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ORIGINAL ARTICLE

Observational Study

Peripartum depression and its predictors: A longitudinal observational hospital-based study

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Abstract

BACKGROUND

Depression is a common problem in women in childbearing years due to burdens of motherhood and building a family. Few studies estimate the prevalence of antepartum depression compared to those in the postpartum period.

AIM

To estimate the prevalence and the severities of peripartum depression and major depressive disorder and their predictors.

METHODS

This is a longitudinal observation study. It included 200 women scoring ≥ 13 with the Edinburgh Postpartum Depression Scale, indicating presence of symptoms of depression. They had a gestational age of ≥ 6 wk and did follow-ups until the 10th week to 12th weeks postpartum. Information of women's reactions to life circumstances and stressors during the current pregnancy were gathered from answers to questions of the designed unstructured clinical questionnaire. Severities of depression, anxiety, and parenting stress were determined by the Beck Depression Inventory, State-Trait Anxiety Inventory for Adults, and Parenting Stress Index-Short Form, respectively. Psychiatric interviewing was done to confirm the diagnosis of major depression. Measuring the levels of triiodothronine (T3), thyroxine (T4), and thyroid stimulating hormone (TSH) was done in both antepartum and postpartum periods.

RESULTS

Out of 968 (mean age = 27.35 ± 6.42 years), 20.66% (*n* = 200) of the patients had

clinically significant symptoms of depression and 7.44% had major depression. Previous premenstrual dysphoria, post-abortive depression, and depression unrelated to pregnancy and were reported in 43%, 8%, and 4.5% of the patients, respectively. Psychosocial stressors were reported in 15.5% of the patients. Antepartum anxiety and parenting stress were reported in 90.5% and 65% of the patients, respectively. Postpartum T3, T4, and TSH levels did not significantly differ from reference values. Regression analysis showed that anxiety trait was a predictor for antepartum (standardized regression coefficients = 0.514, *t* = 8.507, *P* = 0.001) and postpartum (standardized regression coefficients = 0.573, *t* = 0.040, *P* = 0.041) depression. Antepartum depression (standardized regression coefficients = -0.086, *t* = -2.750, *P* = 0.007), and parenting stress (standardized regression coefficients = 0.080, *t* = 14.34, *P* = 0.0001) were also predictors for postpartum depression.

CONCLUSION
Results showed that 20.66% of the patients had clinically significant symptoms of depression and 7.44% had major depression. Anxiety was a predictor for antepartum and postpartum depression. Antepartum depression and parenting stress were also predictors for postpartum depression.

Key Words: Peripartum depression; Antepartum depression; Postpartum depression; Anxiety; Edinburgh postpartum depression scale; Parenting stress

Core Tip: The prevalence rates of depression and anxiety are higher in pregnant women compared to non-pregnant women because motherhood and family responsibilities represent additional burdens on pregnant woman. The prevalence rate of peripartum depression has been estimated to range from 5%-58% or even higher in different nations; however, meta-analyses studies from different countries and populations reported similar approximated prevalence rates for postpartum, as well as antepartum, depression, which is 10%-16.4%. A unified consensus has been made to use specific screening tools for determination of peripartum depression. The Edinburgh Postpartum Depression Scale is a commonly and widely used 10-item screening questionnaire with an estimated sensitivity of 75%-100% and a specificity of 76%-97%. Here, we estimated the prevalence of antepartum and postpartum depression for Egyptian women and determined their independent risk predictors.

INTRODUCTION

Depression is common among adults[1,2]. The estimated prevalence of depression among Americans aged 20 and over in a given 2-wk period during the years 2013 to 2016 was 8.1%, with twice folds higher rates in women than men[2] . During the childbearing years, women are also more susceptible to major stresses, depression, and other psychiatric conditions and disorders due to superimposed children and family burdens[1]. There is a wide range of prevalence rates of antepartum and postpartum depression (*i.e.* peripartum depression) reported from different countries worldwide, with estimates ranging from 5% to 58% or even higher[3-7]. This is non-surprisingly attributed to different population characteristics, socioeconomic states, and time and methods for evaluation[8-12]. However, meta-analyses of large studies done in different areas of the world have shown that the approximate estimated prevalence is 10% to 15% for antepartum depression[13-17] and 10% to 16.4% for postpartum depression[18-20]. It has been indicated that the prevalence rates of postpartum depression seems closer or even similar to that of antepartum depression[21,22]. Studies have also shown the greater risk for being admitted to a psychiatric hospital is at the 1st month after delivery than at any time of life[3,8,13,18]. The American Psychiatric Association uses the term "peripartum depression" to define major depression in its diagnostic and statistical manual of mental disorders version 5 (DSM-5) to characterize depression which occurs in the antepartum (during pregnancy) and postpartum (within the first 4 wk after delivery) periods[23]. However, it has been recommended to expand the diagnostic criteria from 1 mo to 6 mo after delivery, as it has been observed that this entire period carries a high-risk for developing depression[24].

Despite the large amount of research over decades to determine the prevalence, risks, and causes of peripartum depression and find effective methods for its screening, prevention, and treatment, the risks and causes of peripartum depression are poorly understood. Several experimental and clinical research studies have suggested that the major risk for developing peripartum depression is the rapid fluctuation in reproductive hormones during pregnancy, delivery, and postpartum periods[25]. Others suggested "alternative biological processing" as the cause of peripartum depression which is based on the finding of different peripartum depression phenotypes that reflect complex mechanisms which include an interplay between: (1) Fluctuations in reproductive[25], thyroid[26], hypothalamic pituitary adrenal axis axis[27], and lactogenic hormones (prolactin and oxytocin)[28]; (2) Immunity[29]; (3) Genetics[30]; and (4) Social, obstetric, and psychological factors[3,8,13,18,31].

Peripartum depression is a major cause of maternal and neonatal morbidity if untreated[32]. Therefore, the World health Organization and United States Preventive Services Task Force recommend screening for peripartum depression. Interventions for mild/moderate symptoms include psycho-therapy or treatment with antidepressants (*e.g.,* selective serotonin reuptake inhibitors) and combined psychotherapy and pharmacotherapy for moderate/severe symptoms[33,34].

Studies which estimated the prevalence of antepartum depression are few compared to those in the postpartum period. Here, we aimed to estimate the prevalence of depression in women in the antepartum and postpartum periods and their demographic, social, obstetric, psychological, and hormonal predictors.

MATERIALS AND METHODS

Study design, period, region
This is a longitudinal observational study completed over a period of 3 years (2017-2020). The initial sample size composed of 1100 women who were consequently recruited from the antenatal out-patient clinic of the department of Obstetrics and Gynecology, Mansoura University, Mansoura, Egypt. Inclusion criteria were: (1) Gestational age of more than or equal 6 wk (*i.e.* antepartum period); (2) Compliance to the study's follow-up schedule during pregnancy (*i.e.* antepartum period) and at least 10 to 12 wk after delivery (*i.e.* postpartum period)[24]; (3) Matched social, economic, and educational levels; and (4) Edinburgh Postpartum Depression Scale (EPDS) screening questionnaire scoring of at least 13, indicating presence of clinically significant symptoms of depression[35,36]. Exclusion criteria was: Past history of significant medical or psychiatric diseases. The ethics Committees of Faculties of Medicine of Mansoura and Assiut Universities, Mansoura and Assiut Governorates, Egypt, approved the study protocol. Women gave their informed consents for participation in the study, No. AUFM_NP/OG_422/2016.

Methods
The social, economic and educational level evaluations: Evaluations for social, economic, and educa-tion levels were done using the Socio-Economic Scale[37], a structured questionnaire which collects information about level of parents' education, month's income, sanitation, and crowning index. Its total scoring is 30. The socioeconomic status is classified as high (scoring: more than 25 to at least 30), middle (scoring: more than 20 to at least 25), low (scoring: at least 15 to less than 20), or very low (scoring: less than 15).

Psychometric evaluations and testing: They were done by the specialist psychiatrist (ME).

In the Antepartum period (gestational age of more than or equal 6 wk)
EPDS: This is a widely used screening questionnaire for perinatal depression. It has ten questions which ask about the recent reaction (a week prior to its administration) of the woman to life stressors and conditions. EPDS scoring more than 13 indicates presence of symptoms of depression[35,36].

Clinical questionnaire: We designated an unstructured clinical questionnaire to collect information about the woman's reactions to recent life circumstances, events, and stresses related to the recent pregnancy. The questions asked about: (1) Feeling of happiness; (2) Husband's feeling towards his wife's recent pregnancy; (3) Reaction of the husband towards baby's sex; (4) History of child loss (abortions or stillbirths); (5) Postpartum complications; (6) Psychosocial stressors (*e.g.,* divorce, loss of job, death of a husband, family arguments, and financial problems); (7) Husband's aggression against his wife (verbal, emotional, or physical); (8) Sexual abuse during childhood; (9) Previous psychiatric problems; and (10) Presence of family members with psychiatric problems.

DSM-5: Psychiatric interviewing was done for confirmation of the diagnosis of major depression according to the Structured Clinical Interview for DSM-5 (Structured clinical interview for DSM-5)[38].

Beck depression inventory II

The severity of symptoms of depression was determined using Beck depression inventory II (BDI-II)[39, 40]. They were classified as minimal (scoring: 0-13), mild (scoring: 14-19), moderate (scoring: 20-28), or severe (scoring: 29-63).

State-Trait Anxiety Inventory for adults

The severity of manifestations of anxiety was determined using State-Trait Anxiety Inventory for adults (STAI-AD)[41,42]. STAI helps to differentiate between state from trait anxiety. State anxiety is a temporary condition while trait anxiety is long-lasting and more general condition. It also differentiates between subjective feelings of anxiety from depression. The severity of anxiety symptoms was classified as absent (scoring: less than or equal 20), mild (scoring: 21-30), less than moderate (scoring: 31-36), moderate (scoring: 47-42), more than moderate (scoring: 44-57), severe (scoring: 58-63), or very severe (scoring: more than or equal 64).

Antepartum laboratory testing

Antepartum laboratory testing was done at the early week of the third trimester. After an overnight fast (for 12 h), blood samples were withdrawn at 8:00 a.m. to measure serum levels of triiodothronine (T3), thyroxine (T4), and thyroid stimulating hormone (TSH) using immunoenzymetric assay kits [IMMULITE reproductive hormone assays' kits (Diagnostic products corporation, Los Angeles, United States)]. The reference levels are: T3 = 81-178 ng/dL, T4 = 4.5-12.5 ng/dL, and TSH = 0.4-4 mIU/mL.

In the postpartum period (at least 10 to 12 wk after delivery):

Participants were evaluated in the postpartum period using BDI-II[39,40].

Parenting Stress Index-Short Form[43]**:** The Parenting Stress Index-Short Form is 36-item questionnaire divided into three sets of questionnaires (or subscales of 12 items for each) to assess: (1) Parental Distress due to the parental role (*e.g.,* the new responsibility being a mother makes me as being locked down); (2) Parent-Child Dysfunctional Interaction (*e.g.,* this new child put on me a greater demand compared to my other kids); and (3) Difficult Child (*e.g.,* This child does not provide me with empathy as I expect from a child to a mother). Each subscale's set has score ranging from 12-60. Parenting stress index-short form (PSI-SF) score is the sum of three subscales' set scores (range: 36-180). The higher scoring indicates enhanced stress level. A raw score exceeding 90 indicates significant symptomatic stress.

Postpartum laboratory testing: Measurement of the levels of T3, T4, and TSH were done in the 10th week postpartum.

Statistical analyses

Data were processed using SPSS for windows, version 20.0 (SPSS Inc., Chicago, IL, United States). Comparative statistics were carried out with *t*- and Chi-square tests or ANOVA (if variables are more than two). Correlation analyses between an antepartum score of BDI-II and the results of demographic, socio-economic status scoring, and psychometric testing's scores were carried out with Spearman's rho correlation coefficient. Multiple logistic regression analysis was carried out to check for demographic, clinical, and psychosocial factors, which independently predict or associate with antepartum and postpartum depression. Significance was considered with probability value less than 0.05.

RESULTS

The number of women screened for depression was 968; of them 200 (20.66%) had EPDS scoring more than 13 (*i.e.* had clinically significant symptoms of depression) (Figure 1A). The patients' ages ranged from 17 years to 34 years (mean: 27.35 ± 6.42 years), with the majority having an age range between 23 years to 34 years (*n* = 164, 82%). All were housewives, the majority were rural residents (*n* = 155, 77.5%), cannot read (*n* = 145, 72.5%), and were of middle socioeconomic status (*n* = 132, 66%). Nearly half were multipara. A past history of fetal losses (abortions and still births) was found in 40%. The majority had normal vaginal deliveries in their past pregnancies, as well as the current pregnancy (*n* = 168, 84%). Only one patient underwent *in vitro* fertilization in the current pregnancy. The majority (*n* = 156, 78%) did their first visit to the antenatal care unit (parallel to our first psychiatric evaluation) in the 3rd trimester, with 13.5% (*n* = 27) in the 2nd and 8.5% (*n* = 17) in the 1st trimesters. Antenatal complications in the recent pregnancy which were indications for caesarian section were found in 16% (*n* = 32). Only 4% (*n* = 8) had postpartum problems (Table 1). Results of the unstructured clinical questionnaire showed that the majority of the patients (91%) were happy with their current pregnancy, and none had past history of postpartum depression; however, 43% had a history of premenstrual dysphoric disorder, 8% had history of post-abortive depression, and 4.5% had history of depression unrelated to pregnancies. Only one had history of sexual abuse during childhood. Psychosocial stressors were found in 15.5%

Table 1 Demographic, social, and obstetric characteristics of screened women with symptoms of depression

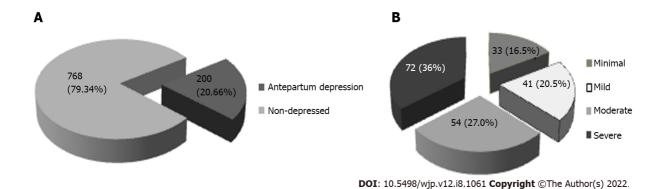| Demographic and social characteristics	*n* = 200
Age, yr	17–34 (27.35 ± 6.42)
17-22 yr, *n* (%)	36 (18)
23-34 yr, *n* (%)	164 (82)
Residence	
Urban	40 (20)
Rural	160 (80)
Maternal education	
None (can't read)	145 (72.5)
Can read (or can read and write)	18 (9)
Primary	6 (3)
Secondary	12 (6)
High	19 (9.5)
Socio-economic status	
Low	36 (18)
Middle	132 (66)
High	32 (16)
Obstetric characteristics	
Parity	
Primipara	97 (48.5)
Multipara	103 (51.5)
History of fetal loss	
Abortions	74 (37)
Still births	6 (3)
Mode of previous deliveries	
Vaginal	168 (84)
Cesarean	30 (15)
Both vaginal and cesarean	2 (1)
History of *in vitro* fertilization in the current pregnancy	1 (0.5)
Gestational age of the first antenatal care visit	
First trimester	17 (8.5)
Second trimester	27 (13.5)
Third trimester	156 (78)
Type of delivery in the current pregnancy	
Vaginal	168 (84)
CS	32 (16)
Indications of CS (*i.e.* antenatal complications)	32 (16)
Placenta previa	22 (11)
Accidental hemorrhage	8 (4)
Obstructed labor	2 (1)
Postpartum complications of current pregnancy	8 (4)

CS: Cesarean.

Figure 1 Antepartum depression. A: Prevalence rate of antepartum depression. B: Severities of antepartum depression.

(Table 2).

During pregnancy, symptoms of severe depression were found in 36% (mean Beck Depression Inventory II or BDI-II scoring: 44.48 ± 6.55), while 27% (mean BDI-II scoring: 24.26 ± 3.32) and 20.5% (mean BDI-II scoring: 16.26 ± 2.86) had moderate and mild symptoms, respectively (Figure 1 and Table 3). Psychiatric interviewing also showed that 7.44% (72/968) had major depression (women with severe symptoms). When stratified according to demographic, social, and obstetric variables, we observed no difference in severities of symptoms of depression in relation to age ($P = 0.452$)**,** education levels ($P = 0.326$), or socioeconomic status ($P = 0.482$). When distributed according to the gestational age at presentation, the majority ($n = 156$, 78%) had symptoms of depression during the 3rd trimester, 13.5% ($n = 27$) during the 2nd, while only 8.5% ($n = 17$) had depression during the 1st trimester ($P = 0.0001$).

Compared to reference values, women in their 3rd trimester had higher levels of T3 and T4, but not TSH (Table 4). No difference in levels of T3, T4, and TSH in the postpartum period were detected compared to reference values.

The majority of women had symptoms of severe anxiety ($n = 181$, 90.5%) compared to less severe symptoms ($P = 0.0001$) [no anxiety = 1 (0.5%); mild = 6 (3%); less than moderate = 12 (6%); moderate = 8 (4%); more than moderate = 70 (35%); severe = 67 (33.5%); and very severe = 36 (18%)]. They had STAI-AD scoring ranged between 21 and 78 (mean: 53.31 ± 11.82) (Table 5).

Assessment of women in the postpartum period showed reduction in the severity of symptoms of depression ($P = 0.0001$). Approximately, two thirds ($n = 130$, 65%) had clinically significant parenting stress (Table 5).

Significant correlations were found between BDI-II scoring in the antepartum period and socioeconomic status scoring ($r = -0.224$, $P = 0.001$), STAI scoring ($r = 0.600$, $P = 0.0001$), and PSI-SF scoring ($r = 0.141$, 0.047), but not with age ($r = -0.021$; 0.763) and BDI-II scoring in the postpartum period ($r = -0.110$, $P = 0.320$). Significant correlation was found between BDI-II scoring in the postpartum period and PSI-SF scoring ($r = 0.158$, 0.052). Multiple regression analysis showed that in the antepartum period, only anxiety was the strong predictor of depression (standardized regression coefficients = 0.514, $t = 8.507$, $P = 0.001$). In the postpartum period, antepartum depression (standardized regression coefficients: -0.086, t: -2.750, $P = 0.007$), anxiety (standardized regression coefficients = 0.573, $t = 0.040$, $P = 0.041$), and parenting stress (standardized regression coefficients = 0.080, $t = 14.34$, $P = 0.0001$) were the predictors for postpartum depression (Table 6).

DISCUSSION

Results of this study showed that 20.66% of pregnant women had clinically significant symptoms of depression. Severe symptoms were found in 36% (72/200) of women, and this group also fulfilled the criteria of major depression, meaning that 7.44% (72/968) of women developed major depression in the peripartum period. Women included in this study had a closer age for marriage and similar obstetric characteristics as the rest of the world. The majority were from rural areas, had lower levels of education, and moderate/low socioeconomic statuses. There also shared psychological stressors regardless of culture. However, ours had distinguished characters and predictors; for example, more than 90% were happy with their current pregnancy, 4.5% had history of depression unrelated to pregnancies, 15.5% had psychosocial stressors, 78% developed manifestations of depression in the 3rd trimester, and 90% had manifestations of anxiety (which varied from moderate to very severe), but none fulfilled the diagnostic criteria of isolated generalized anxiety disorder and none had T3 and T4 (but not

Table 2 Results of the women's reactions to the recent life circumstances, events, and stresses related to recent pregnancy

Psychiatric characteristics	*n* = 200, *n* (%)
I was unhappy with the current pregnancy	10 (5)
My husband was unhappy with the current pregnancy	0
Reaction to the current baby's sex	
Happy	182 (91)
Indifference	18 (9)
Past history of loss of a living child	14 (7)
Past history of mental illness unrelated to pregnancy	9 (4.5)
Depression and/or anxiety	
Treated	2 (1)
Untreated	7 (3.5)
Past history of postpartum depression	0
History of premenstrual dysphoric disorder	86 (43)
Past history of post-abortive depression	16 (8)
Past history of depression unrelated to pregnancies	9 (4.5)
Family history of mental illness	0
Past history of being a victim of one of the followings	
Sexual abuse during childhood	1 (0.5)
Physical abuse during childhood	32 (16)
Physical abuse by a known person	2 (1)
Physical abuse by an unknown person	0
Physical aggression during pregnancy	2 (1)
Emotional/verbal abuse	22 (11)
Current psychosocial stressors	31 (15.5)
Divorce	0
Loss of a job	0
Death of spouse	1 (0.5)
Family argument	24 (12)
Financial problems	6 (3)

for TSH) levels out-ranged the reference values for non-pregnant women.

EPDS was the preferred screening tool for depression. In general, manifestations of peripartum depression are not specific. Therefore, a unified consensus has assigned 3 tools to screen women for peripartum depression[3-7], which are: (1) EPDS[35,36]: It is a 10-item questionnaire with an estimated sensitivity of 75% to 100% and a specificity of 76% to 97%; (2) Patient Health Questionnaire-9[44]: It has an estimated sensitivity of 75% and a specificity of 90%; and (3) The 35-question Postpartum Depression Screening Scale[45]: It has a sensitivity of 91% to 94% and a specificity of 72% to 98%. However, in practice, the family physicians usually use a familiar two-step screening questionnaire, Patient Health Questionnaire-2, as a first step, followed by comprehensive questionnaire if one from the two questions indicates presence of symptoms of depression.

Nationwide studies showed wide range prevalence rates for peripartum depression; however, a common prevalence estimate for antepartum depression nationwide is around 13%[20,21,46]. Our results showed a closer prevalence rate to those reported from different countries. In Egypt, few studies addressed the same topic (antepartum or postpartum depression) and its predictors[5,9,14]. Prevalence estimates from different countries are as follow: 14.8% in Spain[17], 16.8% in Turkey[47], 18% in Bangladesh[6], 24.3% in Oman[15], 27% in Canada[48], 32.9% in Cote d'Ivoire[7], 33.8% in Tanzania[49], and 44.2-57.5% in Saudi Arabia[16,50]. In Egypt, Abdelhai and Mosleh[9] did a cross sectional study on 376 randomly recruited pregnant women. The authors used a Hospital Anxiety and Depression Scale questionnaire and Hurt, Insulted, Threaten, and Scream Inventory (to screen for the presence of

Table 3 Comparative statistical results of symptoms of depression during pregnancy according to social, demographic, and obstetric variable

Socio-demographic and obstetric variables	The severity of depression symptoms				*P* value
	Minimal, *n* = 54, 27%	Mild, *n* = 41, 20.5%	Moderate, *n* = 33, 16.5%	Severe, *n* = 72, 36%	
Age, *n* (%)					0.452
17-22 yr (*n* = 36)	7 (19.4)	8 (22.2)	9 (25)	12 (33.3)	
23-34 yr (*n* = 164)	47 (28.7)	33 (20.1)	24 (14.6)	60 (36.6)	
Maternal education, *n* (%)					0.326
Low (*n* = 181)	29 (16)	40 (22.1)	44 (24.3)	68 (37.6)	
High (*n* =19)	4 (10.5)	1 (5.3)	9 (47.4)	5 (26.3)	
Socio-economic status, *n* (%)					0.482
Low (*n* = 36)	9 (25)	5 (13.9)	3 (8.3)	19 (52.8)	
Middle (*n* = 132)	25 (18.9)	33 (26.8)	26 (19.7)	48 (36.4)	
High (*n* = 32)	20 (62.5)	3 (9.4)	4 (12.5)	5 (15.6)	
Gestational age, *n* (%)					0.0001
1st trimester (*n* = 17)	2 (11.8)	1 (5.9)	5 (29.4)	9 (52.9)	
2nd trimester (*n* = 27)	2 (7.4)	5 (18.5)	9 (33.3)	11 (40.7)	
3rd trimester (*n* = 156)	50 (32.1)	35 (22.4)	19 (12.2)	52 (33.3)	

Table 4 Hormonal results in the antepartum period

Laboratory investigations	Participants, *n* = 200		*P* value[1]	*P* value[2]
	Antepartum	Postpartum		
T3 in ng/dL, range	106–305 (184.22 ± 38.13)	49.06–296 (164.70 ± 45.72)	0.05	0.678
High, *n* (%)	98 (49)	80 (40)	-	-
T4 in ng/dL, range	5.2–28 (12.40 ± 2.38)	4.5–19.1 (11.19 ± 2.67)	0.05	0.845
High, *n* (%)	63 (31.5)	82 (41)	-	-
TSH in mIU/mL, range	0.02–8.50 (1.70 ± 0.11)	0.01–8.44 (1.64 ± 0.32)	0.435	0.760
High, *n* (%)	5 (2.5)	22 (11)	-	-
Low, *n* (%)	1 (0.5)	-	-	-
Borderline, *n* (%)	15 (7.5)	-	-	-

[1]Pregnant women *vs* reference.

[2]Antepartum *vs* postpartum.

Data are presented as mean ± SD. Reference values: T3: 106.32 ± 15.80 (81–178) ng/dL; T4: 9.32 ± 2.44 (4.5-12.5) ng/dL; TSH: 1.56 ± 0.32 (0.4–4) mIU/mL. T3: Triiodothronine; T4: Thyroxine; TSH: Thyroid stimulating hormone.

domestic violence). The authors found both depression and anxiety in 63% of the subjects and only anxiety in 11.4% or depression in 10.4% of the subjects. Domestic violence was found in 30.6% of the subjects, with the majority (25.2%) experienced physical violence from the husband. The authors found significant independent association between the presence of anxiety and depression and exposure to domestic violence (OR = 3.27, 95%CI: 1.28-8.34; *P* = 0.013), particularly among women who had husbands of low educational level compared to those with higher levels (*i.e.* a university-graduated) (OR = 0.22, 95%CI: 0.64-0.75, *P* = 0.01).

Previous studies found that there are several factors which could either associate or potentiate antepartum depression[51]. In this study, although women encountered significant psychosocial stresses, regression analysis showed that none was an independent predictor for peripartum depression. Also, none of the demographic, education, socioeconomic, or obstetric factors independently predicted peripartum depression. It is not surprising to find absence of an association between younger age of

Table 5 Comparative statistics between antepartum and postpartum manifestations of depression

Psychiatric manifestations	Participants, *n* = 200		*P* value
	Antepartum	Postpartum	
BDI-II score, range	1–38 (26.13 ± 8.85)	2–46 (22.27 ± 6.74)	0.455
Severity of depression, *n* (%)			0.0001
Minimal	33 (16.5)	104 (52)	
Mild	41 (20.5)	64 (32)	
Moderate	54 (27)	27 (13.5)	
Severe	72 (36)	5 (2.5)	
STAI score, range	21–78 (53.31 ± 11.82)	-	-
PSI-SF score, range	-	36–18 (136.57 ± 45.86)	-
Women with clinically significant stress, *n* (%)	-	130 (65)	-

Data are presented as mean ± SD. BDI: Beck Depression Inventory; PSI-SF: Parenting Stress Index-Short Form; STAI: State-Trait Anxiety Inventory.

marriage and low levels of education or socioeconomic status and antepartum depression, particularly in Arab and some low/middle income countries, because, a female is protected by her family or husband's family (*i.e.* each spouse's family will be responsible for the financial burden for pregnancy, delivery, and even earlier postnatal care). Oman Islam *et al*[52] found that neither the maternal age nor the gravidity was a risk for antepartum depression. In contrast, several studies found that the young age of marriage is a predictor for antepartum depression. They suggested that the financial hardship, unwanted pregnancies, and a lack of partner support are the main causes of depression among younger mothers[53,54]. Prost *et al*[55] found associations between stress and antepartum depression and older maternal age in Indian women. Some studies found correlations between peripartum depression and low levels of socioeconomic status and education[56,57]. In Brazilian women, Melo *et al*[57] found 2.38-fold increase in the odds of antepartum depression in association with low maternal educational level (OR = 2.38; 95%CI: 1.38-4.12). In Mexican women, Lara *et al*[56] found 5-fold increase in the odds of postpartum depression in association with low maternal education (OR = 5.61; 95%CI: 1.87-16.80).

In this study, when stratified according to gestational age, we observed that the majority (78%) developed depression in their 3rd trimester (*P* = 0.0001); however, gestational age was not a predictor for depression. Also, none of the obstetric risk factors was a predictor for antepartum depression which is in contrast to several studies[31,58]. Bunevicius *et al*[31] found higher prevalence of depression in the 1st trimester and the lowest in mid-pregnancy. They even found differences in predictors of antepartum depression when stratified according to gestational age. They found that unwanted and unplanned pregnancy and high neuroticism were the independent predictors in the 1st, 2nd, and 3rd trimesters, while low education and previous episodes of depression were the independent predictors in the 3rd trimester. They also observed that psychosocial stressors in the end of pregnancy were trimester specific.

In this study, psychosocial stressors (including previous depression episodes, family history of depression, premenstrual dysphoria, domestic violence, and sexual abuse) were found in 15.5%. Prost *et al*[55] screened 5801 Indian mothers from rural Jharkhand and Orissa, eastern India, where over 40% of the population live below the poverty line, at 6 wk after delivery. The authors used the Kessler-10 item scale and found that 11.5% (95%CI: 10.7–12.3) had symptoms of distress (K10 score: more than 15). They found that the independent predictors for postpartum distress were high maternal age, severe poverty, health problems in the antepartum period, caesarean section, unwanted pregnancy from the mother's side, small infant size, and child loss (*e.g.*, stillbirths or neonatal death). They also found that the loss of an infant (OR = 7.06, 95%CI: 5.51–9.04) or an unwanted pregnancy (OR = 1.49, 95%CI: 1.12–1.97) significantly increased the risk of maternal distress.

In this study, 90.5% of women had symptoms of moderate/severe anxiety in the antepartum period. In Sao Paulo, Brazil, Faisal-Cury and Rossi Menezes[59] found symptoms of depression of different severities in 20% of pregnant women assessed by BDI and nearly 60% had anxiety assessed by STAI. Karmaliani *et al*[60] found manifestations of anxiety and depression in 18% Pakistani pregnant women.

In this study, although major depressive disorder was diagnosed in 7.44% of pregnant women, neither antepartum nor postpartum bipolar disorder or history of bipolar disorder in the non-pregnancy periods was observed in the 968 women screened for this study. This could be attributed to the fact that this is not a population-based study. It is also possible that the prevalence rate for peripartum bipolar disorder is lower than unipolar or bipolar depression[61-63]. There are many published studies on both unipolar and bipolar postpartum depression, whereas there are few on bipolar postpartum depression. A survey on general population of the United States estimated that a 12 mo prevalence rate for

Table 6 Predictors for antepartum and postpartum depression in pregnant women

Predictor variables	B[1]	β[2]	t	P value
Age	-0.020	-0.015	-0.287	0.774
	0.046[3]	0.058[3]	1.193[3]	0.234[3]
Socio-economic scale	-0.015	-0.070	-1.286	0.200
	-0.010[3]	-0.074[3]	-1.497[3]	0.136[3]
Education	0.011	0.067	1.187	0.2
History of postpartum depression	-0.834	-0.083	-1.647	0.101
	-0.857[3]	-0.091[3]	-2.647[3]	0.121[3]
Antepartum anxiety trait	0.469	0.514	8.507	0.001
	0.021[3]	0.040[3]	0.573[3]	0.041[3]
Antepartum T3 level	-0.036	-0.045	-1.673	0.513
	0.033[3]	0.065[3]	2.867[3]	0.578[3]
Antepartum T4 level	-0.046	-0.056	-1.893	0.654
	0.022[3]	0.078[3]	2.867[3]	0.745[3]
Antepartum TSH level	-0.045	-0.089	-1.654	0.607
	0.049[3]	0.037[3]	2.867[3]	0.425[3]
Antepartum depression	-0.086[3]	-0.148[3]	-2.750[3]	0.007[3]
Parenting stress index	0.080[3]	0.697[3]	14.34[3]	0.0001[3]
R = 0.843; R = 0.806[3]				
R2 = 0.711; R2 = 0.649[3]				
Adjusted R2 = 0.701; Adjusted R2 = 0.641[3]				
Standard error = 6.094; Standard error = 7.254[3]				
ANOVA < 0.001; ANOVA < 0.001[3]				

[1]Unstandardized regression coefficients.

[2]Standardized regression coefficients.

[3]Post-partum results.

ANOVA: Analysis of variance; T3: Triiodothronine; T4: Thyroxine; TSH: Thyroid stimulating hormone.

postpartum bipolar disorder was 2.9%[61]. Authors also found that many women with postpartum bipolar disorder had acute mood episodes and the risk of bipolar episodes were greater during the postpartum period than other periods of life[62]. Wisner *et al*[63] found that among the 14% of women with postpartum depression, 22.6% actually had bipolar disorder.

In this study, the only predictor for antepartum depression was antepartum anxiety trait ($P = 0.001$). The predictors for postpartum depression were antepartum depression ($P = 0.007$), anxiety trait ($P = 0.041$), and parenting stress ($P = 0.0001$). Despite the observed reduction in the severity of symptoms of depression in the postpartum period (2.5%) compared to the antepartum period (36%), antepartum depression was also a strong predictor for postpartum depression ($P = 0.007$). Previous studies indicated that antepartum anxiety is an independent predictor for both antepartum and postpartum depression [64], and severe anxiety and even panic attacks are often associated with peripartum major depressive episode[65]. Faisal-Cury and Rossi Menezes[59] screened 432 women from Osasco, São Paulo, for depression and anxiety using STAI and BDI designed questionnaires. The authors found a prevalence of 59.5% for anxiety state (95%CI: 54.8-64.1), 45.3% for anxiety trait (95%CI: 40.6-50.0), and 19.6% for depression (95%CI: 15.9-23.4). The authors found that the mothers' low levels of education and the absence of formal marriage were significant independent predictors for anxiety trait (OR = 5.26; 95%CI: 2.17-12.5, $P = 0.001$; OR = 3.43; 95%CI: 1.68-7.00, $P = 0.001$), anxiety state (OR = 2.27; 95%CI: 1.08-4.76, $P = 0.02$; OR = 2.22; 95%CI: 1.09-4.53, P = 0.02), and depression (OR = 2.43; 95%CI: 1.40-4.34, $P = 0.002$; OR = 2.82; 95%CI: 1.35-5.97, $P = 0.005$). They found that women with lower incomes (OR = 2.22; 95%CI: 0.98-5.26, $P = 0.05$) and a race other than white (OR = 1.7; 95%CI: 1.00-2.91, $P = 0.04$) were significant independent predictors for anxiety trait. They also found that couples with lower income (OR = 2.43; 95%CI: 1.40-4.34, $P = 0.001$) and frequent previous abortions (OR = 2.21; 95%CI: 1.23-3.97, $P = 0.009$)

were significant independent predictors for depression. In the two different community studies done by Karaçam and Ançel[65] on 1039 Turkish pregnant women, the authors found manifestations of severe depression in 27.9% which required antidepressants therapy. The authors found that the lack of social support, recent life stresses, or domestic violence just before or during the recent pregnancy, and negative self-perception were strong independent predictors for both depression and anxiety; and formal marriage and its dissatisfaction, unwanted pregnancy, and being a housewife were strong independent predictors for depression only.

In this study, we found that the only predictors for postpartum depression were antepartum depression, anxiety, and parenting stress. Studies from the developed and developing areas of the world indicated a strong association between postpartum and antepartum depression. Some even found that the only predictor for postpartum depression was antepartum depression[64-66] Several studies also found that antepartum anxiety is associated (10%-29%) and a strong predictor for postpartum depression[66]. In the recent study done by Abd Elaziz and Abdel Halim[19] on 120 Egyptian women, the authors found postpartum depression in 27.5% of the subjects. They found that the predictors for postpartum depression were the presence of domestic violence (OR = 6.4, 95%CI: 2.5-15.3), previous episodes of postpartum depression (OR = 5.5, 95%CI: 1.6-17.9), presence of stressful life events (OR = 3.6, 95%CI: 1.4-8.1), and difficult social interaction at the time of stress (OR = 4.1, 95%CI: 1.7-9.1). Previous studies reported an association between postpartum depression and parenting stress. Leigh and Milgrom[46] screened women from Angliss and Northern Victorian hospitals and found higher PSI scores in women with postpartum depression compared to non-depressed women ($P < 001$). They found significant independent associations between postpartum depression and parenting stress ($P < 0.001$) and previous history of depression ($P < 0.01$). It has been suggested that in addition to parenthood, more burden is added on a working or career-oriented mother as being unable to carry out many work authorizations and home responsibilities.

In this study, we did not identify a significant correlation between thyroid hormonal changes in the peripartum period and depression. The role of hormonal fluctuations during perinatal period and its relationship to peripartum depression is not established. and many studies have controversial results [28,67-70]. For example, Amino *et al*[69] found low mean values of T4 levels during the 3rd trimester and early postpartum periods in women with postpartum depression. Abou-Saleh *et al*[70] found significant increase in levels of postpartum T4 in women with depression compared to unmarried/non-pregnant women; higher T4 was the only predictor for severe antepartum depression, and higher TSH was found in women with high scoring of EPDS, indicating presence of clinically significant symptoms of depression, and had previous history of depression compared to those without past history of depression. In the systematic review done by Szpunar and Parry[28] which included studies on women in the peripartum period who had major depression and did repeated measurements of TSH levels in the antepartum or postpartum periods, the authors found controversy between the studies and an absence of association between TSH and peripartum depression.

We suggest the followings as causes of differences between the results of this study and others: (1) Differences in methodologies (laboratory, screening questionnaires, and psychometric testing evaluation in different trimesters and postpartum periods) or study settings (*e.g.*, community or hospital-based or recruitment from primary health care center); (2) The causes and risks for peripartum depression could not be primarily or solely attributed to the biological changes during this stressful period of life; and (3) Differences in culture, beliefs, and genetic vulnerabilities: We suggest that that the observed high frequency of antepartum anxiety and its relationship to depression could be attributed to poverty, illiteracy, lack of social support, domestic violence, and psychological stressors.

CONCLUSION

There is wide variation in prevalence rates of peripartum depression from different countries. Our results showed that 20.66% had clinically significant symptoms of depression and 7.44% had the diagnosis of major depression. Although the topic has already been addressed in other studies and the results of the study corroborate the data found in the literature with regards the prevalence, predictors, and severity of depressive symptoms, the results of this study may help improve knowledge, taking into account the prevalence of the disease which is not always recognized and valued. Antepartum anxiety was the only variable found as a predictor for antepartum depression and also for postpartum depression, together with antepartum depression and parenting stress. Therefore, screening for peripartum depression and its risks is important.

ARTICLE HIGHLIGHTS

Research background

Depression is a common public health problem. It is an important cause of morbidity for mothers in

their peripartum period, with an estimated prevalence of 7%-58% or even higher in some countries. A common prevalence of antepartum or postpartum depression reported in different studies is approximately 13%. The suggested mechanism(s) of peripartum depression include(s) complex interplay between biological factors (fluctuation in reproductive, thyroid, and hypothalamic pituitary adrenal axis hormones), immune system activity, genetics, and psychosocial stressors. Therefore, World health Organization and United States Preventive Services Task Force recommend screening for women in peripartum period looking for manifestations of depression and determine their risks.

Research motivation
The research hotspots include determination of: (1) The prevalence of peripartum (antepartum and postpartum) depression. Because related studies are few for antepartum compared to postpartum depression; (2) The severities of depression in relation to different demographic, social, obstetric, hormonal, and psychological variables; and (3) The predictors which are independently associated with each of antepartum or postpartum depression.

Research objectives
This study systematically assessed women in their peripartum period to estimate the prevalence and predictors of peripartum depression.

Research methods
The Edinburgh Postpartum Depression Scale screening questionnaire; designed unstructured clinical questionnaire to gather information about the women's reactions to recent life circumstances, events, and stress in relation to the recent pregnancy; Beck Depression Inventory II, the State-Trait Anxiety Inventory for Adults, and Parenting Stress Index-Short Form for severity categorization of depression, anxiety, and parenting stress respectively; psychiatric interviewing to confirm the diagnosis of major depressive disorder (according to the Diagnostic and Statistical Manual of Mental Disorders, version 5); and measurements of triiodothronine, thyroxine, and thyroid stimulating hormone levels in the antepartum and postpartum periods.

Research results
The prevalence of women with clinically significant symptoms of peripartum depression in our locality is 20.66%. Major depression was found in 7.44%. Symptoms of depression were less severe in postpartum period than antepartum. Antepartum anxiety was the only predictor for both antepartum and postpartum depression. Antepartum anxiety and depression and parenting stress were the predictors for postpartum depression.

Research conclusions
Nearly one fifth of women developed clinically significant manifestations of depression in their peripartum period, mainly attributed to anxiety and parenting stress.

Research perspectives
In our locality, the importance of antepartum depression as a risk for postpartum depression and subsequently parenting stress has been largely under-recognized. Health care providers and insurance policies need to focus attention to the magnitude of the problem of peripartum depression to encourage education for obstetricians, mothers, and families about its high prevalence and associated risks. A multidisciplinary team for screening and management of peripartum depression is required (*e.g.*, prevention and expertise guidance related to the recommended treatment options, such as psychotherapy and/or pharmacotherapy).

FOOTNOTES

Data sharing statement: This study has no data to be shared.

STROBE statement: The authors have read the STROBE Statement—checklist of items, and the manuscript was prepared and revised according to the STROBE Statement—checklist of items.

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