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The Effect of an Educational program about COVID-19 for Pregnant Women on the Occurrence of Postpartum Depression

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Abstract

Background: Postpartum Depression (PPD) is a highly prevalent psychological morbidity among pregnant and parturient women; it could be affected by COVID-19 pandemic. **Aim of the study:** To assess the Effect of an Educational program about COVID-19 for pregnant women on the Occurrence of postpartum depression. **Subjects and methods:** quasi-experimental controlled pre-post study was conducted at the MCH Unit of Obstetrics and Gynecology at El-Fayoum city on 230 pregnant women attending the setting randomly and equally divided into the intervention group to receive educational program and a control group A self-administsred questionnaire with Edinburgh Post-Partum Depression (PPD) scale was used in data collection. The work was done through assessment, educational program planning, implementation, and evaluation phases. **Results:** The intervention group knowledge, attitude, and practice significantly increased after the educational program ($p<0.001$). Pre-intervention PPD 31.3% in the intervention group of PPD and 15.7% in the control group ($p=0.005$). At Time 2 (1 week postpartum), the prevalence in the control group was 94.8% compared to 33.9% in the intervention group ($p<0.001$). At Time 3 (6-week Follow-up), it was 100.0% in the control group and 58.3% in the intervention group ($p<0.001$). The effect of the program on PPD was confirmed by multivariate analysis. **Conclusion and recommendations:** The provision of clear applied knowledge, positive attitudes, and correct practices related to COVID-19 to pregnant women is effective in decreasing the prevalence of PPD among them. It is recommended to implement the developed educational program in antenatal care settings.

Keywords: COVID-19, Educational program, Postpartum depression & Pregnant women.

Introduction

The perinatal period is a critical period in women's life with many physical and mental changes that may expose them to a higher risk of many minor or even major psychological disorders **(Shimoya et al., 2022)**. They may view this period as a traumatic experience if they suffer pregnancy or labor problems, in addition to their negative feelings of pain, fear, and lack of support **(Chiorino et al., 2020)**. Postpartum Depression (PPD) is considered a highly prevalent psychological morbidity among pregnant and parturient women **(Zhang et al., 2022)**. It is characterized by mood swings and extreme concerns about the newborn, with associated emotional and behavioral changes interfering with self-care and parenting role of the mother, and thus jeopardizing the mental growth and development of the infant **(Shelke & Chakole, 2022)**. Thus, the American Psychiatric Association recommends testing pregnant women for psychiatric disorders twice prenatally, and once postpartum **(Chen et al., 2020)**. Yet, the condition is often undiagnosed and under-treated due to lack of awareness and fear of stigmatization **(Sakina et al., 2022)**.

A recent mishap that could have a negative impact on pregnant women's psychological health is the COVID-19 pandemic. For instance, it has been claimed that PPD was conspicuously the most common psychological health disorder following childbirth during COVID-19 pandemic **(Alsabi et al., 2022)**. However, research provides controversial results regarding the effect of COVID-19 pandemic of the prevalence of PPD. Thus, studies in the Netherlands **(Boekhorst et al., 2021)**, in Denmark **(Overbeck et al., 2022)**, and in the United States **(Taljan et al., 2022)** found no significant changes in PPD among pregnant women throughout COVID-19 pandemic stages. Conversely, a systematic review reported significantly higher risk of PPD during the pandemic with Odds Ratio 1.54 **(Gao et al., 2022)**. On the same line, a study in seven European countries found a significant increase in the prevalence of PPD during the COVID-19 pandemic, and the rates significantly varied among these countries **(Mateus et al., 2022)**. Similar increases in the prevalence rates of

PPD during COVID-19 pandemic were also reported in a study in the United States **(Bajaj et al., 2022)** as well as in Canada **(Zhang et al., 2022)**. Moreover, pregnant women infected with COVID-19 were found to be at higher risk of labor complications ,with more stillbirths and premature babies **(Allotey et al., 2020)**. The possible impact of COVID-19 pandemic on the prevalence of PPD could be attributed to many underlying factors. For instance, the lockdown certainly decreased pregnant women access to healthcare settings as shown in a study in China, which reported high rates of postponement or cancellation of obstetric-related appointments **(Hui et al., 2022)**. A similar situation was also found in Canada where more prenatal appointments were cancelled, and pregnant women were having difficulty in attending prenatal classes, and the majority of them had to change their birth plans, with more birth problems and adverse outcomes **(Khoury et al., 2022)** Thus, there is a need to adjust services with more mental health support and better access to services. Moreover, interventions are urgently required to improve pregnant women's knowledge, attitude, and practices concerning COVID-19 and possible related mental distress **(Kunno et al., 2022).**

Significance of the study

The declaration of COVID-19's pandemic in 2020 had many untoward health consequences, in addition to the economic and social negative impacts. Pregnant women were one of the most vulnerable groups with high risk of mental distress and postpartum depression (PPD) due to concerns about their pregnancy and its outcomes from this virus. The provision of clear information about COVID-19 and how to prevent its deleterious consequences could help in the alleviation of their fears, and consequently decrease their vulnerability to PPD.

Aim of the Study

To assess the Effect of an Educational program about COVID-19 for pregnant women on the Occurrence of postpartum depression.

Research hypotheses:

1. Intervention group women's knowledge will significantly improve after implementation of the program.
2. Intervention group women's attitude will significantly improve after implementation of the program.
3. Intervention group women's practices will significantly improve after implementation of the program.
4. The prevalence of PPD will be significantly lower among intervention group women compared with control group women.

Subjects and Methods

Study design:

A quasi-experimental controlled pre-post study design was used in carrying out the study.

Study setting:

This research was conducted at the MCH Unit of Obstetrics and Gynecology at El-Fayoum city from August to November 2021.

Participants:

Pregnant women attending the study settings constituted the study population. Women eligible for inclusion in the study sample were those in the third trimester of pregnancy with no associated complications. Those with physical or psychological disorders, and not able to communicate were excluded. The sample size was calculated to demonstrate a difference in PPD scores between the intervention and control groups with a moderate effect size (0.4). Using the G*Power software program at 95% level of confidence and 80% power, the required sample size was 100 women. This was increased to 115 to compensate for an expected attrition rate of about 10%. This sample size was also large enough to demonstrate similar improvements in the scores of knowledge, attitude, and practice of women in the intervention group.

A total sample of 230 women was recruited by convenience according to the eligibility criteria. They were randomly and equally divided into two groups of 115 women each. The intervention group was to receive the educational program in addition to the regular care at the setting. The control group only received the regular setting care.

Data collection tools:

The researchers used an interview form comprizing a section for the demographic data and obstetric and medical history, and the Edinburgh Post-Partum Depression (PPD) scale. For the women in the intervention group, the form comprized a knowledge questionnaire, an attitude scale, and a part for the reported practices. Thus, the tool consisted of the following parts.

Part (I): This was for woman's demographic data as age, level of education, job status, husband job, area of residence, as well as the family income.

Part (II): This part covered woman's obstetric history as parity, gravidity, pregnancy follow-up and anti-natal care, effect of COVID-19 on ANC, as well as the history of chronic diseases and previous PPD, exposure to COVID-19, and related vaccination.

Part (III): This part was only for women in the intervention group .It was developed by the researchers based on related literature **(Wang et al., 2022)** It included the following sections.

Knowledge questionnaire: This was developed by the researchers to assess women's knowledge before and

after the educational intervention. It comprised 21 questions to assess their knowledge about PPD such as its definition, risk factors, symptoms/signs, treatment, prognosis, and prevention, in addition to 17 questions to assess their knowledge of COVID-19 such as its risk factors, transmission, symptoms/signs, management, prevention, and effect on pregnancy. Various forms of questions were used including Multiple choice (MCQ) and True/False questions. For scoring, the correct answers were given one point, and the incorrect zero. The scores of each part and of the full knowledge questionnaire were summed-up. A total score attaining 50% or more of the maximum score was considered satisfactory, and otherwise unsatisfactory.

Attitude scale: This was developed by the researchers. It consisted of 11 statements on a 3-point Likert type scale "agree/uncertain/disagree." It included positive statements such as "I think that early detection of COVID-19 improves its treatment and prognosis," and negative statements such as "I believe that COVID-19 is a fatal disease." For scoring, the scale from agree to disagree was given from 2 to zero points, with reverse scoring for negative statements. The total sum of the scale was converted into a percent score. A woman attaining 60% of the total was considered to have positive attitude, or otherwise considered as having negative attitude.

Practice scale: This was rather a reported scale practice. It consisted of 14 items such as "I avoid eating out," "I give more care to my personal hygiene," "I wear mask in crowded and closed areas," etc. The response was on a 3-point scale "Always/Sometimes/Never." These were scored from 2 to zero, respectively. The total sum of the scale was converted into a percent score. A woman attaining 60% of the total was considered to have adequate practice, or otherwise considered as having inadequate practice.

Part IV: This consisted of Edinburgh Post-Natal Depression Scale developed by (**Cox et al., 1987)** to measure PPD among parturient women. A validated Arabic version was used in this study **(Department of Health, Government of Western Australia., 2006))**. The scale consists of ten positive as "I have looked forward with enjoyment to things," and negative as "I have blamed myself unnecessarily when things went wrong" statements. Each statement has a response on 4 levels of increasing severity or frequency. These were scored from zero to 3, with reverse scoring for positive statements so that a higher score indicates more depression. The maximum attainable score is 30. A score of 13 or higher is considered depressed according to **(Mann & Evans., 2015)**.

Tool validity and reliability: Four experts rigorously revised the tool: 2 in community health nursing and 2 in psychiatric nursing departments. They assessed tool relevance, clarity, comprehensiveness, and applicability. Only minor modifications were required. Moreover, the EPDS scale is standardized with documented validity and reliability **(Levis et al., 2020).** Additionally, its reliability was shown to be high in the present study through testing its internal consistency, which yielded Cronbach' alpha coefficient 0.927.

Ethical considerations:

All research ethics principles were fulfilled according to Helsinki Declaration. The researchers explained to each woman the purpose of the study, its procedures, and the data collection methods. They informed them about their rights to refuse or withdraw at any time with no consequences. They were reassured about the confidentiality of any obtained information. Their agreement to fill the questionnaire was considered as consent to participate in the study. Anonymity and confidentiality were ensured by using code numbers.

Pilot study:

A pilot study was carried out on about 10% of the sample to test the clarity and feasibility of the developed tool. It also provided an estimate of the time needed to fill out the tools, and to identify any difficulties or obstacles needed to handle before applying it.

Fieldwork and study maneuver:

The work was done through assessment, planning, implementation, and evaluation phases.

Assessment phase: In this phase, the researchers recruited the study sample and assigned consenting women to either the intervention or the control group. The data collection forms were distributed to women to fill them according to the instructions provided by the researchers. Women in the intervention group filled all four parts of the form, while those in the control group filled only the first, second, and fourth part. The data obtained constituted baseline (Time 1) information.

Planning phase: The researchers used this phase to design the nursing educational program and booklet to be provided to women in the intervention group. The program was developed based on pregnant women's needs, researchers' experience, and opinions of the medical and nursing experts, in addition to pertinent literature. It was aimed at providing pregnant women with the knowledge and skills needed for helping them dealing effectively with their postpartum depression in the era of COVID-19 pandemic and associated fears and concerns. The program and booklet had two main sections. The first was addressing postpartum depression with its definition, causes and risk factors, signs and

symptoms, diagnosis, treatment, and prevention. The second section dealt with COVID-19 and its risk factors, transmission, symptoms and signs, management, prevention, and its effect on pregnancy.

Implementation phase:

In this phase, the researchers started program sessions in small groups of pregnant women. The schedule of the meetings was arranged to be weekly at the same time and in the same room. Each session lasted for 45-60 minutes, two sessions per week for a total of eight sessions for each group. Adult learning principles were applied with active participation of the attendants. Various teaching resources and media were used, with mini-lectures and open discussion with questions and answers. Each session was started by solicitation of women's feedback about the previous one.

Evaluation phase: Women in the intervention and control groups were asked to fill the same previously forms at Time 1. This was done 1 week postpartum and considered as Time 2 or post-intervention. Then, at the 6th postpartum week (Time 3), all women were asked to fill the EPDS.

Statistical analysis:

Data entry and cleaning were done using excel sheets. Categorical data were compared using Pearson Chi-squared or Fisher exact tests as suitable. Spearman rank correlation assessed the correlations among various scores. Logistic regression analysis was used to identify the risk factors predicting the occurrence of PPD. Analysis was performed using IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk, NY, USA).

Results

Table (1): Demographic characteristics of women in the study and control groups (n=250)

Items	Group				X^2 test	p-value
	Intervention (n=115)		Control (n=115)			
	No.	%	No.	%		
Age:						
<35	61	53.0	90	78.3		
35+	54	47.0	25	21.7	16.12	<0.001*
Range	19-44		17-43			
Education:						
Pre-university	85	73.9	83	71.2		
University	30	26.1	32	27.8	0.09	0.77
Job:						
Housewife	101	87.8	106	92.2		
Employed	14	12.2	9	7.8	1.21	0.27
Husband job:						
Employee	32	27.8	30	26.1		
Worker	83	72.2	85	73.9	0.09	0.77
Residence:						
Rural	57	49.6	69	60.0		
Urban	58	50.4	46	40.0	2.53	0.11
Income:						
Insufficient	47	40.9	46	40.0		
Sufficient	68	59.1	69	60.0	0.02	0.89

(*) Statistically significant at p<0.05

Table (2): Obstetric and medical history of women in the study and control groups (n=250)

Items	Group				X^2 test	p-value
	Intervention (n=115)		Control (n=115)			
	No.	%	No.	%		
Gravidity:						
Primigravida	3	2.6	2	1.7		
Multigravida	112	97.4	113	98.3	Fisher	1.00
Parity:						
Primiparous	14	12.2	4	3.5		
Multiparous	101	87.8	111	96.5	6.03	0.01*
Pregnancy FU:						
No	1	0.9	0	0.0		
Yes	114	99.1	115	100.0	Fisher	1.00
Anti natal care affected by pandemic:						
No	12	10.4	0	0.0		
Yes	103	89.6	115	100.0	12.66	<0.001*
Chronic diseases:						
Diabetes	8	7.0	2	1.7	3.76	0.052
Hypertension	31	27.0	42	36.5	2.43	0.120
Gestational diabetes	16	13.9	9	7.8	2.20	0.140
Cardiac/renal	2	1.7	2	1.7	0.00	1.000
History of Postpartum depression:						
No	51	44.3	1	0.9		
Yes	64	55.7	114	99.1	62.12	<0.001*
COVID during pregnancy:						
Had confirmed COVID	1	0.9	1	0.9	0.00	1.000
Had contact with COVID patient	51	44.3	48	41.7	0.16	0.69
Got COVID vaccine:						
No	87	75.7	62	53.9		
1 dose	13	11.3	26	22.6		
2 doses	15	13.0	27	23.5	11.96	0.003*

(*) Statistically significant at p<0.05

Table (3): Pre-post-intervention knowledge and attitude regarding COVID-19 among women in the study group (n=250)

Satisfactory knowledge (50%+)	Time				X^2 test	p-value
	Pre (n=115)		Post (n=115)			
	No.	%	No.	%		
Postpartum depression:						
Definition	102	88.7	111	96.5	5.14	0.02*
Risk factors	34	29.6	16	13.9	8.28	0.004*
Symptoms/signs	61	53.0	106	92.2	44.27	<0.001*
Treatment	6	5.2	80	69.6	101.70	<0.001*
Prognosis	90	78.3	111	96.5	17.40	<0.001*
Prevention	0	0.0	58	50.4	77.56	<0.001*
Total PPD:						
Satisfactory	1	0.9	75	65.2		
Unsatisfactory	114	99.1	40	34.8	107.61	<0.001*
COVID-19:						
Risk factors	94	81.7	113	98.3	17.44	<0.001*
Transmission	109	94.8	115	100.0	Fisher	0.03*
Symptoms/signs	107	93.0	114	99.1	Fisher	0.04*
Management	17	14.8	97	84.3	111.31	<0.001*
Prevention	69	60.0	100	87.0	21.44	<0.001*
Effect on pregnancy	69	60.0	112	97.4	47.95	<0.001*
Total COVID:						
Satisfactory	105	91.3	114	99.1		
Unsatisfactory	10	8.7	1	0.9	7.13	0.005*

Satisfactory knowledge (50%+)	Time				X^2 test	p-value
	Pre (n=115)		Post (n=115)			
	No.	%	No.	%		
Total knowledge:						
Satisfactory	44	38.3	112	97.4		
Unsatisfactory	71	61.7	3	2.6	92.13	<0.001*
Attitude:						
Positive	89	77.4	113	98.3		
Negative	29	22.6	2	1.7	23.42	<0.001*

(*) Statistically significant at p<0.05

Table (4): Pre-post-intervention practices related to COVID-19 among women in the study group (n=250)

Correct practices:	Time				X^2 test	p-value
	Pre (n=115)		Post (n=115)			
	No.	%	No.	%		
Avoid unnecessary errands	71	61.7	110	95.7	39.44	<0.001*
Avoid unnecessary travel	74	64.3	109	94.8	32.76	<0.001*
Avoid eating outside	59	51.3	111	96.5	60.97	<0.001*
Avoid kissing/hugging	47	40.9	101	87.8	55.26	<0.001*
Avoid public transportation	52	45.2	106	92.2	58.96	<0.001*
Wash hands frequently	67	58.3	113	98.3	54.08	<0.001*
More personal hygiene	81	70.4	114	99.1	36.70	<0.001*
Use of disinfectants	69	60.0	102	88.7	24.83	<0.001*
Use vitamins	60	52.2	100	87.0	32.86	<0.001*
When in contact with a case:						
Avoid close contact	55	47.8	98	85.2	36.10	<0.001*
Keep distance (2+ meters)	36	31.3	97	84.3	66.34	<0.001*
Use mask	67	58.3	107	93.0	37.77	<0.001*
Frequent hand wash 20 min with soap and water	58	50.4	105	91.3	46.52	<0.001*
Use alcohol (60%+)	58	50.4	96	83.5	28.38	<0.001*
Total practice:						
Adequate	75	65.2	112	97.4		
Inadequate	40	34.8	3	2.6	39.16	<0.001*

(*) Statistically significant at p<0.05

Table (5): Correlations between study group women' scores of knowledges, attitude, and practice, and their PPD scores (n=250)

PPD score	Spearman's rank correlation coefficient		
	Knowledge	Attitude	Practice
Pre-intervention (Time 1: n=115)	.142	-.298**	-.476**
Post-intervention (Time 2: n=115)	.022	-.276**	-.505**

(**) Statistically significant at p<0.01

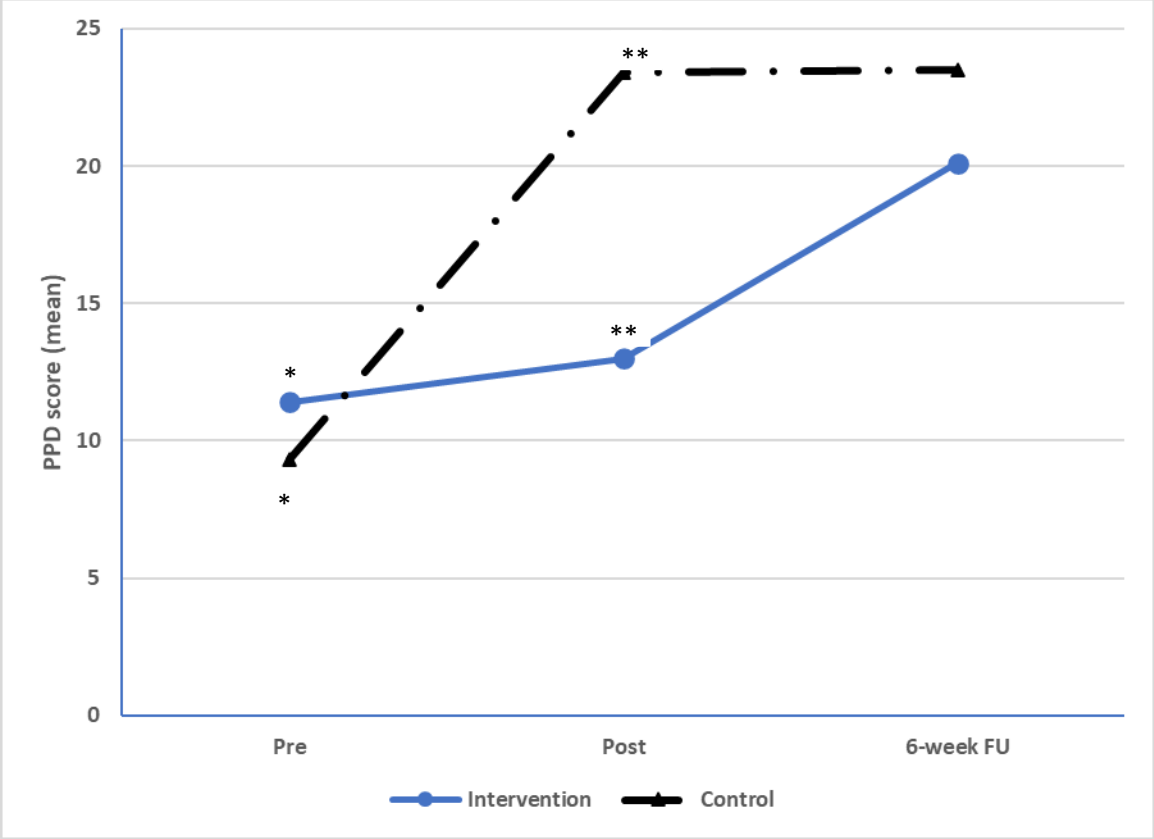
Table (6): Postpartum depression among women in the study and control groups throughout intervention phases (n=250)

Items	Group				X^2 test	p-value
	Intervention (n=115)		Control (n=115)			
	No.	%	No.	%		
Pre-intervention (time 1):						
No (<13)	79	68.7	97	84.3		
Yes (13+)	36	31.3	18	15.7	7.84	0.005*
Post-intervention (time 2):						
No (<13)	76	66.1	6	5.2		
Yes (13+)	39	33.9	109	94.8	92.86	<0.001*
Follow-up (time 3):						
No (<13)	48	41.7	0	0.0		
Yes (13+)	67	58.3	115	100.0	60.66	<0.001*

(*) Statistically significant at p<0.05

Table (7): Best fitting multiple logistic regression model for the occurrence of PPD in the study and control groups (n=250)

Items	Wald	Df	P	OR	95.0% CI for OR	
					Lower	Upper
Constant	49.29	1	.000	.00		
Group (reference: control)	10.56	1	.001	.48	.31	.75
Time	135.99	1	.000	5.65	4.22	7.56
Urban residence	3.45	1	.063	.67	.43	1.02
PPD history	51.89	1	.000	10.22	5.43	19.24
Nagelkerke R Square: 0.499						
Hosmer and Lemeshow Test: p<0.001						
Omnibus Tests of Model Coefficients: p<0.001						
Variables entered and excluded: age, education, job, income, parity, abortions, previous labor problems, ANC, COVID-19 infection, and vaccination						



(,* - **,**) Statistically significant differences at p<0.001*

Figure (1): Scores of Post-Partum Depression (PPD) among intervention and control groups' women throughout study phases (n=250)

As presented in **Table (1):** Most of the women in the intervention and control groups were having pre-university level of education, housewives, and with husbands being workers. Approximately three-fifth of them were having sufficient income. The control group women had a higher percentage residing in rural areas (60.0%), and in the age group <35 years. This latter was the only characteristic that statistically significant differences between the two groups (p<0.001). The great majority of women in the intervention and control groups were multigravida and multiparous, with significantly more multiparous in the control group (p=0.01)

Table (2): Shows all women, except one in the intervention group, reported having had pregnancy follow-up, but significantly more women in the

intervention group confirmed that their antenatal care was affected by the COVID-19 pandemic (p<0.001). The most common chronic disease in the two groups were hypertension. The history of previous PPD was highly statistical significantly differences among women in the control group (p<0.001). Only one woman in each group reported having had confirmed COVID-19 infection during pregnancy. Significantly more women in the control group had COVID vaccination (p=0.003).

Table (3): Demonstrates that women in the intervention group had generally low knowledge about PPD before the intervention, especially regarding its treatment (5.2%) and prevention (0.0%). Their knowledge significantly improved after the intervention and in total only one (0.9%) had satisfactory pre-intervention knowledge of PPD, which significantly increased to 65.2% after the intervention (p<0.001). As for their knowledge of COVID-19, it was generally good before the intervention except for its management (14.8%). Their knowledge of COVID-19 significantly improved after the intervention and in total rose form 91.3% at pre-intervention to 99.1% after the intervention (p<0.001). In total, 38.3% had satisfactory pre-intervention knowledge, and this significantly increased to 97.4% after the intervention (p<0.001). Similarly, their related positive attitude significantly increased from 77.4% pre-intervention to 98.3% after the intervention (p<0.001).

Concerning the practices of women in the intervention group, **Table (4):** Points to generally average correct practices before the intervention. It ranged between 31.3% for the practice of keeping distance to 70.4% for more personal hygiene. All their practices demonstrated significant improvements after the intervention (p<0.001), reaching 99.1% for more personal hygiene. Their total practice significantly improved from 65.2% pre-intervention to 97.4% after the intervention (p<0.001).

Table (5): Shows that the pre-intervention (Time 1) and post-intervention (Time 2) PPD scores of women in the intervention group had statistically significant weak negative correlations with their attitude scores, and moderate negative correlations with their practice scores. The strongest was the correlation between post-intervention PPD and practice scores (r=-0.505). Meanwhile, their PPD scores had no significant correlations with their knowledge scores.

Table (6) & Figure (1): Demonstrate that at Time 1 (baseline) the women in the intervention group were having a higher prevalence (31.3%) of PPD in comparison with those in the control group (15.7%), p=0.005, as well as higher scores (p<0.001). This was reversed at Time 2 (1 week postpartum), with higher prevalence in the control group (94.8%) compared to intervention group (33.9%), p<0.001, and higher scores among them (p<0.001). At Time 3 (6-week Follow-up), there was still higher prevalence in the control group (100.0%) compared to intervention group (58.3%), p<0.001.

Table (7) identified being in the intervention group as a significant independent negative predictor, i.e., protective, of the prevalence of PPD (Odds Ratio 0.48, 95% Confidence Interval 0.31 – 0.75). On the other hand, the time lapse (from Time 1 to Time 3) as well as the previous history of PPD were significant positive predictors. Urban residence tended to be protective but did not reach statistical significance (p=0.063).

Discussion

The study hypothesized that intervention group women's knowledge, attitude, and practice will significantly improve after implementation of the educational program, and the prevalence of PPD will be significantly lower among them in comparison with control group women. The study findings revealed significant improvements in intervention group women's knowledge, attitude, practices, and the prevalence of PPD was lower among them after implementation of the educational program, thus leading to acceptance of all set study hypotheses.

According to the present study findings, women in the intervention group had deficient knowledge of PPD before implementation of the educational program. A similarly low women's knowledge of PPD was reported in a study in India **(Poreddi et al., 2021).** This could be attributed to the low emphasis provided to this issue by the healthcare providers during antenatal care visits. In this respect, a systematic review of frontline health professionals' literacy of PPD showed deficiency in their related knowledge, which could have a negative impact on their role as health educators and sources of information for pregnant women **(Branquinho et al., 2022)**. Meanwhile, their pre-intervention knowledge of COVID-19 was clearly better, which is quite expected given the great concerns about this disease during its pandemic, and the showers of information provided in all media. A similarly low knowledge of PPD was found in a recent systematic review **(Daehn et al., 2022)** as well as in a study in India **(Lodha et al., 2022)**.

After implementation of the present study intervention, highly statistically significant differences improvement were noticed in women's knowledge of both PPD and COVID-19, leading to acceptance of the first research hypothesis. This success could be attributed to the program content, which responded to women's identified needs and emphasized applied knowledge. In congruence with

this, a qualitative study in Canada highlighted that woman preferred educational programs providing applied knowledge of PPD like symptoms, signs and management options **(Siddhpuria et al., 2022)**.

Concerning the attitudes of women in the intervention group, more than three-fourth of them were having positive attitudes towards COVID-19 before implementation of educational program. This could be due to their major concerns about the disease and its negative impacts on their pregnancy and its outcomes. It could explain the extremely low percentage of those who received COVID-19 vaccination among them. After implementation of the educational program, almost all women in the intervention group were having positive attitudes, which would confirm the second research hypothesis. In line with this, a study in Turkey found that a large proportion of pregnant women were having fears and negative attitudes towards COVID-19; the authors recommended interventions to improve their attitude and consequently increase their willingness to be vaccinated **(Kaya Odabaş et al., 2022)**. Thus, a study in Italy reported that 82.7% of pregnant women received COVID-19 vaccination and this was due to their related positive attitudes **(Colciago et al., 2022)**.

The current study has also addressed the practices of women related to COVID-19. It was found that almost two-thirds of the intervention group women were having adequate practices related to COVID-19. This again could be attributed to the massive health education messages promulgated by the health authorities through all types of media, especially concerning hand and personal hygiene and use of masks. Nonetheless, their practice of social distancing was lowest. In contrast, a systematic review of pregnant women's practices during COVID-19 in Ethiopia reported that only around a half of them were having adequate practices **(Mose et al., 2022)**.

After implementation of the present study educational program, the practices of the women in the intervention group significantly improved, with approximately all of them having adequate practices. The finding demonstrates the positive impact of the educational program on women's practices, which provides support to accept the third research hypothesis of the study. In line with this study result, a study in Turkey found that an online educational intervention was successful in improving pregnant women's behaviors and subsequently had a positive impact on their COVID-19 related concerns during pre and postnatal periods **(Uludağ et al., 2022)**.

According to the current study results, almost one-third of the women in the intervention group had baseline PPD as measured in the prenatal period (Time 1). The rate was significantly lower among those in the control group. These are relatively high prevalence rates of PPD could be attributed to women's heightened fears and concerns about their pregnancy due to COVID-19 pandemic, which goes in line with **(Fan et al. 2022)** in a study in China. Our rate is close to that reported in a recent study in Saudi Arabia, which reported a rate of 32.8% **(Alzahrani et al., 2022)**, as well as with a PPD pooled rate of 34.0% reported in a meta-analysis during COVID-19 pandemic **(Chen et al., 2022)**. Conversely, a lower rate (11.7%) was reported among women in France **(Ben-Hassine et al., 2022)**. Meanwhile, a study in the United States reported a rate of PPD as high as 75% among parturient women **(Goyal et al., 2022)**. The discrepancies among studies could be attributed to different cultures as well as differences in the methods of data collection, e.g., face-to-face interview vs self-administration as highlighted by (**Chrzan-Dętkoś et al. 2022)**.

At Time 2 (1 week postpartum), the prevalence rates of PPD showed a slight increase, while the prevalence greatly increased in the control group, and the difference was statistically significant. The increases in the rates between Time 1 (prenatal) and Time 2 (immediate postnatal) was expected according to the known trajectory or timeline of PPD. However, the increase was minimal among the women in the intervention group, and it was significantly lower in comparison with those in the control group, which could be attributed to the effect of the educational intervention. This was further confirmed by the results of the regression analysis, where women in the study group were having less than a half of the risk (OR=0.48) of developing PPD in comparison with those in the control group, leading to acceptance of the fourth research hypothesis. The finding was in agreement with the results of a randomized clinical trial in Taiwan, which demonstrated a significant impact of an educational program administered to pregnant women on the prevalence of PPD among them **(Kuo et al., 2022)**.

At 6-week follow-up assessment (Time 3), the prevalence rates of PPD continued to rise in both groups but was significantly lower among women in the intervention group. Meanwhile, the scores of PPD showed a slight decline while those in the control group continued to rise. The findings are also in congruence with the reported PPD timelines, as well as with the results of present regression analysis, which identified time as a strong positive predictor of PPD. In line with this, a study in Cuba found that the PPD symptoms persisted among women for a long as 24 months postpartum **(Lauzurique et al., 2022)**.

The effect of the various components of the educational program was also investigated in the current study. The results demonstrated the presence of significant negative correlations between women's

PPD scores and their attitude scores and practice scores. Conversely, they had no significant correlations with their knowledge scores. This demonstrates that the provision of information that leads to improvement in knowledge without positive impact on women's attitudes and practices was not effective in the prevention of PPD occurrence among them. Similarly, a prenatal educational program to improve women' knowledge, attitude, and practices in Japan led to significant decreases in the prevalence of PPD among them **(Shimpuku et al., 2022)**. Moreover, a study in the United States demonstrated that behavioral changes related to dealing with COVID-19 pandemic had a significant positive influence on pregnancy outcomes and PPD prevalence among them **(Werchan et al., 2022)**

Lastly, the present study identified the previous history of PPD as the strongest positive predictor of PPD occurrence. Thus, a woman with such previous history is at ten-fold higher risk of developing it in following pregnancies. The finding is in congruence with (**Alzahrani et al. 2022)** whose study of postpartum depression in Saudi Arabia and its associated factors identified the previous history of PPD as a significant positive predictor.

Although the present study provides important information regarding the prevention of PPD in the COVID-19 pandemic era, results should be interpreted taking into consideration its limitations. The first limitation was the design, being quasi-experimental rather than randomized clinical trial, which led to some baseline differences between the intervention and control groups. This was however managed through the multivariate analysis, which helped adjustment for these confounding factors. The second limitation was relatively high rates of PPD reported among women, which could be attributed to their apprehension related to the COVID-19 pandemic and their deficient knowledge of PPD.

Conclusion

The study findings indicate that the provision of clear applied knowledge, positive attitudes, and correct practices related to COVID-19 to pregnant women was effective in alleviating their concerns and in decreasing the prevalence of PPD among them.

Recommendation

It is recommended to implement the developed educational program in antenatal care settings. The study can be replicated using a randomized controlled blind clinical trial to provide stronger evidence to support its results.

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