TABLE 2 Support for FGM based on gender among high school students in The Gambia: a report of coefficent estimates by logistical regressional analysis

Variables	Coefficients	SE	*P* value
Gender	0.01	0.35	0.990
Islam supports FGM	2.06	0.38***	0.001
FGM maintains virginity	1.08	0.35***	0.002
Difficulty getting married without FGM	0.70	0.39	0.071
Met NGO advocating banning of FGM	0.25	0.36	0.487
Taught about FGM at school	0.19	0.35	0.587
N	241		
Pseudo-R^2	0.27		

Abbreviations: FGM, female genital mutilation; NGO, non-governmental organization; SE, standard error.

***Indicates *P* value <0.05.

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Obstetrics

Detection of SARS-CoV-2 in biological samples of pregnant women infected with COVID-19: A prospective cross-sectional study

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Mother-to-child transmission of SARS-CoV-2 might occur during the antepartum (in utero), intrapartum, and/or postpartum period. Theoretically, in utero transmission is possible in cases of maternal COVID-19 infection due to disruption in the placental interface or viral particles in the amniotic fluid as a result of viremia. Intrapartum and postpartum transmission might occur due to the neonate's exposure to the mother's infected genital secretions and breastmilk. The probability of vertical transmission is further heightened due to the wide expression of the SARS-CoV-2 receptor, angiotensin-converting enzyme 2 (ACE2), in the vagina, uterus,

This study is registered with the Clinical Trial Registry of India: (CTRI/2020/09/027618).

TABLE 1 Baseline characteristics and laboratory results of study participants

S. no.	Age	Parity	Co-morbidity	ICMR severity	Day of sampling	Vaginal swab	Cervical swab	Amniotic fluid	Placental membrane swab	Cord blood	Breast milk	Newborn throat swab	Maternal outcome
1	23	2		Moderate	1	−	−	−	−	−	−	−	Recovered
2	23	1	Pyelonephritis	Moderate	4	−	−	−	−	−	−	−	Recovered
3	24	1		Moderate	1	−	−	−	−	−	−	−	Recovered
4	23	1	HTN	Mild	2	−	−	−	−	−	−	−	Recovered
5	23	1		Mild	1	+	+	+	+	+	−	−	Recovered
6	25	1	Hypothyroidism	Mild	1	+	−	+	+	+	−	−	Recovered
7	40	4		Mild	2	NA	NA	NA	−	−	−	−	Recovered
8	30	1		Mild	1	−	+	−	+	+	−	−	Recovered
9	23	1		Mild	1	+	+	−	+	+	−	−	Recovered
10	29	1		Mild	2	+	−	−	+	−	+	−	Recovered
11	30	2		Mild	3	−	−	−	−	−	−	+	Recovered
12	30	1		Mild	1	−	−	+	+	−	−	+	Recovered
13	26	2		Mild	1	−	−	−	−	−	−	−	Recovered
14	25	1		Mild	1	−	−	−	−	−	−	−	Recovered
15	18	1		Mild	1	−	−	−	−	−	−	−	Recovered
16	19	1		Mild	2	−	−	−	−	−	−	−	Recovered
17	26	2		Mild	2	−	−	−	−	−	−	−	Recovered
18	27	2		Mild	2	NA	NA	NA	−	−	−	−	Recovered
19	24	1		Mild	1	+	+	+	−	−	NA	−	Recovered
20	32	6		Moderate	1	−	−	−	−	−	−	−	Recovered
21	23	1		Moderate	1	−	−	−	−	−	+	−	Recovered
22	34	2		Moderate	1	−	−	−	−	−	−	−	Recovered
23	25	1	APLA syndrome	Mild	1	+	−	+	+	+	+	−	Recovered
24	33	5	Eclampsia	Moderate	1	−	−	−	−	+	−	−	Recovered
25	27	2		Mild	1	−	−	−	−	−	−	−	Recovered
26	31	2		Severe	2	−	NA	−	−	−	NA	IUD	Expired
27	25	1		Mild	1	−	−	−	+	−	+	−	Recovered
28	40	2		Mild	1	−	−	−	−	−	−	−	Recovered
29	27	1		Mild	1	+	+	−	−	−	−	+	Recovered
30	25	1		Moderate	2	−	−	−	−	−	−	−	Recovered
31	18	1		Moderate	1	NA	NA	NA	−	−	+	−	Recovered

(Continues)

TABLE 1 (Continued)

S. no.	Age	Parity	Co-morbidity	ICMR severity	Day of sampling	Vaginal swab	Cervical swab	Amniotic fluid	Placental membrane swab	Cord blood	Breast milk	Newborn throat swab	Maternal outcome
32	30	2		Mild	3	−	−	−	−	−	−	−	Recovered
33	34	1		Mild	1	+	−	−	+	−	−	+	Recovered
34	29	3		Mild	1	−	+	−	−	−	−	+	Recovered
35	27	3		Mild	2	+	+	−	−	−	−	+	Recovered
36	32	2		Mild	1	−	−	−	−	−	−	+	Recovered
37	26	2		Mild	1	−	NA	−	−	−	+	−	Recovered
38	27	2		Mild	2	−	−	−	−	−	−	−	Recovered
39	28	1		Severe	2	−	−	+	−	−	NA	+	Expired
40	25	3		Mild	1	−	−	−	−	−	−	−	Recovered
41	27	1		Mild	1	−	−	−	−	−	−	+	Recovered
42	24	1	Acute fatty liver of pregnancy	Mild	1	−	−	−	−	−	−	+	Recovered
43	36	2		Moderate	1	−	−	−	−	−	−	−	Recovered
44	33	1	Diabetes mellitus & hypothyroidism	Severe	5	−	−	−	−	−	NA	+	Expired
45	25	2		Mild	1	−	−	−	−	−	−	−	Recovered
46	30	2		Mild	1	−	−	−	−	−	−	−	Recovered
47	28	5		Mild	2	−	−	−	−	−	−	−	Recovered
48	27	2		Mild	5	−	−	−	−	−	−	−	Recovered
49	27	1		Mild	1	−	−	−	−	−	−	−	Recovered
50	31	3	HbsAg +	Moderate	1	−	−	−	−	−	−	−	Recovered
51	26	2	Acute kidney injury, septic shock, disseminated intravascular coagulation, & antepartum hemorrhage	Severe	1	−	−	−	−	−	NA	IUD	LAMA
52	28	2	GDM & hypothyroidism	Mild	1	−	−	−	−	−	−	−	Recovered
53	22	1		Mild	1	−	−	−	−	−	NA	−	LAMA
54	30	1		Mild	1	−	−	−	−	−	−	−	Recovered
55	24	3		Mild	1	−	−	+	+	+	NA	IUD	Recovered

(Continues)

TABLE 1 (Continued)

S. no.	Age	Parity	Co-morbidity	ICMR severity	Day of sampling	Vaginal swab	Cervical swab	Amniotic fluid	Placental membrane swab	Cord blood	Breast milk	Newborn throat swab	Maternal outcome
Total no. of positive results (%)						9/52 (17.3%)	7/50 (14%)	7/52 (13.46%)	10/55 (18.18%)	7/55 (12.72%)	6/48 (12.5%)	11/52 (21.15%)	

Abbreviations: APLA, antiphaspholipid antibody; GDM, gestational diabetes mellitus; HbsAG +, hepatitis B surface antigen positive; HTN, hypertension; ICMR, Indian Council of Medical Research; IUD, intrauterine death; LAMA, left against medical advice; NA, not available.

and placenta.[1] To date, there is no consensus on the detection of SARS-CoV-2 in the amniotic fluid, placenta, cord blood, vaginal and cervical fluid, and breastmilk in infected mothers. Several case reports have studied its presence in one or a small number of patients.[2–10] Studies of multiple biological samples, with adequate sample size and correlation with neonatal COVID-19 status, of pregnant women infected with COVID-19 are needed to determine the occurrence of vertical transmission. The present study aimed to assess whether the presence of SARS-CoV-2 could be detected in the biological samples of pregnant women with COVID-19 infection.

This was a prospective cross-sectional study conducted at a tertiary care center in India from March 10 to May 31, 2021. Reverse transcriptase-polymerase chain reaction testing by throat swab was performed on all pregnant women with or without COVID-19 symptoms at the time of admission. Women positive for COVID-19 infection who underwent a vaginal or cesarean delivery were included in this study. Disease severity was assessed according to the Indian Council for Medical Research (ICMR) criteria.[11] This study received ethical approval from the AIIMS institutional ethics committee (AIIMS/IEC/20/575). Written informed consent was obtained from all participants for the collection of biological samples.

Vaginal, cervical, and placental swabs were obtained from the posterior fornix of the vagina and ectocervix, as well as in between the amniotic and chorionic membrane. Additionally, approximately 1 ml of amniotic fluid, cord blood, and breast milk were collected. All samples were immediately transported to the microbiology laboratory in a viral transport medium, and subjected to transcription-mediated amplification (TMA) by the Hologic Panther system (Hologic Inc., Marlborough, MA, USA) using USFDA- and EUA-approved Aptima assay (Hologic Inc.) for SARS-CoV-2 detection.

A total of 55 pregnant women with COVID-19 infection were delivered during the study period. Amniotic fluid and vaginal swabs were collected in 52 women (3 had premature rupture of membranes [PROM]), cervical swabs in 50 women (3 had PROM, 2 were fully dilated and had an effaced cervix), placental swabs and cord blood were in all 55 women, and breast milk was collected from 48 women (3 expired, 2 left against medical advice, and there were 3 cases of intrauterine death [IUD]). Throat swabs were obtained from 52 neonates.

The mean age of the study participants was 27.34 ± 4.6 years, and mean parity was 1.83 ± 1.13. Baseline characteristics and laboratory results of the study participants are described in Table 1.

SARS-CoV-2 was detected in the vaginal fluid of 9 (17.3%) patients, 7 (14%) cervical swabs, 7 (13.46%) samples of amniotic fluid, 10 (18.18%) placental swabs, cord blood of 7 (12.72%) patients, and breast milk (12.5%) of 6 participants. A total of 11 (21.15%) neonates tested positive for SARS-CoV-2 infection.

The results of the present study suggest a SARS-CoV-2 positivity rate of 34.5% in the biological samples of pregnant women infected with COVID-19 as one or more samples were positive in

19 of the 55 enrolled women. A total of 15 of these participants had mild disease, three had moderate disease, and one had severe disease.

Out of 11 neonates positive for COVID-19, evidence of SARS-CoV-2 transmission was identified in six mothers. Positive results were obtained from amniotic fluid (2), placental fluid (2), vaginal fluid (3), and by cervical swabs (3). Postpartum transmission could not be assessed as breastfeeding was not advised for mothers infected with COVID-19. Neonatal testing was performed within 12 h of birth; therefore, the possibility of environmental infection was not likely. However, a false-positive result because of fetal contamination through contact with maternal blood and feces was still a possibility in the remaining five neonates.

The vertical transmission rate of SARS-CoV-2 have been described in the literature as 6%[10] and 3.91%[12]; however, various case reports did not report detection of SARS-CoV-2 in any samples of vaginal fluid, amniotic fluid, cord blood, placental membranes, peritoneal fluid, and breast milk.[2–6] In spite of this, occasional studies have documented the presence of SARS-CoV-2 in small proportions through biological samples collected from pregnant women infected with COVID-19.[7–10] The high positivity rate in our study may be explained by the larger sample size and utilization of a more sensitive TMA-based technique for sample testing.[13]

The strengths of the present study are its fair sample size, prospective nature, and evaluation of multiple samples; however, there are certain limitations as we did not evaluate maternal blood and feces or IUD fetuses for the presence of SARS-CoV-2. Furthermore, neonatal throat swabs were not repeatedly tested after 24 h and we did not test for the presence of IgM antibodies in the neonate's blood. A well designed study including these parameters will provide more robust results.

CONFLICTS OF INTEREST

The authors have no conflicts of interest.

AUTHOR CONTRIBUTIONS

KK proposed the study idea. DD and RK collected the samples. DK and RS performed the laboratory analysis. KK drafted the manuscript with direction from JC. AG, AB and JC critically evaluated the manuscript. All authors (KK, DK, DD, RK, RS, AG, AB, and JC) contributed to and approved of the final version of the manuscript.

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