



A Cross-Sectional Analysis to Evaluate Knowledge, Attitude And Practices Among Pregnant Women During COVID-19 Pandemic

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Abstract

Objective To assess knowledge, attitude and practices (KAP) towards COVID-19 among pregnant women at a tertiary care hospital.

Methods This was a questionnaire-based cross-sectional analysis pertaining to COVID-19 which was conducted at a tertiary care obstetric facility in India among 200 consecutive consenting pregnant women. They were assessed for demographic details and KAP score (knowledge—17 questions, attitude—9 questions and practice—8 questions). Analysis of data was done using Statistical Package for the Social Sciences (SPSS) version 25.0.

Results The participants had adequate mean knowledge score (\pm SD) of 22.5 (\pm 3.5) were following good practices [mean score (\pm SD) = 15.5 (\pm 2.6)] and showed positive attitude for preventive measures against COVID-19 [n (%) = 194(96%)]. Low knowledge score (p -value 0.030) was seen in non-health care workers.

Conclusion This study demonstrated that majority of the pregnant women had satisfactory knowledge, positive attitude and were following practices in right manner regarding COVID-19 but continued efforts for generating awareness were warranted.

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As India is battling the second COVID-19 wave and in the absence of definitive cure, strengthening of health policies directed at pregnant women should be prioritized with special focus on significant gaps in KAP.

Keywords COVID-19 · Pregnant · Knowledge · Attitude · Practice

Introduction

The infectious coronavirus disease (COVID-19) has led to a global pandemic making it one of the biggest public health emergencies for mankind [1, 2]. The only effective approach in cutting down the spread of infection is to create public awareness and taking precautions as no definitive treatment is proven yet [3]. Government of India (GOI) has taken necessary steps to disseminate the required information among citizens by engaging in media campaigns and issuing advisories about the novel coronavirus, its mode of transmission and preventive measures to the general public. The Health Ministry via Department of Telecommunications has reached people across the country by directing all known telecom companies to include a 30-s COVID-19 prevention caller tune to their networks. The GOI has left no stone unturned to educate people about best practices and spreading pertinent advisories regarding control of spread of COVID-19 and has also launched the Aarogya Setu mobile application in this regard. [4].

People must adhere to preventive behaviour, which is mostly influenced by their knowledge, attitudes and practices (KAP), in order to curtail spread of infection [5]. It is also known that knowledge and attitude of public towards infectious diseases affect their emotions and panic reactions can impede preventive attempts to control spread of infection [6]. Pregnant women form a special vulnerable group due to unique changes in pregnancy placing them at a higher risk for contracting severe infection [3]. Current awareness among pregnant women regarding COVID-19 is inadequately studied, so the aim of this analysis was to evaluate KAP of pregnant women regarding COVID-19 at a tertiary care obstetric centre in India.

Material and Methods

This was a cross-sectional analysis conducted at a tertiary hospital in India. Approval was sought from Institute Ethics Committee (Reference no.—IECPG-247/24.06.2020, RT- 32/22.07.2020). All pregnant women attending the hospital were invited to participate in the study. Women who were not willing to participate or those who were sick/hemodynamically unstable were excluded. After obtaining informed written consent, 200 consecutive consenting pregnant women were recruited.

A questionnaire was self-constructed based on Royal College of Obstetricians and Gynaecologists (RCOG) guideline and World Health Organization (WHO) recommendations on COVID-19 in pregnancy [7, 8]. It was reviewed and verified by all the authors. The questionnaire was available in both English and Hindi language; translation in Hindi was done by a language expert. In case the woman was illiterate, she was administered the questionnaire verbally by a member of the study team.

The questionnaire comprised of two sections—demographic details and KAP. Demographic details included name, age, address, religion, education status and profession. Source of knowledge of participants on COVID-19 including mass media, family and friends or health care providers was also recorded. The KAP part of questionnaire assessed various aspects of knowledge, attitude and practices relating to COVID-19 infection.

The knowledge was evaluated through a set of 17 questions on epidemiology, transmission, clinical features, prevention, treatment available, effect of COVID-19 on mother and foetus, mode of delivery in COVID-19 mothers, feeding options for baby and different district zones based on risk profile. To investigate the degree of knowledge of each pregnant woman, a scoring system was applied. Depending on the question and response, score of 2 was given for correct response, 1 was given to a response which was correct to some extent and 0 was given to wrong response. The score ranged from 0 to 33 and sufficient knowledge was present if their score was equal to or more than the median score. Pregnant women were categorised as having inadequate knowledge if they scored less than the median.

Attitude was measured by a set of 9 questions which evaluated their behaviour towards COVID-19 disease, seriousness in following preventive measures, concerns if they contract the disease, place of delivery and quarantine and their confidence in victory in the fight against COVID-19. Practices among participants were scored using 8 questions based on adherence to preventive measures, frequency of handwashing, eating habits, behavioural changes towards family members, consumption of herbal medicines, coughing etiquettes and preferred feeding methods for the baby. Total practice score ranged from 2 to 23. Furthermore, 3 more practice related questions were asked. One was related to change in frequency of sexual intercourse since onset of pandemic and other was most common daily activity related to increased frequency of handwashing during pandemic. The third question was a hypothetical situation of

first trimester during pandemic and their decision regarding continuation or termination of pregnancy. These 3 questions were not scored as there was no particular correct response to these practices. Respondents were classified as following good practices if their score was equal to or more than the median value. Participants scoring less than the median score were categorised as those with poor practices.

Data were compiled using the excel spreadsheet. Statistical analyses were carried out using Statistical Package for the Social Sciences (SPSS) for windows version 25.0 (SPSS Inc., Chicago, IL, USA). Qualitative variables were presented as numbers or percentages. Frequency data across categories were compared either by Fisher's exact test or Pearson's Chi-square test as appropriate. Mean values of normally distributed data (tested by Kolmogorov–Smirnov) were tested by one-way ANOVA/students *t*-independent test as appropriate. We used either Mann–Whitney *U* test or Kruskal–Wallis test for comparison of median values of skewed as appropriate. Statistical significance was considered at *p*-value ≤ 0.05 for all statistical tests.

Results

A total of 200 pregnant women participated in the study. Baseline information of study participants is depicted in Table 1. For each question on knowledge, the distribution of responses from participants was investigated (Table 2). Overall, the respondents had adequate mean knowledge score (\pm SD) of 22.5 (\pm 3.5). The median knowledge score was 21 with 60% respondents having adequate knowledge (score ≥ 21) regarding COVID-19.

The attitude of pregnant women towards COVID-19 was studied through various questions listed in Table 3. There was universal agreement among pregnant women (100%) regarding delivery at hospital if they contracted COVID-19.

Response to each question on practices towards COVID-19 is presented in Table 4. Among the participants, increase in sexual intercourse frequency was seen in 22% (44), decrease in 50% (100) and no change in 28% (56) which could be due to the fear of contracting COVID-19 from their partners and thus affecting the course of pregnancy. When given the option of either continuing with pregnancy or terminating it in first trimester as a hypothetical situation, majority (91%) of the participants opted for continuation of pregnancy. Of these, 27.5% participants were confident regarding practicing preventive measures properly, 29% believed that they would take available treatment and get cured of COVID-19, 15% believed that neither she nor her baby would contract COVID-19, 14.5% wanted that baby as they feared infertility in future and 5.5% regarded baby as God's gift. Around 9% of pregnant mothers wanted to abort

Table 1 Baseline characteristics of study participants

Parameter	Total number = 200
Age (Years) (Mean \pm S.D)	28.6 \pm 3.9
Range (Years)	19–38
<i>Religion n (%)</i>	
Hindu	173 (86.5)
Muslim	19 (9.5)
Sikh	1 (0.5)
Christian	7 (3.5)
<i>Area of living n (%)</i>	
Rural	32 (16.0)
Suburban	22 (11.0)
Urban	146 (73.0)
<i>Distribution of subjects by COVID status of current residence n (%)</i>	
Hotspot	20 (10)
Non-hotspot	180 (90)
<i>Education level n (%)</i>	
Primary education and below	32 (16)
Secondary education	90 (45)
Graduation and higher	78 (39)
<i>Occupation n (%)</i>	
Health care related	27 (13.5)
Non-health care related	173 (86.5)
<i>Source of information n (%)^a</i>	
Mass media- specify	184 (92)
Family and friends	40 (20)
Healthcare providers	34 (17)

^a % values exceeded 100 due to multiple responses

the baby in view of COVID-19 pandemic as they feared the effect on foetus as no cure was available.

Baseline characteristics of study participants were compared with mean knowledge and practice score. Health care workers had significantly increased mean knowledge score (*P*-value 0.030) when compared to non-health care workers. However, their mean practice scores revealed no statistically significant difference (Table 5).

Various study variables were correlated with different domains of knowledge and practices as shown in Table 6. Significant positive correlation ($r=0.150$) was seen between knowledge about type of disease and frequency of hand-washing (p -value = 0.034) and also with preventive measures ($r=0.256$; p -value < 0.001) being practiced by participants. Those women who were aware about the symptoms suggestive of COVID-19 had positive correlation ($r=0.205$) with preventive practices (p -value 0.004). Those who were aware about prevalence of COVID-19 were found to have significantly increased frequency of handwashing (p -value 0.009). Significant positive correlation ($r=0.141$) was seen between knowledge about the risk of COVID-19 in pregnancy and preventive use of face masks (p -value 0.046). Significant

Table 2 Knowledge regarding COVID-19

Question	Response	Score	n (%)	
K1	What is the current stage of spread of COVID-19?	Pandemic	1	150 (75)
		Others (outbreak, epidemic)	0	50 (25)
	Mean score \pm SD, (range)			0.8 \pm 0.4, (0–1)
K2	What type of disease is COVID-19?	• Communicable	2	150 (75)
		• Both communicable and non-communicable	1	32 (16)
		• Non-communicable/not answered	0	18 (9)
		Mean score \pm SD, (range)		
K3	Which group is at the highest risk of contracting severe form of COVID-19?	Adults with comorbidities	1	102 (51)
		Others (adults without comorbidities, all age groups, pregnant women)	0	98 (49)
		Mean score \pm SD, (range)		
K4	Which of the following are symptoms suggestive of COVID-19? ^a	Fever	1	196 (98)
		Cough	1	196 (98)
		Breathlessness	1	192 (96)
		Myalgia/weakness	1	154 (77)
		Mean score \pm SD, (range)		
K5	How can COVID-19 be transmitted?	Respiratory droplets	1	192 (96)
		Others (flies, mosquitoes, meat products)	0	8 (4)
	Mean score \pm SD, (range)			1.0 \pm 0.2, (0–1)
K6	Which of the following are preventive measures for COVID-19? ^a	Social distancing	1	196 (98)
		Hand hygiene	1	194 (97)
		Wearing masks	1	194 (97)
		Avoiding crowded places	1	196 (98)
		Mean score \pm SD, (range)		
K7	What is the ideal duration of handwashing for hand hygiene?	20–30 s	1	96 (48)
		Others (2 min, 3 min, > 3 min)	0	104 (52)
		Mean score \pm SD, (range)		
K8	What is the trend of prevalence of COVID-19 in India?	Increasing	1	150 (75)
		Others (same, decreasing, do not know)	0	50 (25)
	Mean score \pm SD, (range)			0.7 \pm 0.4, (0–1)
K9	Does COVID-19 pose additional risk of infection to the pregnancy?	No	2	6 (3)
		Do not know	1	48 (24)
		Yes	0	146 (73)
		Mean score \pm SD, (range)		
K10	If the answer to question 9 is yes, then how-	(a) The foetus will be affected	NA	NA
		(b) Delivery will be complicated		
		(c) Antenatal complications are associated		
		(d) All of the above		
		(e) More research is required		
K11	What is the treatment of cure available for COVID-19?	Vaccine	1	26 (13)
		Homoeopathic	1	4 (2)
		Allopathic	1	14 (7)
		No proven treatment yet	2	142 (71)
		Not answered	0	14 (7)
		Mean score \pm SD, (range)		

Table 2 (continued)

Question	Response	Score	n (%)
K12 What is the prophylactic treatment available for COVID-19? ^a	Hydroxychloroquine	1	120 (60)
	Vaccine	1	88 (44)
	Lemon	1	88 (44)
	Ginger/garlic	1	86 (43)
	Not answered	0	0
Mean score \pm SD, (range)		1.9 \pm 1.5, (0–4)	
K13 What should be the mode of delivery in COVID-19 patient?	Vaginal delivery	1	32 (16)
	Operative vaginal delivery	1	4 (2)
	Caesarean section	1	46 (23)
	Not affected by COVID-19 status	2	46 (23)
	Not answered	0	72 (36)
Mean score \pm SD, (range)		0.9 \pm 0.7, (0–2)	
K14 What are the feeding options for the baby born to COVID-19 mother? ^a	Breastfeeding	1	36 (18)
	Expressed breast milk	1	50 (25)
	Formula-feed	1	94 (47)
	Not answered	0	40 (20)
Mean score \pm SD, (range)		0.9 \pm 0.6, (0–3)	
K15 What precautions should you ensure if you are tested COVID-19 positive, and you are with the baby? ^a	Hand hygiene	1	194 (97)
	Wear mask	1	196 (98)
	Disinfecting/cleaning surfaces with which you have been contacting with	1	182 (91)
Mean score \pm SD, (range)		2.9 \pm 0.4, (0–3)	
K16 If a pregnant female has been close contact with someone infected with the COVID-19 virus, what should be the period of isolation for observation of symptoms?	14 days	1	154 (77)
	Others (7 days, > 14 days, do not know)	0	46 (23)
Mean score \pm SD, (range)		0.8 \pm 0.4, (0–1)	
K17 If you are residing in the red zone, what is your risk of having COVID-19?	Higher than the green zone	1	106 (53)
	Others (same as green zone, higher than green zone, lower than orange zone)	0	94 (47)
Mean score \pm SD, (range)		0.5 \pm 0.50, (0–1)	
Overall mean knowledge score \pm SD, (range)		22.6 \pm 3.5, (10–29)	

^aDue to multiple responses, more than 100 per cent is possible

negative correlation ($r = -0.162$) was found between knowledge about preventive measures for COVID-19 and use of herbal products and traditional medicines (p -value 0.022).

Discussion

This study was conducted with the aim of providing an insight into the knowledge, attitude and practices of pregnant women regarding COVID-19 infection. Pregnant women form a unique vulnerable group due to the immunological suppression during pregnancy and measures should be taken to prevent COVID-19 infection in this subgroup. This is crucial particularly in developing nations like India where

the health infrastructure is not as strong as in developed countries.

Respondents had an overall correct knowledge rate of 68.5% (22.6/33*100), demonstrating that majority of pregnant women were knowledgeable about coronavirus but previous study in China among general population showed greater correct knowledge rate (90%) [9]. Overall, mean knowledge score (22.5) of the participants was adequate which is similar to knowledge level among pregnant women in previous study [10]. The adequate knowledge could be attributed to robust efforts by GOI in spreading information and increasing awareness since the beginning of pandemic. Therefore, it is not surprising that mass media (television, radio and internet) were the primary sources of information about COVID-19 for majority of the study participants

Table 3 Attitude towards COVID-19

Question	Response	n (%)
A1 Do you think you can have COVID-19?	Yes	78 (39)
	No	66 (33)
	Do not know	56 (28)
A2 Do you think your baby can be affected?	Yes	68 (34)
	No	70 (35)
	Do not know	62 (31)
A3 If you develop symptoms suggestive of COVID-19, whom would you communicate about it first?	Health personnel	114 (57)
	Parents	16 (8)
	Husband	70 (35)
	Nobody	0 (0)
A4 What will you do if you suspect that you have COVID-19?	Visit health care facility	172 (86)
	Visit traditional/ local healer	28 (14)
	Do not believe in treatment	0 (0)
A5 What concerns you the most if you are diagnosed with COVID-19?	Fear of transmitting it to baby/family members	138 (69)
	Social stigma	2 (1)
	Cost of treatment	0 (0)
	Fear of death	18 (9)
	I am confident that it will get cured	42 (21)
A6 On a scale of 1–5, how seriously one should follow preventive steps? 1—minimum, 5—maximum	1	4 (2)
	2	0 (0)
	3	4 (2)
	4	14 (7)
	5	178 (89)
A7 Where should the pregnant females with COVID-19 get delivered?	(a) Home	0 (0)
	(b) Hospital	100 (100)
	(c) Does not matter	0 (0)
A8 Suppose you test COVID-19 positive and are asymptomatic, where would you opt to get quarantined?	Home	88 (44)
	Hospital	92 (46)
	Anywhere	20 (10)
A9 Do you think that India can win the battle against COVID-19?	Yes	172 (86)
	No	4 (2)
	Do not know	24 (12)

(92%) which is similar to the study results among pregnant women in a low-resource African setting [11]. Significant predictor of knowledge was occupation (p -value = 0.030) with higher scores observed in health care workers as expected. There was no significant correlation of knowledge score with education, religion or area of distribution by COVID-19 status which is in contrast to previous studies [9, 10]. Commonly known COVID-19 related symptoms were fever (98%), cough (98%) and breathlessness (96%) but pregnant women were comparatively less aware about myalgia/weakness (77%) which is similar to the results of study in Iran by Erfani et al. [12] and this could be possible as myalgia and weakness are considered as physiological symptoms in pregnancy.

Health crisis situation like this also demands efforts towards correcting misleading information and misguided

perceptions of the general public. This study discovered various misconceptions among pregnant respondents regarding the duration of handwashing, additional risk of COVID-19 in pregnancy and feeding options for the baby. Less than half (48%) of the participants correctly answered ideal duration of handwashing. Majority of the participants (73%) believed that COVID-19 poses additional risk of infection to pregnancy due to effect on the foetus (17%), antenatal complications (9%), delivery-related complications (3%) or all of the above (25%) whereas 18% answered that more research was required on this topic while 28% did not answer. These concerns can lead to unnecessary apprehension among pregnant mothers as revealed by other studies [13, 14]. Majority of the pregnant mothers (71%) were aware that there was no clinically approved treatment for COVID-19 and 13% thought that vaccine was the available treatment of choice

Table 4 Practice towards COVID-19

Question	Response	Score	n (%)
P1 What precautions are you practicing in order to prevent contracting and spreading of COVID-19? *	(a) Wearing mask	1	196 (98)
	(b) Avoid crowded places	1	190 (95)
	(c) Avoid handshaking	1	182 (91)
	(d) Washing vegetables before storing them	1	164 (82)
	(e) Social distancing	1	178 (89)
Mean score \pm SD, (range)		4.5 \pm 1.0, (1–5)	
P2 Has there been any change in the frequency of handwashing to prevent contracting and spreading of COVID-19?	(a) Increased	2	174 (87)
	(b) Decreased	0	4 (2)
	(c) Same as before	1	22 (11)
Mean score \pm SD, (range)		1.9 \pm 0.40, (0–2)	
P3 If the answer to P2 is option a, then how?		Not applicable	
P4 Since the onset of COVID-19 pandemic, has there been any change in the frequency of sexual intercourse?	(a) Increased	Not applicable	44 (22)
	(b) decreased		100 (50)
	(c) Same		56 (28)
P5 Suppose you are in the first trimester during the ongoing COVID-19 pandemic; would you like to continue pregnancy?	(a) Yes, I want to Continue pregnancy	Not applicable	182 (91)
	(b) I do not want to continue pregnancy		18 (9)
P6 Has there been any change in behaviour towards family members? *	(a) Avoid hugging	1	142 (71)
	(b) Avoid kissing	1	133 (66.5)
	(c) Avoid sharing food from the same plate	1	122 (61)
	(d) Avoid sleeping together	1	88 (44)
	(e) No change	0	46 (23)
Mean score \pm SD, (range)		2.4 \pm 1.5, (0–4)	
P7 Do you wear a mask when you go outside your home to prevent contracting and spreading of COVID-19?	(a) Always	2	178 (89)
	(b) Most of the times	1	22 (11)
	(c) Do not believe in it	0	0 (0)
Mean score \pm SD, (range)		1.9 \pm 0.3, (1–2)	
P8 Any change in eating habits to prevent contracting COVID-19? *	(a) Eat more of lemon	1	98 (49)
	(b) Increased garlic in the food	1	72 (36)
	(c) Drink hot water	1	116 (58)
	(d) Avoid eating from outside	1	150 (75)
	(e) No change	0	4 (2)
Mean score \pm SD, (range)		2.18 \pm (0–4)	
P9 Do you take herbal products and traditional medicines to prevent contracting and spreading of COVID-19?	Yes	1	62 (31)
	No	0	104 (52)
	Do not know	0	34 (17)
Mean score \pm SD, (range)		0.3 \pm 0.5, (0–1)	
P10 Any precaution that you take while coughing to prevent spreading of COVID-19?	(a) Use tissue	1	56 (28)
	(b) Use Handkerchief	1	70 (35)
	(c) Bent of elbow	1	54 (27)
	(d) Use hand	0	20 (10)
Mean score \pm SD, (range)		0.9 \pm 0.3, (0–1)	
P11 Given all the options, how would you prefer to feed your baby after birth?	(a) Breastfeed	2	76 (38)
	(b) Expressed breast milk	1	38 (19)
	(c) Formula feed	1	86 (43)
Mean score \pm SD, (range)		1.4 \pm 0.5, (1–2)	
Overall mean practice score \pm SD, (range)		15.5 \pm 2.6, (9–21)	

*Due to multiple responses, more than 100% is possible

Table 5 Comparison of baseline characteristics of study participants and mean knowledge and practice score using ANOVA or *t*-test

Parameter	Knowledge score			Practice score		
	Mean	SD	<i>P</i> -value ^a	Mean	SD	<i>P</i> -value ^a
Overall	22.5	3.5		15.5	2.652	
<i>Education</i>						
Till primary level	21.5	4.5	0.108	15.0	2.6	0.370
Secondary level	23.0	2.6		15.4	2.7	
Graduation and above	22.3	3.9		15.8	2.5	
<i>Occupation</i>						
Health care workers	23.8	3.4	0.030	15.3	2.9	0.730
Non-health care workers	22.3	3.5		15.5	2.6	
<i>Area of distribution by COVID-19 condition</i>						
Hotspot	23.1	1.9	0.409	14.90	2.9	0.291
Non-hotspot	22.4	3.7		15.56	2.6	

Bold value indicate statistically significant as *P*-value < 0.05

^aBased on *t*-test/one-way ANOVA as appropriate

Table 6 Pearson’s correlation between the study variable and different domains of knowledge and practices

Variables ^a	Correlation (Y)	<i>P</i> -value
Overall knowledge versus practice	0.038	0.590
K2 versus P2	0.150	0.034 ^b
K2 versus P1	0.256	<0.001 ^c
K3 versus P2	0.227	0.001 ^c
K4 versus P1	0.205	0.004 ^b
K8 versus P2	0.183	0.009 ^b
K6 versus P9	-0.162	0.022 ^b
K9 versus P7	0.141	0.046 ^b

^aK2: What type of disease is COVID-19?

K3: Which group is at the highest risk of contracting severe form of COVID-19?

K4: Which of the following are symptoms suggestive of COVID-19?

K6: Which of the following are preventive measures for COVID-19?

K8: What is the trend of prevalence of COVID-19 in India?

K9: Does COVID-19 pose additional risk of infection to the pregnancy?

P1: What precautions are you practicing in order to prevent contracting and spreading of COVID-19?

P2: Has there been any change in the frequency of handwashing to prevent contracting and spreading of COVID-19?

P7: Do you wear a mask when you go outside your home to prevent contracting and spreading of COVID-19?

P9: Do you take herbal products and traditional medicines to prevent contracting and spreading of COVID-19?

^bSignificant at *P* < 0.05; ^cHighly significant at *P* < 0.001

[15]. Around half (47%) of the participants believed that formula feed was the feeding option of choice for COVID-19 positive mothers followed by expressed breast milk (25%) and direct breastfeeding (17%) while 23% participants did

not answer. Also, mode of delivery was another less known area among the respondents as only 23% correctly answered that there was no effect on the method of delivery. These are potential areas for health education programmes and mass media coverage for reducing the gap of knowledge among pregnant women in order to enhance their attitude and practices.

Overall, the respondents showed positive attitude regarding seriousness for following preventive measures against COVID-19 (96%) and visiting health care facility when suspected to have COVID-19 related symptoms (86%). 86% pregnant women believed that India could emerge victorious in the fight against this health emergency. These findings are in line with recent studies by Zhong et al. and Al-Hanawi et al. where the results showed positive attitude among general public [9, 16]. Positive attitude and confidence in control of COVID-19 among pregnant mothers could be a reflection of the government's relentless actions, stringent steps such as nationwide lockdown and suspension of routine activities such as schools and universities, domestic and international flights [4].

It is a common consensus that more educated people comply better with preventive and treatment measures but there was no significant statistical correlation (*p*-value 0.590) in this study between overall knowledge score and the practices followed. Participants (64%) were overall following good practices (mean score = 15.5, median score = 15) for prevention of COVID-19 infection. This could be due to constant reinforcements by GOI through mass media coverage regarding good practices for prevention such as social distancing, wearing masks and hand hygiene [4]. Around 87% of pregnant women reported increased frequency of handwashing during COVID-19 pandemic and it was significantly increased (*r* = 0.150, *P*-value 0.034) among those who were aware about communicable nature of the disease.

Also, this group of pregnant women frequently practiced increased safety measures such as wearing masks (98%), avoiding crowded places (95%), avoiding handshakes (91%), social distancing (89%) and washing vegetables before storing them (89%) which could be explained by their awareness of mode of spread of disease. It is similar to level of practice observed in the study among pregnant women by Kamal et al. [10]. These preventive measures were followed more by those who had good knowledge about common symptoms of COVID-19 ($r=0.205$, P -value 0.004). Also, awareness about increasing trend of COVID-19 in India had a significant increased impact ($r=0.183$, P -value 0.009) on the frequency of handwashing. Awareness about effective preventive measures for COVID-19 had significantly negative impact on use of herbal or traditional medicines among participants. This could also be explained as a practice of avoiding unnecessary herbs/traditional medicines during pregnancy owing to possible adverse effects of these on foetus [17].

This study results could help the authorities in formulating policies directed towards the pregnant women with a special focus on those with low KAP (example—non-health care workers) who are at higher risk of contracting the disease. The areas that need to be focussed possibly include duration of handwashing and preferred method of breastfeeding in COVID-19 mother. Pregnancy is a landmark requiring extra attention and dissemination of information regarding knowledge and right practices will help diminish the anxiety and apprehension among the pregnant women and their relatives and will enhance positive attitude.

To the best of our knowledge, this is one of the initial studies providing insight into KAP among pregnant women in India. The questionnaire had been designed based on standard RCOG guideline and WHO resources and it evaluated various aspects of COVID-19 disease. This study was specific to pregnant population and hence, data might be helpful in formulating health policies targeting this subpopulation. Also, good knowledge, right practices and positive attitude are the only pillars of prevention with novel coronavirus variants, rising number of cases and uncertain future [18]. Due to evolving evidence on this topic, answers to the questionnaire may change with time. Furthermore, it is a single centre study and may not be generalised to the entire population. In future, multicentric research is warranted for better KAP assessment of pregnant women.

Conclusion

This study demonstrated that majority of the pregnant women had satisfactory knowledge, positive attitude and were following appropriate practices regarding COVID-19 but further efforts in creating awareness should be continued.

Knowledge on handwashing and breastfeeding in COVID-19 positive mothers was significantly low in pregnant women. As India is battling the second coronavirus wave and in the absence of definitive cure, strengthening of health policies directed at pregnant women should be prioritized with special focus on significant gaps in KAP.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Consent for participation Informed consent was obtained from all individual participants included in the study.

Consent for publication Obtained.

Ethical approval Ethical clearance was obtained from the Institute Ethics Committee for Post Graduate Research (IECPG-247/24.06.2020, RT-32/22.07.2020). All procedures performed in studies involving human participants were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study protocol was approved by the Institute Ethics Committee, All India Institute of Medical Sciences, New Delhi.

Human or Animal Rights This article does not contain any studies with human participants or animals performed by any of the authors.

Informed Consent All participants gave written informed consent before the study began.

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