion

The current study acknowledges the effect of the Corona pandemic and its related lockdown measures on the prevalence of blood parasites in Saudi Arabia. To increase the importance of the study, we compared results obtained for blood samples submitted during the pandemic with the same time-period long before the pandemic. We choose the same months of the preceding year for comparison to avoid seasonal and climate change impacts on the prevalence of such infectious agents.

Malaria is one of the most widespread infectious diseases of tropical and sub-tropical countries four countries have eliminated malaria and been certified by the World Health Organization (WHO) as malaria free. Today, 34 countries, including the Kingdom of Saudi Arabia, are actively attempting to eliminate malaria. Malaria control in Saudi Arabia was initiated in 1948 by the Arabian American Oil Company (ARAMCO) in the Eastern province, primarily to protect employees living around the oases [6]. This programme was used by the Saudi Arabian government as the template for a national malaria programme in 1952, which targeted malarious districts across the kingdom and was designed to protect pilgrims en route to the holy sites of Mecca and Medina. Saudi Arabia joined the WHO global malaria eradication effort in 1963 and, by the early 1970s, transmission was arrested in the Eastern and Northern provinces. In Saudi Arabia, malaria persists in the provinces of Aseer and Jazan,both bordering the Republic of Yemen, following a series of outbreaks of which the worst was in 1998 [7].

Our results suggest that during the pandemic, there was a marked decline in the total number and proportion of positive cases of blood parasites relative to the previous year's matching cohort. It is unclear whether this reduction may be due to steps taken by the local health authority to slow the spread of the Corona virus or due to the reluctance of patients to visit hospitals for fear of being able to catch the virus. Travel prohibitions, daily washing of hands, and frequent use of disinfectants can play a role in reducing other infections.

The Blood parasites were found in 15.2% of all samples recorded during the two periods in the current study. Inconsistent with this result, community-based studies conducted in various geographical areas in Saudi Arabia have recorded higher prevalence estimates implying that blood parasite infection is a major public health problem in Saudi Arabia [8,9]. The higher rates can be due to unsuitable hygiene and agricultural backgrounds in these regions.

Furthermore, in the current research, there was a highly important patient-gender relationship between the two cohorts, where the majority of parasitosis was observed in males, consistent with the previous study [8]. In our study, males were considered more vulnerable to infection than females. This sex-based disparity may be attributed to behavior and culture variation between the two the two sexes in Saudi Arabia. In this highly- conservative country, males are more likely to come into contact with sources of infection than females.

Our study showed the sex distribution involved in the study and demonstrated that males are more affected with malaria than females in figure 1, our result is in agreement with study done by Ismail et al. [10]. This may be due to men working in the fields are more exposed to mosquito bites. In some societies, men have a greater occupational risk of contracting malaria than women if they work in mines, fields or forests at peak biting times, or migrate to areas of high endemicity for work, in addition to leisure activities, sleeping arrangements may also affect malaria transmission. In some societies, men tend to sleep outdoors and this may increase their risk of exposure to mosquitoes bites. Also study done by Cotter et al. Cotter et al Showed men may be more vulnerable than women to exposure, Women may be more willing than men to invest in malaria-prevention measures such as insecticide-treated bed nets [11].

Our study showed 63.2% of diagnosed malarial cases were P. falciparum infected cases as shown in Table 3 this in contrast to study done by Abdel-Wahab et al. Maha M. et al as most of our patients are from Africa where P. falciparum is endemic [12].

The present study was not free of constraints. First, because it is the first study concerned with investigation of parasitic infections in humans during the Corona pandemic, it was difficult for us to compare our findings with those of others. Second, because our study was medical records- based, we used the available patients data for the analysis. Data on the key clinical symptoms and the socio-demographic variables, such as the patient's residence, education, work, income, drinking water supply and wastewater disposal, have been missing from patients records. Such data, if was available, could provide a detailed explanation of the prevalence of blood parasites among the population. Third, being a hospital based, our findings do not reflect the true prevalence in the country. Finally, our study focused on routine hospital diagnostic methods that lack sensitivity of parasite detection. Such less sensitive techniques could under- estimate the true prevalence of these parasites.

Conclusion

In conclusion, infections with blood parasites remain an important issue for the study population. A significant decrease in the prevalence of these parasites was reported during the COVID-19 pandemic time period, compared to pre-pandemic period. The lock-down measures taken by the Saudi government to control the pandemic could play a role in this reduction. This study will provide invaluable data needed to prepare meaningful public control programs aimed to reduce the prevalence and morbidity of parasitic infections in the study population.

Conflict of interests

The authors declare that they have no conflict of interests.

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