Knowledge and Preventive Practices of COVID-19 among Pregnant Women Attending Sohag University Hospitals

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Abstract

Background: Due to the immunosuppressive nature of pregnancy, severe sickness and COVID-19 infection are often more likely to affect pregnant women. It has been advised to take many safety measures to prevent being exposed to the virus. The preparedness to embrace public health initiatives is greatly influenced by knowledge and behavior regarding COVID-19. **Aim:** Analyze the level of knowledge and practices of pregnant women regarding COVID-19 prevention. **Methods:** A descriptive design was used in the current study. **Setting:** The present study was conducted at antenatal outpatient clinics in Sohag University Hospital. **Subjects:** 350 pregnant women who attended to antenatal outpatient clinics were included in the in the study. **Tools of data collection:** Data collection was obtained by using A structured interviewing questionnaire that involved three parts (personal data, knowledge assessment sheet and practices assessment sheet). **Results:** Majority of the studied women had satisfactory practices, whereas more than two thirds of them had inadequate knowledge regarding COVID-19 prevention. **Conclusion:** Pregnant women have insufficient understanding of COVID-19 and poor preventive behaviors. **Recommendations:** Establish educational initiatives to improve women's awareness of and behavior toward COVID-19.

Keywords: COVID-19, Knowledge, Practices & Pregnant women

Introduction:

Corona Virus Infection is the RNA virus (COVID-19) under an electron microscope. In 2019 exhibits a traditional crown-like look due to the presence of glycoprotein spikes on its envelope. Early in December, the COVID-19 pandemic began in Wuhan, the seventh-most populous city in China, and quickly spread over the entire country. Bangkok, Thailand, reported the discovery of COVID-19's first verified case outside of China on January 13, 2020 (Thailand) **(Perlman & Netland, 2020) & (WHO, 2020).**

Coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus-2 (SARS-Cov-2) was declared a pandemic by the World Health Organization (WHO) in March 2020 . As on 14th March 2021, there have been more than 11.8 million confirmed cases and more than 26 lakh deaths worldwide. The disease has had an unprecedented impact on routine healthcare facilities including maternity care. Pregnancy is one of the most vulnerable times in a woman's life; dealing with the economic and health aspects of a pandemic in addition to the usual stresses of pregnancy is bound to affect pregnant women even when they may not be COVID positive. Also, any disease of this scale and widespread impact are likely to give rise to misinformation and misconceptions, which in turn lead to uncertainty and fear **(Khalil et al., 2020).**

Even though everybody is at risk of becoming infected, pregnant women are more prone to become the victims of COVID-19 compared with the general population. It is transmitted by airborne droplets; thus is easily inhaled by pregnant women and is difficult to remove due to the change in anatomical structure of the respiratory system during pregnancy. Furthermore pregnancy is an immune suppressed state and are generally more susceptible to viral respiratory infections and their complications. Pregnant women are at an increased risk for severe illness from COVID-19. The rate of morbidity, cesarean section delivery and preterm birth were also found to be increased. Vertical transmission is a matter of debate **(Cheng et al., 2020 & Zhao et al., 2020).**

Fever, coughing, and exhaustion are the most typical initial signs of COVID-19 disease. Other symptoms include sputum production, headache, hemoptysis, diarrhea, dyspnea, and lymphopenia. Sepsis, acute respiratory distress syndrome, septic shock, and severe pneumonia are symptoms of more extreme cases that can be fatal. According to the WHO, the COVID-19 incubation period lasts between two and

ten days. The incubation time, according to some studies, can extend longer than two weeks and a particularly long incubation period might indicate double exposure **(Wu & McGoogan, 2020).**

Vaccination during pregnancy is an important opportunity when women generally enter the health system and can improve vaccine coverage in the population. In August 2021, the U.S. Centers for Disease Control and Prevention (CDC) released data on the safety of COVID-19 vaccines in pregnant women and encouraged vaccination among women planning for pregnancy, during breastfeeding and during pregnancy. Data suggest that the benefits of COVID-19 vaccination outweigh any known or potential risks during pregnancy. According to the CDC, no evidence suggests that vaccination would cause harm during pregnancy or that there are any safety concerns regarding pregnancy or newborn outcomes **(Stroobandt & Stroobandt, 2021).**

The World Health Organization has recommended a number of preventive measures, such as frequent hand washing with water and soap, social disengagement, covering the mouth and hands when coughing, and refraining from touching the eyes, nose, and mouth **(Hadaway, 2020).**

Every action a nurse takes, including symptom identification, sanitation and illness prevention, must be demonstrated to others. As the frontline of healthcare, nurses also have the duty to inform pregnant women and the broader public on healthy lifestyle choices and virus prevention. The nurses' role helps pregnant women who were infected or touched individuals who had coronavirus by taking direct care, teaching, coaching, counseling, and collaborating to help them be able to take care of themselves. Moreover, if pregnant women know and understand the spreading and effects of the coronavirus on pregnant women and fetuses in utero, this knowledge helps them to be able to take good care of their fetuses and continue carrying out quality pregnancy and birth **(Belingheri et al., 2020).**

Significance of the study

Pregnant women might be at increased risk for severe illness from COVID-19 compared to non-pregnant women. Additionally, there may be an increased risk of adverse pregnancy outcomes **(CDC, 2020).** The anatomical and physiological changes occurring during pregnancy make the pregnant women more vulnerable to severe infections as an increase in the transverse diameter of the thoracic cage and an elevated level of the diaphragm, decrease maternal tolerance to hypoxia. Lung volume changes and vasodilation can lead to mucosal edema and increased secretions in the upper respiratory tract. In addition, alterations in cell-mediated immunity contribute to

the increased susceptibility of pregnant women to be infected by intracellular organisms such as viruses **(Schwartz & Graham, 2020).**

Different study showed that, knowledge and practices towards infectious diseases are associated with level of panic emotion among the population especially pregnant women and risk group, which can further complicate attempts to prevent the spread of the disease. So, to facilitate outbreak management of COVID-19 among pregnant women there is an urgent need to understand pregnant women's awareness of COVID-19 at this critical moment. Therefore, the researcher conducted this study to assess the pregnant women' knowledge and practices of COVID-19 prevention **Madappuram & Kamel, 2020).**

Aim of the study:

The study aimed to assess of pregnant woman's level of knowledge and
preventive practices regarding COVID-19

Research Questions:

1- What are the levels of knowledge of pregnant woman about COVID-19?
2- What are reported practices of pregnant woman to prevent COVID-19?

Patients and Methods:

Patients and methods of this study are displayed into four designs technical, operational, administrative, and statistical design.

Technical Design:

Which involved research design, setting, study sample, and tools of data collection.

Research Design:

Descriptive design was conducted for this study.

Setting:

The present study was conducted at antenatal outpatient clinics in Sohag University Hospitals. It was a single clinic with two rooms that served both rural and urban regions in Sohag Governorate.

Sample:

A sample of 350 of all available pregnant women attended antenatal out-patient clinics, at Sohag University Hospital. The total number of pregnant women that was attended to antenatal out-patient clinics through the year (2020) was 4000 women.

Tools of the study:

Data collection was obtained by using the following:

A structured interviewing questionnaire:

This tool was developed by the researcher based on scientific literature review from **(Nwafor et al.**, **2020)** and written in an Arabic language to gather data and consisted of three parts as following:

Part 1: Involved Personal data which included: Name, age, level of education, occupation, religion and residence. **Obstetric history which included**: Numbers of gravidity, numbers of parity, history of

abortion and number of living children and **Current obstetrics data which included:** Weeks of gestation, Current medical problem with pregnancy, Fetus's gender of the current pregnancy, Follow up during pregnancy with spread of COVID-19 and Schedule of pregnancy follow up is affected by spread of COVID-19.

Part 2: Include: Knowledge assessment sheet about COVID-19 which included seven questions as: definition of COVID-19, symptoms that present with COVID-19, Mode of transmission, factors increase risk for COVID-19 infection, risk groups for COVID-19, protective measures from COVID-19 and source of information**.**

Knowledge scoring system:
The scoring system for pregnant women' knowledge was evaluated upon fulfillment of the interviewing questionnaire as the pregnant women' knowledge checked with a model key answer. Therefore, the correct answer was scored (1) grade and the incorrect and unknown questions was scored (0). Although knowledge was considered adequate if the percent score was 70% or higher and inadequate if the percent score was below 70%, this is how the overall knowledge score was calculated **(Serwaa et al., 2020).**

Part 3: Reported Practices assessment sheet: It was designed by the researcher to assess pregnant women' reported practices related to preventive measures regarding COVID-19 such as: hand washing with soap, use alcohol and wear mask, avoid touching eye, nose and mouth, stay at home, maintain distance of 1 meter, avoid check hand with friends, stay away from crowded places, used tissue when sneeze or cough, avoided throw the used masks or tissue in the public road and clean the home and walls) **(Kamal et al., 2020).**

Practices scoring system:
 Every point is worth one (1) for a successful performance and zero (0) for a failed performance. While the following percentages were used to generate the total practices score: 85% were deemed unsatisfactory, and 85% were deemed satisfactory **(Kamal et al, 2020)**

Tools Validity:
Tools of the study were reviewed by five panel experts- three from the Obstetrics& Gynecological Nursing department, Faculty of Nursing at Assiut University and two from the Faculty of Medicine at Assuit University to test the face and content validity to make sure that the tools accurately measures what supposed to measure . Modifications of the tools were done according to the panel judgment on clarity of sentences, appropriateness of content and sequence of items.

Tools Reliability:
Reliability for tools was applied by the researcher for testing the internal consistency of the tools. Reliability was assessed using Cranach's alpha test and was estimated as (0.867). It was measured by using reliability item deprived from scale and analyze that found in SPSS program.

Pilot study:
After preparatory of the questionnaire it was pre-tested on 10% of cases that consider 35 pregnant women to see the validity and reliability of the study tools. Subjects included in the pilot study were included in the study as there was no major modifications in the study tools.

Field work:
Data collection of the study took about 6 months started at the beginning of October 2021, and completed by the end of March 2022. It involved the following:

Preparatory phase:
The instruments were developed based on this material, and obstetrics and gynecology experts validated them.

Procedures:
An official permission was obtained from the authorized person to carry out the study.

- The researcher interviewed each pregnant woman (who attend antenatal outpatient clinics for follow up) separately in a class room beside the clinic, with taking the following precautions
  - Wearing a mask of both researcher and pregnant women (so the researcher took at least 10 masks with her to give women who haven't one)
  - Maintain a 1-meter space between the researcher and the suspected women.
  - Make sure that the seat where, the pregnant woman sat in was spread with alcohol in between each woman.
- Pregnant women were informed of the study's nature and goal, and verbal consent was then sought for voluntary participation.
- The interview questionnaire read on the pregnant woman through the researchers even if the women able to read (to limit transmit of infection by paper`s sheet).
- Confidentiality of the data, assured
- The researcher was available in the study settings 3 days per week in each study setting from 9:00am to 1: pm. Face to face interview through structured interview questionnaire about knowledge and reported practices Of COVID-19
- Data collection from women, who accepted to be included in the study after explaining the aim of the study, the interview of every woman took about 15 minutes
- After finishing the questionnaire, the researcher was

given the pregnant woman oral instruction regarding COVID -19 preventive measures.

Administrative design:
Permission was obtained from the director of outpatient clinic at Sohag University Hospital

Statistical design:
The statistical package for the social science (SPSS) version 26 was used for data entry and analysis. Numbers, percentage means, and standard deviation were used to present the data. To demonstrate the relationship between variables, the chi-square test was utilized. To compare means, the T-test was utilized. When <0.05, a P-value is deemed statistically significant.

Result:

Table (1): Distribution of studied women according to socio demographic characteristics:

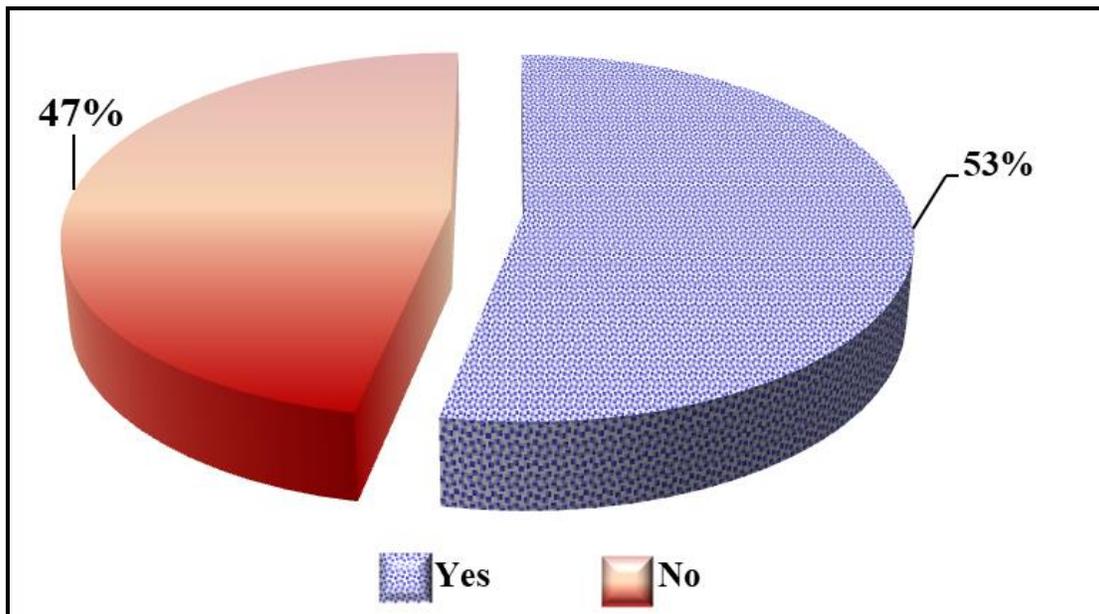| Socio demographic characteristics	N (350)	%
Age group:		
• Less than 25 year	147	42.0
• 25-35 year	180	51.4
• More than 35 year	23	6.6
x̄ ±SD / Years	**26.33±5.43**	
Residence:		
• Urban area	60	17.1
• Rural area	290	82.9
Religion:		
• Muslim	314	89.7
• Christian	36	10.3
Educational level:		
• Illiterate	33	9.4
• Basic education	82	23.4
• Secondary	159	45.5
• University	76	21.7

Figure (1): Effected of spread of COVID-19 on regular schedule of pregnancy follow up:

Table (2): Distribution of studied women according to current obstetric data:

| Current obstetric data	N (350)	%
Weeks of gestation		
• First trimester	114	32.6
• Second trimester	124	35.4
• Third trimester	112	32.0
Current medical disorders with pregnancy		
• Yes	53	15.1
• No	297	84.9
If yes mention disorders:		
• Diabetes mellitus	16	30.2
• Hypertension	23	43.4
• Diabetes& Hypertension	7	13.2
• Respiratory disorder	2	3.8
• Heart disease	5	9.4
Follow up during pregnancy with spread of COVID-19		
• Yes	212	60.6
• No	138	39.4
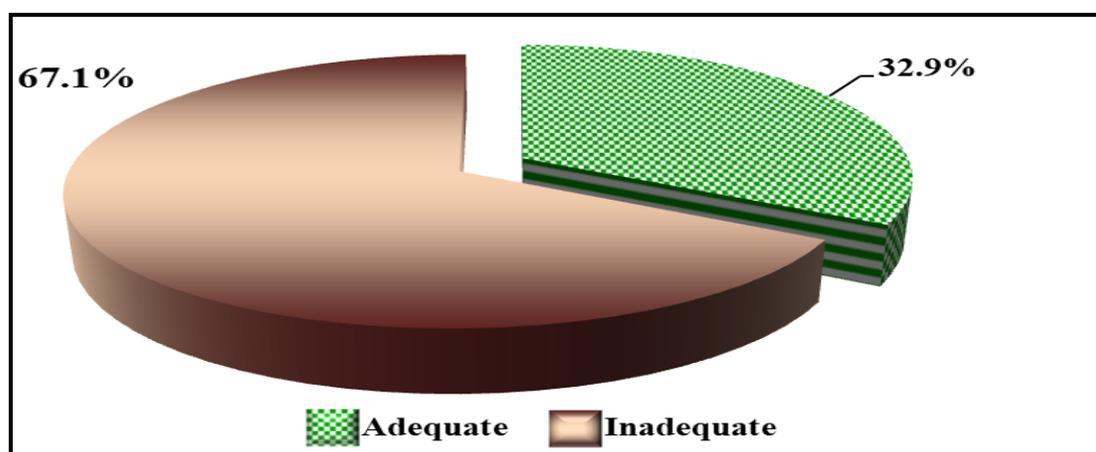
Figure (2): Total knowledge score of studied women about COVID-19

Table (3): Relation between total knowledge score about COVID-19 and socio demographic characteristics:

Socio demographic characteristics	Total knowledge score about covid-19				Chi-square	
	Adequate(115)		Inadequate(235)			
	N	%	N	%	X^2	p-value
Age group:						
• Less than 25 year	50	43.5	97	41.3		
• 25-35 year	59	51.3	121	51.5	0.567	0.753
• More than 35 year	6	5.2	17	7.2		
Occupation						
• House wife	38	33.0	8	3.4	59.42	**0.001**[**]
• Have a work	77	67.0	227	96.6		
Residence:						
• Urban area	39	33.9	21	8.9	33.91	**0.001**[**]
• Rural area	76	66.1	214	91.1		
Religion:						
• Muslim	104	90.4	210	89.4	0.096	0.756
• Christian	11	9.6	25	10.6		
Educational level:						
• Illiterate	6	5.2	27	11.5		
• Basic education	4	3.5	78	33.2	72.8	**0.001**[**]
• Secondary	54	47.0	105	44.7		
• University	51	44.3	25	10.6		

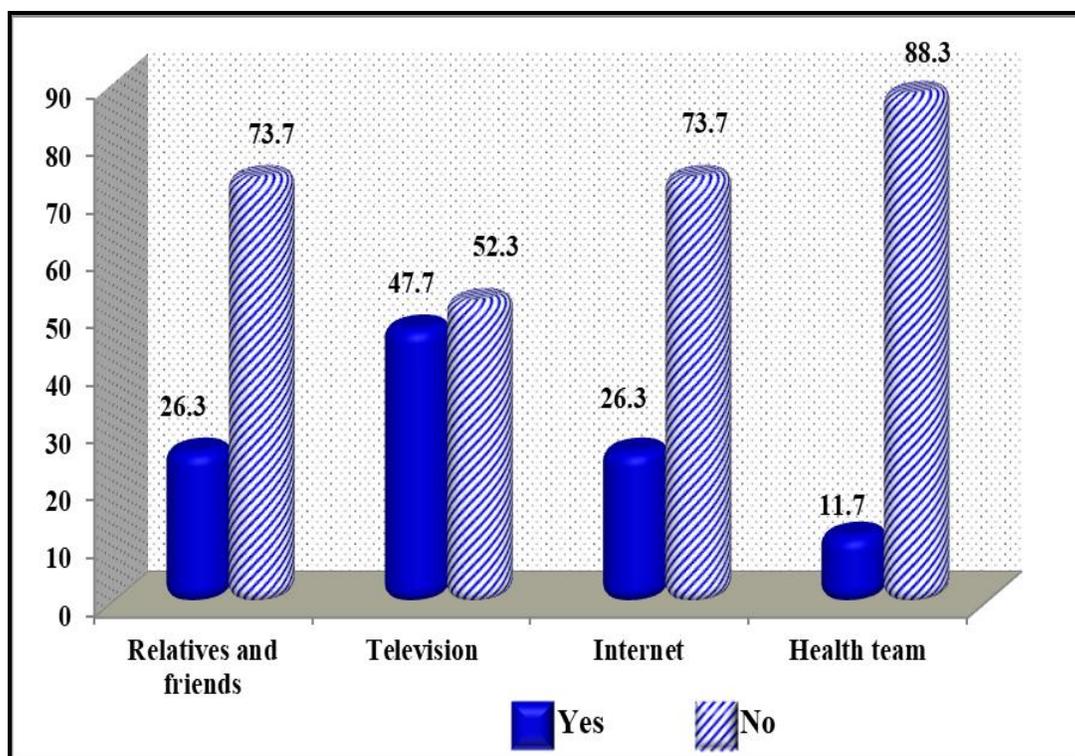*(**) highly statistical significant difference*

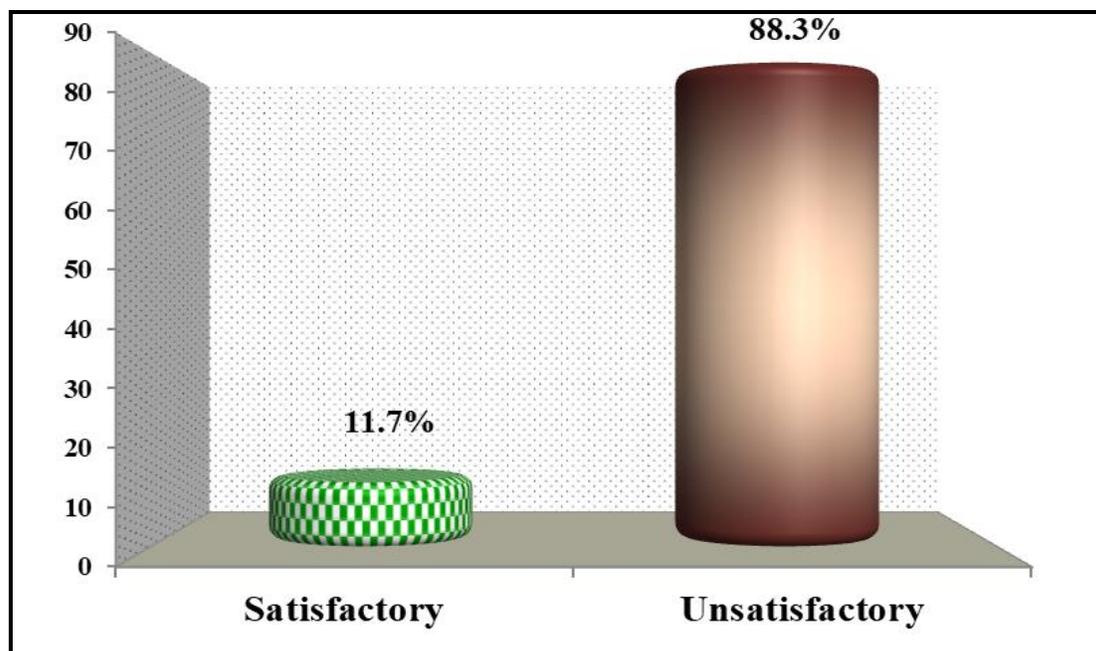**Figure (3): Source of studied women's information about COVID-19**

Figure (4): Total practices score of studied women about COVID-19

Table (4): Relation between total practices score about COVID-19 and socio demographic characteristics:

Socio demographic characteristics	Total practices score about covid-19				Chi-square	
	Satisfactory(41)		Unsatisfactory(309)			
	N	%	N	%	X^2	p-value
Age group:						
• Less than 25 year	20	48.8	127	41.1		
• 25-35 year	19	46.3	161	52.1	0.945	0.624
• More than 35 year	2	4.9	21	6.8		
Occupation						
• House wife	14	34.1	32	10.4	17.9	**0.001**[**]
• Have a work	27	65.9	277	89.6		
Residence:						
• Urban area	17	41.5	43	13.9	19.3	**0.001**[**]
• Rural area	24	58.5	266	86.1		
Religion:						
• Muslim	37	90.2	277	89.6	0.014	0.905
• Christian	4	9.8	32	10.4		
Educational level:						
• Illiterate	3	7.3	30	9.7		
• Basic education	4	9.8	78	25.2	10.3	**0.016**[*]
• Secondary	18	43.9	141	45.6		
• University	16	39.0	60	19.4		

(*) statistical significant difference   (**) highly statistical significant difference
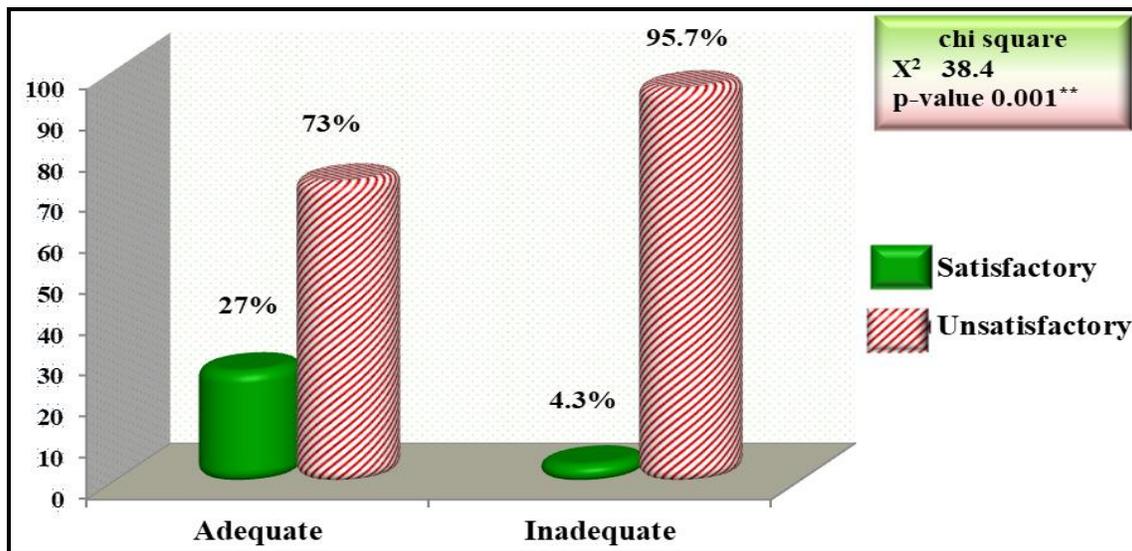

Figure (5): Relation between total knowledge and total practice score about COVID-19:

Table (1): Shows regarding socio-demographic characteristics, it 51.4% of studied women had an age group from (25-35) years with a mean and SD of 26.33±5.43. Concerning residence 82.9% were from rural areas. About religion, 89.7% of studied women were Muslims. As regard level of education 45.4% of studied women had a secondary level of education. About 86.9% studied women were housewives.

Table (2): Displays current obstetric data of studied women and shows that 35.4% of studied women were in their second trimester. About 15.1% of studied women had a medical problem with pregnancy; hypertension involved 43.4% of the problem followed by Diabetes Mellitus with a percent of 30.2%. Regarding Fetus's gender, 41.4% of studied women didn't determine the gender of

their fetus. About 60.6% of studied women went to outpatient clinics for follow up.

Figure (1): Demonstrates that 53% of studied women their follow up schedule were affected by spread of COVID-19.

Figure (2): Clarifies total knowledge score of studied women about COVID-19, and shows that 32.9% of studied women had adequate knowledge and 67.1% of them had inadequate knowledge about COVID-19.

Table (3): Shows that there were a positive relation between total knowledge of studied women and occupation, residence and educational level p-value 0.001 for all.

Figure (3): Reveals source of studied women's information about COVID-19, and illustrates that 47.7% of studied women gained their information about COVID-19 from television. About 26.3% of them gained their information from relatives and internet.

Figure (4): Explains that 11.7% of the pregnant women who participated in the study had satisfactory COVID-19 practices manifested by avoiding throw the used masks or tissue in the public road, use a tissue when sneeze or cough and clean the home and walls.

Table (4): Illustrates that there were a relation between total practices about COVID-19 and occupation, residence and educational level p-value were 0.001, 0.001, and 0.016.

Figure (5): Illustrates that there was a relation between total knowledge about COVID-19 and total practice score about COVID-19 at p $-<$ 0. 01. As most of the studied women had adequate knowledge and satisfactory practices.

Discussion:

The respiratory system is being severely harmed by a single-stranded novel coronavirus known as COVID-19. It is an infectious disease with a range of symptoms, such as fever, dyspepsia, fatigue, and nostalgia. Pregnant women were more likely to be exposed to COVID-19 due to their immunosuppression and physiologic changes during pregnancy. Pregnancy is also an immune-suppressive state that increases exposure to COVID-19 and other viral infections **(Argaw et al., 2021)**.

The purpose of the current study was to assess the knowledge and preventative practices of pregnant women regarding COVID-19.

Regarding socio-demographic characteristics. The present study illustrated that more than half of studied women were in age group from (25-35) years with a mean and SD of 26.33±5.43. Concerning residence most of them were from rural areas. About religion, most of studied women were Muslims. As regard level of education more than one third of studied

women had a secondary level of education. The majority of studied women were housewives.

These findings were in the same line with **Mohamed et al., (2020)**, who conducted a study in Egypt on "pregnant women's knowledge, attitude, and self-protective measures practice regarding corona virus prevention: health educational intervention" found that more than half of the studied women were between the ages of 25 and 30 with a mean age of 27.84 years and 26.97 years, respectively. Additionally, more than half of study subjects had secondary education, while more than two thirds lived in rural areas and were unemployed.

Also **Septiasari & Viandika., (2021)**, who analyzed the characteristics of pregnant women at Jaya Kusuma Hudasa Clinic Kepanjen for their study, "The Correlation Between COVID-19 Knowledge and Anxiety of Pregnant Women During Covid-19 Pandemic," and found that the majority of pregnant women were between the ages of 20 and 35.Based on education, almost half of them had Senior High School graduate. Based on job, majority of pregnant women are house wife.

Concerning current obstetric data of studied women. The current study showed that more than one third of studied women were in their second trimester. Pregnancy-related medical issues affected less than one-fifth of the women in the study; hypertension was the most common issue, accounting for more than one third of the issues, followed by diabetes mellitus with more than one quarter. Over one-third of the women in the study were unsure of the gender of their unborn child. More than two thirds of the study's female participants visited outpatient clinics for follow-up care.

These findings were supported by **Awad et al., (2020)**, who carried out their study about **"**COVID-19: pregnant women's knowledge, perceptions & fears**"** and reported that less than one quarter of sample were in the second pregnancy trimester, more than one quarter in the second pregnancy trimester. Regarding complications and comorbidities, less than one fifth of them had gestational complications (gestational diabetes or hypertension) and had chronic diseases.

The study's findings showed that the dissemination of COVID-19 had an impact on the scheduling of pregnant women's follow-up visits for more than half of the women who were subjected to the study. Theses may due to the pregnant women fear from infection at the clinic or hospital.

The study findings were in consistent with **Hanawi et al., (2020)**, who conducted a study about "knowledge, attitude, and practice of COVID-19 among the public" in the Kingdom of Saudi Arabia and discovered that the spread of COVID-19 had a

detrimental effect on the follow-up schedule for almost two thirds of the sample.

Regarding total knowledge score of studied women about COVID-19, the results showed that more than two thirds of studied women had inadequate knowledge about COVID-19, this may be due to the majority of studied sample have low educational level or they not have educational program about COVID-19.

The study findings were consistent with **Izhar et al., (2021)**, during their study in Pakistan, researchers assessed the knowledge, worries, attitudes, and practices of pregnant Pakistani women during the COVID-19 pandemic and discovered that almost two-thirds of the women had insufficient knowledge of the disease. Also, a study carried by **Abdulla et al., (2021)**, about "Knowledge and Practice of Pregnant Iraqi Women about COVID-19 Preventive Measures" , who show that the knowledge score level were inadequate in about three quarters of the participant and adequate in about one quarter.

In addition relation between total knowledge scores about COVID-19 and socio demographic characteristics, the findings showed that there were a positive relation between total knowledge of studied women and occupation, residence and educational level p-value 0.001 for all. These study findings consistent with **Izhar et al., (2021)**, who mentioned that there was positive associated between knowledge and age; level education and residence.

In the same line **Anwar et al., (2020)**, Who carried a study about "Women's Knowledge, Attitude, and Perceptions toward COVID-19 in Lower-Middle-Income Countries " who observed at their study that there was a significantly different mean knowledge scores between different age groups. Compared to the younger age groups, participants aged 51–60 years and >60 years had a significantly lower mean knowledge score. Additionally, inhabitants of rural areas had significantly lower mean knowledge scores than did women, and the knowledge mean scores did not significantly correspond with the education levels of the women.

As regard total practices score of studied women about COVID-19, the current findings clarified that majority of studied women had an unsatisfactory practices regarding COVID-19. This study finding was in the same line with **Izhar et al., (2021)**, who showed that more than two thirds of studied sample had poor level of practices concerning COVID-19.

Also **Abdulla et al., (2021)**, who mentioned that about two thirds of the participants were presented with poor practice while less than one third with good practice. These present findings were consistent with **Temesgan et al., (2021)**, their study about " Adherence to COVID-19 preventive practice and

associated factors among pregnant women in Gondar city, northwest Ethiopia" they reported in their study that less than half of the study subjects adhered well to COVID-19 preventative practices.

The present findings were accordance with **Besho et al., (2021)**, who conducted a study about" Knowledge, Attitude and Practice Toward Corona virus Infection Among Pregnant Women Attending Antenatal Care at Public Hospitals in Three Wollega Zones, Ethiopia" found that roughly two thirds of the women had poor practice and that more than one third of the study participants had good practice of COVID-19 infection prevention methods. The possible reason may be due to, the lack of knowledge of pregnant women about COVID -19 affect on level of practices regarding prevention of COVI-19.

Concerning the relation between total practices score about COVID-19 and socio demographic characteristics, the current results illustrated that there were a positive relation between total practices about COVID-19 and occupation, residence and educational level. From the researcher point of view, this indicates that level of education for pregnant women, affects on level of awareness regarding prevention of COVID-19.

This was consistent with **Besho et al., (2021)**, who indicated that there was significant relation between studied women's age and practices toward preventive measures of COVID-19 infection. On the other hand **Izhar et al., (2021),** who reported that there was no correlation between total practices and residence.

The study finding was consistent with **Awad et al., (2020)**, who applied their study in Lebanon that a high knowledge level about COVID-19 was high enough when the pregnant woman had an older age, was employed, was paid a higher monthly salary, had a higher educational level, was a healthcare provider and was a nonsmoker.

Regarding the relationship between total knowledge and total practice scores for the COVID-19, the current findings showed that there was a positive relationship between total knowledge and total practice, with a p-value of 0.001. This may be because the women's practices for the COVID 19 should be based on accurate knowledge. These study findings were compatible with **Hoque et al., (2021)**, they evaluated pregnant women's knowledge, attitudes, and practices on the COVID-19 in their study, which found a substantial positive correlation between knowledge and practice.

In the same line **Temesgan et al., (2021)**, who noticed that awareness of the respondents and adherence to COVID-19 preventative actions, were significantly correlated. The findings incongruent with **Aghababaei et al., (2020)**, who displayed at their study in Iran that the knowledge negatively

associated with protective measures and practices of pregnant women.

Conclusion:

Based on the results of the present study, it can be concluded that, more than two thirds of Pregnant women had inadequate knowledge. Also, majority of them had unsatisfactory preventive practices regarding COVID-19.In addition; there was a positive relation between total knowledge and total practice about COVID-19 at p –value 0.001.

Recommendations:

- Health-care providers give more attention to educating pregnant women at any point of contact; legal enforcement should be implemented to improve practice of preventive measures regarding COVID-19.
- During health education special consideration should be given to those who are from rural areas, and to less-educated pregnant women.
- Heath educational intervention regarding prevention of COVID19 should be provided through maternity nurses for all pregnant women at all MCH centers until the total management of COVID19 virus.
- Antenatal heath care providers should have plan to communicate online with pregnant women.

Acknowledgement:

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