Association of COVID-19 and Dengue Fever Virus Disease on Recovery and Prevention of COVID-19 Infection in The Health Sector Workers in Taiz City, Yemen

العلاقة بين كوفيد – 19 وفيروس حمى الضنك لحماية المصابين بكوفيد– 19 لدى العاملين في مجال الرعاية الصحية في مدينة تعز– اليمن

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Abstract:

This study is aimed to confirm the current unproven correlation between COVID-19 infection and prior Dengue fever infection. The possible overlapping immunity between COVID-19 infection and Dengue fever infection on the health care workers (HCW) in Taiz City, Yemen was investigated. This study is designed as a cross-sectional study. The number of subjected HCWs to this study was 180 individuals, and they were tested for COVID-19 infection by RT-PCR, and blood specimens of HCWs were tested for prior Dengue fever infection by ELIZA. The total positive results were 87 positive results to COVID-19 infection and the total positive results were 121 positive results to Dengue infection, but the total COVID-19 with pervious Dengue infection were 60. The aim is achieved by studying the impact of some factors including blood group typing, clotting time, platelets count, gender, as well as the impact of DF IgG levels on the severity of COVID-19 infection .This study finds that there was a relationship between COVID-19 and Dengue infection. The most important findings of this study was the relationship between the type of Dengue infection (primary or secondary) and severity of COVID-19. The study shows that secondary infection with dengue reduces the severity of COVID-19 infection by 92%, and the COVID-19 is light, P-value = 0.021, While at 8%, COVID-19 is more severe. While in the primary infection of Dengue, COVID-19 was 55% light COVID-19, and COVID-19 was 45% more severe. The study reveals that there is a relationship between dengue IgG levels and the type of dengue infection with the severity of COVID-19 infection, meaning that high levels of dengue IgG with a new primary or secondary infection were non-severe infection with COVID-19 or no infection with COVID-19, with P-value=0.014 .The study also shows that blood grouping A was the most blood grouping that was infected with severity of COVID-19 P-Values(0.040) and the blood grouping O was the most blood grouping that was infected with Dengue infection P-Values(0.000), and that was answered why blood grouping O when was infected with COVID-19, the infection was light. The blood coagulation time was high in dengue patients by 84% and the odds value=5.25, CI=(0.24857- 1.272), P-value=0.001 while in COVID-19 patients were low .

Keywords: COVID-19; Previous Dengue fever ; ABO grouping; Platelets ; Clotting time; Dengue IgG levels; Health workers; Taiz city; Yemen .

Badria, M. Abdel–Wasae, Najeeb, K. AL–shorgani, Bushra, S. AL–sharabi

الملخص:

تهدف هذه الدراسة إلى تأكيد العلاقة الغير مثبتة بين الإصابة بكوفيد–19 والإصابة السابقة بحمى الضنك. تمت
دراسة احتمال وجود مناعة متداخله بين الإصابة بكوفيد–19 والإصابة بحمى الضنك لدى العاملين في مجال الرعاية
الصحية في مدينة تعز، اليمن. تم تصميم هذه الدراسة كدراسة مقطعية. كان عدد العاملين في مجال الرعاية الصحية الذين
خضعوا لهذه الدراسة 180 فردًا، تم فحصهم بحثًا عن الإصابة بكوفيد–19 بواسطة RT–PCR كما تم اختبار عينات
دم العاملين في مجال الرعاية الصحية بحثًا عن إصابة سابقة بحمى الضنك بواسطة اختبار ELIZA. وكان إجمالي النتائج
الإيجابية 87 نتيجة إيجابية بكوفيد–19 وكانت إجمالي النتائج الإيجابية 121 نتيجة إيجابية للإصابة بحمى الضنك، وكان
إجمالي كوفيد–19 مع الاصابة السابقة بحمى الضنك 60. تم تحقيق الهدف في هذه الدراسة من خلال دراسة تأثير بعض
العوامل مثل نوع فصيلة الدم، ووقت التخثر، وعدد الصفائح الدموية، والجنس، بالإضافة إلى تأثير مستويات الاجسام
المضادة من نوع IgG لحمى الضنك على شدة الإصابة بـCOVID-19. كما وجدت هذه الدراسة أن هناك علاقة
بين كوفيد–19 والإصابة بحمى الضنك. وكانت أهم النتائج التي توصلت إليها هذه الدراسة هي العلاقة بين نوع الإصابة
بحمى الضنك (اولية أو ثانوية) وعلاقتها بشدة الإصابة بكوفيد–19، حيث أظهرت الدراسة أنه عند الإصابة الثانوية
بحمى الضنك، فإنها تقلل من شدة الإصابة بكوفيد–19 بنسبة 92%، والكوفيد–19 تكون الإصابة خفيفة، قيمة
p-values = 0.021 ، بينما كانت نسبة 8% كوفيد–19 أكثر شدة . وفي العدوى الأولية لحمى الضنك، كانت
الإصابة بكوفيد–19 خفيفة بنسبة 55%، كما كانت الإصابة بكوفيد–19 أكثر شدة بنسبة 45%. وأظهرت الدراسة
أن هناك علاقة بين مستويات IgG لحمى الضنك ونوع الإصابة بحمى الضنك مع شدة الإصابة بـCOVID-19، مما
يعني أن المستويات المرتفعة من IgG لحمى الضنك مع إصابة أولية أو ثانوية حديثة ساعدت على أن تكون الإصابة غير
شديدة بالكوفيد–19 ، أو عدم الإصابة بالكوفيد–19، و كانت قيمة 0.014 = P-values . وأظهرت الدراسة أن
فصيلة الدم A كانت أكثر فصائل الدم من حيث الإصابة الشديدة بالكوفيد–19 وكانت (P-Values = 0.040)
بينما كانت فصيلة الدم O هي اكثر الفصائل الدموية من حيث الإصابة بحمى الضنك، (P-Values = 0.000) .
وبهذا تتم اجابة السؤال لماذا فصيلة الدم O عند الإصابة بـCOVID-19 تكون الإصابة خفيفة. أيضاً توصلت
الدراسة الى أن وقت تخثر الدم مرتفعًا في مرضى حمى الضنك بنسبة 84% وكانت قيمة الأرجحية = 5.25، = CI
(1.272 – 0.24857)، وقيمة P-values = 0.001 بينما كانت منخفضة في مرضى كوفيد–19.

الكلمات المفتاحية: كوفيد–19، الإصابة السابقة بحمى الضنك، فصائل الدم, الصفائح، زمن التجلط،
مستويات الاجسام المضادة IgG الضنك، العاملين في الرعاية الصحية، مدينة تعز، اليمن .

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Badria, M. Abdel-Wasae, Najeeb, K. AL-shorgani, Bushra, S. AL-sharabi

1. Introduction

A new coronavirus termed COVID-19 (coronavirus disease 2019) is currently associated with an increasing number and rate of morbidities and fatalities. The genetic analysis of the COVID-19 exhibited >50% sequence identity to MERS-COV and 80% to SARS-COV (Peng et al., 2020).

Dengue viruses (DENVs) are the most important human arboviruses worldwide and are transmitted by mosquitoes of the genus Aedes in the form of four distinct serotypes (DENV-1, DENV-2, DENV-3, and DENV-4). Dengue causes serious infection in humans, resulting in morbidity and mortality in most tropical and subtropical areas of the world. It is estimated that there are currently 50–100 million cases of dengue every year worldwide, including more than 500,000 reported cases of dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) (Simmons et al.,2012).

Notably, some key contrasting features could help separate the clinical presentations of these two illnesses. COVID-19 principally begins with respiratory symptoms, and cough is present in the initial symptoms in 75% of cases, with up to 25% having a productive cough, something improbable in patients with dengue. Moreover, sore throat and nasal manifestations, portrayed in COVID-19, have not been depicted commonly in dengue. Patients with dengue may show monocytosis, apart from lymphopenia and thrombocytopenia. This finding also has not been portrayed in COVID-19 (Ridwan et al., 2020).

COVID-19 and dengue fever are difficult to discriminate because they share clinical manifestations and laboratory features (Chen et al., 2020).

There is a study in Brazil showed that there are significant factors associated with the uneven distribution of COVID19 cases: one of them a larger number of cities with a high incidence of dengue were of very low COVID19 incidence (Ananya, 2020).

Countries highly endemic for dengue (>1.5 million cases/year) were ob-

Association of COVID-19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID-19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel–Wasae, Najeeb, K. AL–shorgani, Bushra, S. AL–sharabi

servably less affected by COVID–19 at the beginning in terms of transmission, infection and mortality (Ridwan et al., 2020 and Ulrich et al., 2020). Based on relative mutual exclusiveness of COVID–19 and dengue severity maps and evidence of serological cross–reactions of SARS-COV-2 with dengue, immediate immunization with last year's live–attenuated dengue vaccine for susceptible populations in Europe, North America and non–dengue endemic Asian countries such as China and Iran were proposed as a measure of boosting immunity and halting the pandemic. The antiviral immune response directed towards the dengue virus may also protect against COVID–19 because of viral interference (Panda & Sharawat, 2021).

The importance of this study lies in the fact that it helps to confirm the possible and currently unproven theory that there is a so–called overlapping immunity between COVID–19 and dengue.

The aim of this study is to prove the overlapping immunity between COVID–19 and Dengue fever infection in HCWs in Taiz city.

1. Method

Study Area
The study area was in Taiz city, Yemen.
The spatial distribution: The hospitals in the three districts affiliated to Taiz city (Al–Mudhaffar district, Al–Kahera district and Salah district).
Sampling procedure:
Samples were selected under following inclusion and exclusion criteria. The sample size were 180 previous patients to Dengue virus or COVID–19 patients or both and were selected randomly from a total of 4251 workers in health care workers in section in three districts of Taiz city during the study period, between November 2021 and June 2023.

Association of COVID–19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID–19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel–Wasae, **Najeeb**, K. AL–shorgani, **Bushra**, S. AL–sharabi

The sample size was calculated according to the following equation:

n= z2×p×(1–p)/d2

Z= degree of freedom 1.96 or 95 %

P= prevalence

d= margin of error = 0.05 %

P=(4430/3885943)*100 = 0.114

n= (1.96×1.96)×0.114×(1–0.114)/0.05×0.05

n= 3.8416×0.114×0.886/0.0025

n=155

n=155 +25= 180

In addition to 155 cases we added 25 samples as control

25 = control sample (No infection)

Sample collection

Three ml of venous blood obtained from workers in health sector. The blood samples placed in a sterile plain tube and allowed for clotting at room temperature for 30 minutes then centrifuged 3000 rpm for 5 minutes by cen–trifuge RCF 1790xg. Serum detected of DENGV IgG antibody by ELIZA method, COVID 19 IgG & IgM antibodies by Cassette.

Inclusion Criteria: Any individual who has a previous infection with Dengue virus or COVID–19 virus or both in HCW.

Exclusion criteria: Any individual who has not a previous infection with Dengue virus or COVID–19 virus (except control samples).

 Measurement of blood clotting:

Blood clotting time was measured using drop method, and the blood drop was taken on a clean, dry glass slide and was left till fibrin threads were seen. Once the fibrin threads were seen, time was recorded .The normal time for blood clotting was 1–6 minutes.

Association of COVID–19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID–19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel–Wasae, Najeeb, K. AL–shorgani, Bushra, S. AL–sharabi

Complete blood count (**CBC**)

A complete blood count (CBC) is a blood test used to evaluate your overall health and detect a wide range of disorders. CBC measured by sysmex kx–21N.

Dengue Virus IgG Elisa

Dengue Virus IgG Elisa carried out according to the instructions of the man–ufacturer (Talkington et al., 2004). Enzyme Linked Immunosorbent Assay (ELISA) for the qualitative/semi quantitative determination of IgG antibodies to Dengue virus subtypes 1,2,3 & 4 in human plasma and sera. The product is intended mostly for the follow–up of Dengue virus infection. For "in vitro" di–agnostic use only, calculate the absorption of Sample in OD 450nm / Cut–Off value (or S/Co) for the Controls and for the samples. CUT-OFF = 0.250. The samples showing an OD 450nm value lower than the Cut–Off value are con–sidered negative for anti–Dengue virus IgG. Samples showing an OD450nm value higher than the Cut-Off value are considered positive for anti–Dengue virus IgG.The result after apply this formula S/Co.　　　Negative Control < 1, Positive Control > 1, Borderline = 1

COVID–19 IgG/IgM cassette CTK Biotech

The laboratory method for detecting **C**OVID–19 is RT–PCR. 35 of tar–get group had a positive result with COVID–19 infection by real time PCR (RT–PCR) from the central laboratory of AL–Thawra hospital. However, this method requires sophisticated equipment and highly trained laboratory techni–cians. Moreover, viral load decreases rapidly 9 or 10 days after onset of symp–toms. During the acute phase of infection, the titer of IgM to SARS-COV rises rapidly and peaks around 2–3 weeks after the infection. SARS COV–specific IgG antibodies appear shortly after IgM and persist for months (Li et al., 2003). The SARS–COV specific antibodies are useful markers for diagnosis and epi–demiologic survey. All reagents are ready to use as supplied.

Data analysis

Data were entered in Excel (Microsoft Corp., Redmond, WA, USA), and then imported into SPSS Version 23 (IBM Corp., Armonk, NY, USA) for descriptive and inferential statistical analysis. Confidence intervals (CI), and

Association of COVID–19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID–19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel–Wasae, Najeeb, K. AL–shorgani, Bushra, S. AL–sharabi

odds ratios were used to test differences in gender and clotting time. Chi–
squared tests were used appropriately. A significance level of 0.05 was used.

3 Results

The total number of screened workers in health sector in Taiz city in this
study was 180 persons including 95 male patients and 85 female patients. The
total positive results were 87 positive results to COVID–19 infection and the
total positive results were 121 positive results to Dengue infection. But the total
number of COVID–19 with pervious Dengue infection were 60.

3.1 Some Paradoxes between COVID–19 Infection and Dengue Infec– tion

3.1.1 Effect of Gender on the Infections

The effect of gender on Dengue infections and COVID–19 infections
as shown in Table 1A noted that the males were exposed by (69.47%) and
odds=2.27586 and CI= (1.47065–3.52195) more than females to Dengue in–
fections, but the opposite result occurs in COVID–19 infection where females
were exposed by (50.59) and odds= 1.02381 and CI= (0.6692–1.56633) more
than male to COVID–19 infections. As shown in Table 1B, the effect of gen–
der on the severity of COVID–19 infections with previous Dengue infection
was noted female more severity of COVID–19 infections by (63%) but in male
by (37%) whereas male was light COVID–19 by (58%) but female by (42%),
p–value = 0.113 .

Association of COVID–19 and Dengue Fever Virus Disease on Recovery and Prevention of COVID–19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel–Wasae, Najeeb, K. AL–shorgani, Bushra, S. AL–sharabi

Table 1A   Effect of gender on the Dengue infections and COVID–19 infections

Sex	N	Dengue infection	%	Odds	CI	p-value	COVID-19	%	Odds	CI	p-value
Male	95	66	69.47%	2.27586	1.47065 (–3.52195)	0.49	44	46.32%	0.86275	0.86275–(1.29128)	0.56
Female	85	55	64.71%	1.83333	1.17502–(2.86048)		43	50.59%	1.02381	0.6692–(1.56633)	

Table 1B Effect of gender on the severity of COVID–19 infections with previous Dengue infection

Sex	COVID–19 with pervious Dengue infection (n=60)						P–values
	Severe COVID–19			Light COVID–19			
	N	%R	%C	N	%R	%C	
Male	14	42%	45%	19	58%	66%	0.113
Female	17	63%	55%	10	37%	34%	

3.1.2 Effect of Blood Grouping Type on Severity of COVID–19 Infection with Previous Dengue Infection

The effect of blood grouping type on severity of COVID–19 infection with previous Dengue infection was noted as shown in Table 2, blood grouping A

Association of COVID–19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID–19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel–Wasae, Najeeb, K. AL–shorgani, Bushra, S. AL–sharabi

was more severity of COVID–19 infection whereas blood grouping O was light COVID–19 infection P–values = 0.040.

Table 2 Effect of type of blood on severity of COVID–19 infection with previous Dengue infection

| Type of blood | COVID–19 with pervious Dengue infection((n=60 | | | | | | P–values |
| | Severe COVID–19 | | | Light COVID–19 | | | |
	N	%R	%C	N	%R	%C	
+A	18	75%	58%	6	25%	21%	
–A	1	50%	3%	1	50%	3%	
+B	1	20%	3%	4	80%	14%	
–B	0	0%	0%	0	0%	0%	0.040
+O	11	39%	35%	17	61%	59%	
–O	0	0%	0%	1	100%	3%	
+AB	0	0%	0%	0	0%	0%	
–AB	0	0%	0%	0	0%	0%	

According to the results shown in Figure 1, the common type of blood in Dengue infection was noted that blood grouping O was the most blood grouping that was infected with Dengue infection **P–Values** (**0.000**), that was answered why blood grouping O when infected with COVID–19 infection, the infection was light.

Association of COVID-19 and Dengue Fever Virus Disease on Recovery and Prevention of COVID-19 Infection in The Health Sector Workers in Taiz City

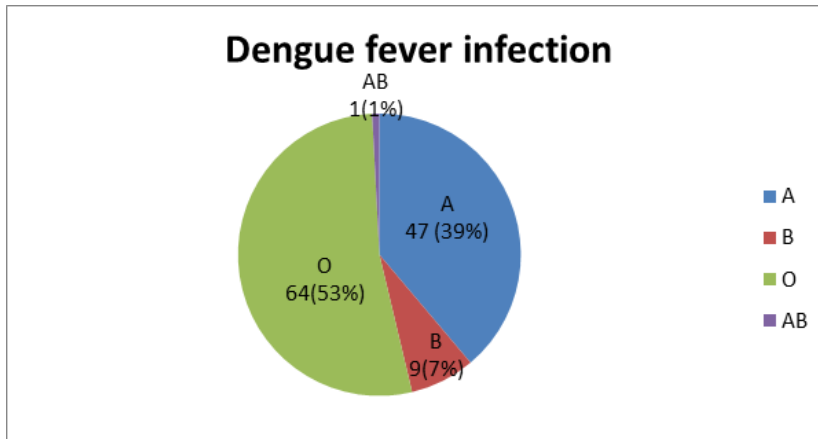Badria, M. Abdel-Wasae, Najeeb, K. AL-shorgani, Bushra, S. AL-sharabi

Figure 1 Common type of blood in Dengue infection

3.1.3 Effect of Infection on Clotting Time Values

Table 3A shows that the effect of Dengue infection on clotting time values that was value in how infected with Dengue infection 84% and the odds value = 5.25, CI= (0.24857–1.272). And the effect of COVID-19 infection on clotting time values was low values in how infected with COVID-19 infection, 63.33% and its value odds = 1.72727, CI= (0.82199–3.62956). In Table 3B showed the effect of COVID-19 and pervious Dengue infection on clotting time values that illustrated that, the pervious Dengue infection effected on clotting time to become high (P-value = 0.001) .

Association of COVID–19 and Dengue Fever Virus Disease on Recovery and Prevention of COVID–19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel–Wasae, Najeeb, K. AL–shorgani, Bushra, S. AL–sharabi

Table 3A Effect of pervious Dengue infection and COVID–19 infection on clotting time values

Clotting time	N	pervious Dengue infection	%	Odds	CI	p-value	COVID-19 infection	%	Odds	CI	p-value
Low	30	17	56.67%	1.30769	0.63517–(2.69228)		19	63.33%	1.72727	0.82199–(3.62956)	
Normal	125	83	68.60%	1.97619	1.36347–(2.8642)	0.094	59	48.76%	0.89394	0.62922–(1.27003)	0.119
High	25	21	84.00%	5.25	0.24857–(1.272)		9	36.0%	0.5625	0.24857–(1.2728)	

Table 3B Effect of COVID–19 and pervious Dengue infection on clotting time values

Clotting time	COVID-19 infection	N	%P	p-values	pervious Dengue infection	N	%P	p-values
Low	No	11	36.67%		No	13	43.33%	
	Yes	19	63.33%	0.144	Yes	17	56.67%	0.465
	Total	30	100%		Total	30	100%	

Association of COVID–19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID–19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel–Wasae, Najeeb, K. AL–shorgani, Bushra, S. AL–sharabi

High	No	16	64%	0.162	No	4	16%	0.001
	Yes	9	36%		Yes	21	84%	
	Total	25	100%		Total	25	100%	

3.1.4 Effect of Severity of COVID–19 Infection with Previous Dengue Infection on Platelets

The effect of severity of COVID–19 infection with previous Dengue infection on platelets was as shown in Table 4. In case of pervious severe dengue platelets were from 150.000 into 280.000 mcl whereas in case of severe COVID–19 platelets were from 280.000 into 400.000 mcl and (P-value = 0.024)

Table 4 Effect of severity of COVID–19 infection with previous Dengue infection on platelets

Platelets	COVID–19 with pervious Dengue infection						p–values
	pervious severe Dengue		Severe COVID–19		Total	P	
	N	P	N	P			
less than 150.000	3	10%	0	0%	3	5%	
from 150.000 into 280.000	16	55%	9	29%	25	42%	
from 280.000 into 400.000	9	31%	19	61%	28	47%	0.024
more than 400.000	1	3%	3	10%	4	7%	
Total	29	100%	31	100%	60	100%	

3.2 Indications of the Relationship between COVID–19 and Dengue Infections

In Table 5, that studies IgG Levels in the primary and secondary Dengue

Association of COVID-19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID-19 Infection in The Health Sector Workers in Taiz City

Badria, **M. Abdel–Wasae**, **Najeeb**, **K. AL–shorgani**, **Bushra**, **S. AL–sharabi**

infection, it was noted that the Dengue IgG levels increased in secondary Den–
gue infection (P–value = 0.000).

Table 5 **IgG Levels in the primary and secondary Dengue infection**

Dengue in–fection	Dengue IgG levels								Total	p-value
	High level of IgG	P%	Medium level of IgG	P%	Low level of IgG	P%	NS1 and IGM	P%	No infection with Dengue	
Primary infec–tion	34	35.42%	31	32.29%	27	28.13%	4	4.17%	0	96	
Secondary infection	15	60%	6	24%	4	16%	0	0%	0	25	
No infection	0	0%	0	0%	0	0%	0	0%	59	59	0.000
Total	49		37		31		4		59	180	

3.2.1 The Relationship between Type of Dengue Infection and Sever and
Light COVID–19

When Dengue happened before COVID–19, it was a secondary infection, the
result was light COVID–19 infection (P–value = 0.021), as shown in Figure 2.
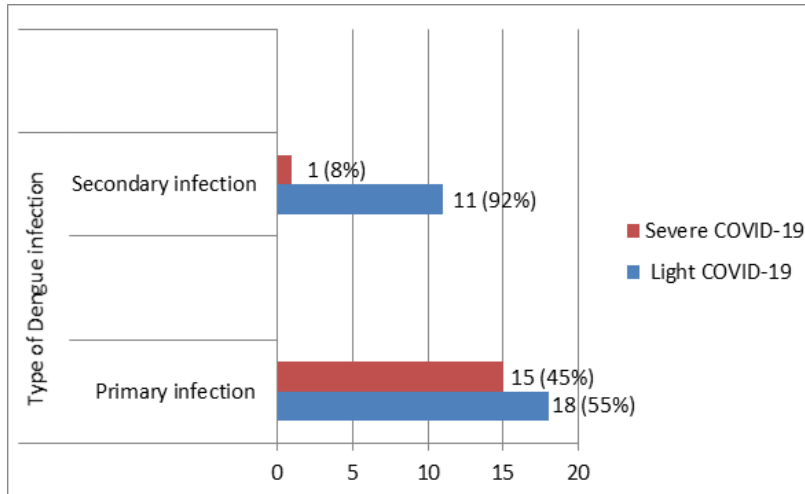
Association of COVID–19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID–19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel–Wasae, Najeeb, K. AL–shorgani, Bushra, S. AL–sharabi

Figure 2 The relationship between type of Dengue infection and sever and light COVID–19 P–values (0.021)

3.2.2 The Relationship between IgG Dengue Levels, Type of Dengue Infection and Severity of COVID–19 Infection

Also According to the results as shown in Table 6, that promoted our findings, there was an effect when high and medium IgG Dengue levels on severity of COVID–19 infection especially when infection was secondary and new infection (P–value = 0.014) (P–value = 0.070) respectively.

Association of COVID–19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID–19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel–Wasae, Najeeb, K. AL–shorgani, Bushra, S. AL–sharabi

Table 6 the relationship between IgG Dengue levels, type of Degue infection and severity of COVID–19 infection

IgG Dengue levels	C0VID–19 In–fection	Type of Dengue infection			P–value
		primary and old infection	primary and new infection	Sec–ondary and new infection	
High level of IgG	Severe COVID–19	7	4	0	0.014
	Non severe or non–COVID–19 infection	9	14	15	
Medium level of IgG	Severe COVID–19	7	2	0	0.070
	Non severe or non–COVID–19 infection	10	12	6	
Low level of IgG	Severe COVID–19	6	1	1	0.715
	Non severe or non–COVID–19 infection	14	6	3	

4. Discussion

This study is indicated to confirm the possible and currently unproven theory that there is a so–called overlapping immunity between COVID–19 and dengue.

Association of COVID-19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID-19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel-Wasae, Najeeb, K. AL-shorgani, Bushra, S. AL-sharabi

Due to the different design and insufficient sample size, the clinical symptoms, laboratory and imaging results of the studies were different (Coller and Shattil, 2008). In our study, the patients samples were analyzed and consisted of 87 COVID-19 infections and 121 Dengue infections .But the total COVID-19 with pervious Dengue infections were 60, in health care workers in Taiz city, Yemen.

In our study, we investigate the relationship between COVID-19 and Dengue Fever Virus Disease and we found in case of pervious Dengue infection that the COVID-19 infection became light infection especially in new or secondary infection P-value (0.021).

In other study in Brazil, it is seen that the regions where people had high antibody (IgM) levels for dengue fever had a low incidence of COVID19 cases, and there was also a lower infection growth rate and mortality (Ananya, 2020). Also it shows that there were significant factors associated with the uneven distribution of COVID-19 cases in Brazil. One of them is a larger number of cities with a high incidence of dengue were very low COVID-19 incidence. There were 3.5 million cases of dengue fever between January 2019 and July 2020. Those regions where people had high antibody (IgM) levels for dengue fever had a low incidence of COVID19 cases, and there was also a lower infection growth rate and mortality. This agrees with logical conclusions to our results.

The controversial results in this study are that blood group A is more severe than the others. It was reached into isolation, intensive care and taking oxygen in (75%) from total of individual with group A that was infected with COVID-19 infection while only 11 individuals (39%) in blood group O severe COVID-19 from total of individual with group O that was infected with COVID-19 infection, but the other were light COVID-19 infection. On the other side, blood grouping O was the most blood grouping that was infected with Dengue infection P-Values (0.000) that was answered why blood grouping O when was infected with COVID-19 infection, the infection was light.

Association of COVID-19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID-19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel-Wasae, Najeeb, K. AL-shorgani, Bushra, S. AL-sharabi

Similarly, in a study by (Behera et al., 2022), which consecutively obtains that 5000 qRT-PCR positive patients (cases) and 11,700 (controls) were included in the present study. Among the cases, the highest number (2379; 47.6%) of samples belonged to A blood group followed by B (1278; 25.6%) while among the control group O blood group had the highest prevalence (4215; 36%). Blood group A had a higher odd of testing positive (Odds ratio-2.552; CI 2.381–2.734; p<0.0001) than all other blood groups. A blood group is also associated with higher risk of ICU admission (Odds ratio- 1.699; 95% CI 1.515–1.905), and 65.3% of this group is also associated with high viral load which gives an indication of higher disease severity. These results agree with our study.

Other results demonstrated that the risk of SARS-COV-2 was higher for patients with blood group A than those with not-A blood type patients. Of the 671 patients with COVID-19, 301 had type A (44.86%), 232 had type B (34.58%), 53 had type AB blood (7.9%), and 85 had type O (12.67%) (Mustafa et al., 2023).

Another study in China was indicated that individuals with blood group A [odds ratio (OR)= 1.33, 95% confidence interval (CI) 1.14 to 1.56] and B (OR= 1.06, 95% CI 1.00 to 1.13) had a substantially higher risk of COVID-19, whereas this was not the case for blood group AB (OR= 1.07, 95% CI 0.88 to 1.30). Individuals with blood group O was not prone to develop the disease (OR = 0.71, 95% CI 0.60 to 0.84) (Liu et al., 2021).

In our study, the clotting time values were 84% high clotting time values in how infected with Dengue infection but the clotting time values were 63.33% low clotting time values in how infected with COVID-19 infection. Also in case of COVID-19 and pervious Dengue infection, the pervious Dengue infection effected on clotting time to became high (P-value = 0.001).

There is a study by (Al-Samkari et al., 2020); it describes the rate and severity of hemostatic and thrombotic complications of 400 hospital-admitted

Badria, M. Abdel–Wasae, Najeeb, K. AL–shorgani, Bushra, S. AL–sharabi

COVID–19 patients (144 critically ill) primarily receiving standard–dose prophylactic anticoagulation. Coagulation and inflammatory parameters were compared between patients with and without coagulation–associated complications. Multivariable logistic models examined the utility of these markers in predicting coagulation–associated complications, critical illness, and death. The study shows that fibrinogen and ferritin were higher in patients with thrombotic complications than in those without. This makes an agreement with logical conclusions to our study.

Additionally, systematic review (Adane, 2021) Coagulation mechanisms are reported to be affected in dengue illness and evidenced by prolonged activated partial thromboplastin time (APTT) and prothrombin time (PT). Forty–two studies with a total of 12,221 dengue fever patients were eligible for meta–analysis in this study, of which 22, 15, and 26 studies were used to determine the magnitude of prolonged APTT, PT, and thrombocytopenia, respectively. The magnitude of prolonged APTT and PT among patients with dengue fever infection were 42.91% (95% CI: 30.95, 54.87) I2 = 99.1% and 16.48% (95% CI: 10.95, 22.01) I2 = 97.0%, respectively. Besides, the magnitude of thrombocytopenia among dengue fever patients was 70.29% (95% CI: 62.69, 77.89) I2 = 99.3%. The magnitude of prolonged APTT in children and adults was 51.21% (95% CI: 24.54, 77.89) and 44.89% (95% CI: 28.32, 61.45), respectively. Similarly, the overall magnitude of prolonged PT in children and adults was 13.40% (95% CI: 6.09, 20.71) and 18.73% (95% CI: 7.49, 29.96), respectively.

The results in this study show that the female infection was 50.59% and more severe COVID–19 by 63%, but male infection was 46.32% and severe COVID–19 was 37%.

In Other study, in China were systematically review the clinical characteristic of COVID–19 patients showed that a higher proportion of infected patients were male (56.9%) (Zhu et al., 2020).

Further rigorous and high–quality research evidence is needed to confirm

Association of COVID–19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID–19 Infection in The Health Sector Workers in Taiz City

Badria, **M. Abdel–Wasae**, **Najeeb**, **K. AL–shorgani**, **Bushra**, **S. AL–sharabi**

this association. In conclusion, undoubtedly, continuous health supporting, continuous medical examination and prompt treatment of patients minimize the spread of COVID–19 and Dengue infections. Health education in general should be increased to raise awareness of the society with importance of prevention of infections. Our duties, as researchers anywhere in the world, are to explore the facts, and credibility, and to be accurate in results.

As with the majority of studies, the design of the current study is subjected to limitations. There are two major limitations.

Limitations of study

Limitations, in this study, that could be addressed in future research are as follows: first, the study lacks of prior research studies on the topic in most variables. Second, materials were late in arriving and their prices were high.

Association of COVID-19 and Dengue Fever Virus Disease on Recovery and
Prevention of COVID-19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel–Wasae, **Najeeb**, K. AL–shorgani, **Bushra**, S. AL–sharabi

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Association of COVID-19 and Dengue Fever Virus Disease on Recovery and Prevention of COVID-19 Infection in The Health Sector Workers in Taiz City

Badria, M. Abdel–Wasae, Najeeb, K. AL–shorgani, Bushra, S. AL–sharabi

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