Original Research Article

A study on adverse obstetric outcome and it's relation with antenatal psychosocial stress

Sija Chandran Lisa Jayachandran[1], Mayadevi Brahmanandan[2]*, Bindu Nambisan[2], Shaila Salmabeevi[2]

[1]Department of Obstetrics and Gynaecology, Sree Gokulam Medical College, Thiruvananthapuram, Kerala, India
[2]Department of Obstetrics and Gynaecology, SATH, Medical College Thiruvananthapuram, Kerala, India

*Correspondence:
Dr. Mayadevi Brahmanandan,
E-mail: drbmaya@gmail.com

ABSTRACT

Background: Antenatal psychosocial stress is a common condition, perhaps more prevalent than gesational diabetes. High ante-partum stress levels are associated with adverse pregnancy outcomes. Data related to psychosocial stress and pregnancy outcomes are very much limited in our country. The objective of the study was to study the obstetric and perinatal outcome in patients with psychosocial stress and to determine the association between socio demographic factors and psychosocial stress in antenatal period.
Methods: Using a 10 item stress scale (which was validated and developed at SAT hospital, Government Medical College, Thiruvananthapuram) 153 antenatal women who satisfied the inclusion criteria and attending the outpatient department (OPD) were evaluated and followed up until delivery and their findings noted.
Results: The average stress scores among mild stress group, moderate and severe stress group were 6.31, 9.18, 14.82 respectively. 23.5% of mild stress group, 23.5% of moderate stress group and 51% of severe stress group had preterm delivery. There was significant association between incidence of preterm labour and stress levels. Incidence of preterm delivery was high in severe stress group (p<0.05). Caesarean section rate was found to be high in patients with increased stress levels. 29.4% of mild stress group, 47.1% of moderate stress group and 60.8% of severe stress group were caesarean sections. Babies of high stress score mothers did not cry soon after birth and the association was significant. There was no statistical significance between socio-demographic factors and stress. Furthermore, no significant association was noted between stress levels and duration of hospital stay, history of complications in previous pregnancy, obstetric complications in present pregnancy, birth weight, neonatal deaths, maternal age, place of residence, education, income and family type.
Conclusions: As psychiatric problems during antenatal period and postnatal period are increasing the world over, identification of women at risk and specific interventions targeted to reduce psychosocial stress will improve feto-maternal outcomes. Hence stress assessment and appropriate interventions like physical relaxation, meditation, counseling and providing social support services should be integrated to routine antenatal care.

Keywords: Psychosocial stress, Obstetric outcome

INTRODUCTION

Psychosocial stress in pregnancy is defined as the imbalance that a pregnant woman feels when she cannot cope with demands which is expressed both behaviourally and physiologically. Prevalence of antenatal psychosocial stress is unclear and its influence on maternal health and obstetric outcomes are often underestimated.

ACOG defines psychosocial issues as non-biomedical factors that affect mental and physical well-being and

therefore advises to perform psychosocial screening at least once in each trimester and in the post-partum period to increase the likelihood of identifying important issues and reducing poor birth outcome.[1]

Antenatal psychosocial stress is common, and high levels are associated with poor pregnancy outcomes. Antenatal depression with a prevalence ranging from 5% to 17% during pregnancy has been linked to preterm birth. Possible mechanism involves a rise in serum cortisol which increases the release of placental corticotropin releasing hormone (CRH) thus triggering the onset parturition and preterm birth. Associations have been noted between psychosocial stress and adverse birth outcomes like preterm delivery as well as low birth weight, IUGR, PPROM, pre-ecclampsia etc.

The central nervous system (CNS) plays an important role in the response to psychological stress. The stress response has often been described as a 'double edged sword'.[2] A certain amount is beneficial whereas if the stress response does not 'shut off' the excess exposure of cortisol is damaging for the organs including the central nervous system.[3] The brain of the developing fetus, which is characterised by cell production, migration and organisation, would be expected to be far more sensitive to these exposures than the adult brain, but little is known about the role of maternal psychological stress during pregnancy for the development of the fetal CNS in humans. The old concept of bringing up children from birth onwards has changed to new concept of 'shaping the future of children right from the womb itself'. Hence, identifying psychosocial stress in pregnancy and determining their associations with adverse obstetric and perinatal outcome is paramount.

In the confidential review of maternal deaths in Kerala (CRMD) of 2004-2005, there were six cases of suicide as causes for maternal deaths.[4] The problem of suicide and its significant contribution to the Kerala scenario is a matter of concern. There is scant literature regarding influence of psycho-social stress among antenatal women on preterm birth, low birth weight, IUGR, pre ecclampsia and other maternal and fetal outcomes, in our part of the country. Hence the significance of this study.

Objective of this study is to find out the maternal and fetal outcome in patients with psychosocial stress in antenatal period and to analyse the association between socio demographic factors and psychosocial stress in antenatal period.

METHODS

The study was designed as a prospective cohort study, in the setting of Department of Obstetrics and Gynaecology, Sree Avittom Thirunal Hospital (SATH) Thiruvananthapuram, Kerala, India. The study duration was 18 months. The population studied was the Antenatal women attending outpatient Department of SAT Hospital, which is a tertiary referral teaching hospital in South Kerala under the government set up.

Perceived stress in antenatal women was studied using locally developed psychosocial stress scale by the Department of Obstetrics and Gynaecology, SAT Hospital, Trivandrum. Antenatal patients at 20-28 weeks were recruited into study. According to stress levels, patients were divided into those with mild, moderate and severe stress.

Null hypothesis stated that there is no relation between psychosocial stress among antenatal women and obstetric outcome.

The maternal outcome variables measured were development of gestational diabetes, pre-eclampsia, gestational hypertension, preterm delivery and PPROM, the mode of delivery, (normal delivery or caesarean), incidence of post partum hemorrhage and the duration of hospital stay. Fetal outcome variables included were IUGR, low birth weight, oligamnios, fetal distress, meconium aspiration, Apgar at 1' and 5', neonatal death and still births. Postnatally, all patients were followed up till discharge and adverse obstetric and perinatal outcomes were studied.

Inclusion criteria

Antenatal women attending OPD of SAT Hospital at 20-28 weeks period of gestation in the age group of 18-40 years.

Exclusion criteria

Antenatal women who were known cases of psychiatric disorder, severely ill or not given consent.

Sampling technique

No probability techniques were used. All consecutive patients fulfilling the inclusion criteria were enrolled in the study, from the antenatal OPD of SAT Hospital.

Sample size was calculated using the formula:

$$n = (Z_\alpha + Z_{1-\beta})^2 \{p_1(1 - p_1) + p_2(1 - p_2) \div \delta^2$$

Where α = Type I error (fixed at 5 % level), 1-β = Power (fixed at 80 % level), л1 = Study group response, л2 = Control group response, δ= p1- p2

p1 = proportion of preterm labour in patients with high stress =17% (C Dunkel Shetter).[5]

p2= proportion of preterm labour in patients with no risk factor is estimated not more than 5 %.

$$n = 7.9(17 \times 83) + (5 \times 95)] \div 12^2$$

n= 51. N=n1+n2+n3=153

n1= (unexposed group) (patients with mild stress)

n2+n3= (exposed group) (patients with moderate and severe stress)

Study tool

Psychosocial stress scale

Structured 10 item questionnaire for assessing psychosocial stress, developed in SAT Hospital, with internal consistency reliability (Cronbach alpha 0.733) was used for the study. Since no accepted scales for measuring psychosocial stress were available in Kerala and as western stress scales were not applicable in our set up, this 10 item questionnaire that was culturally acceptable and appropriate was developed in our institution.

Following items were included in this questionnaire: concerns regarding investigations in pregnancy, concerns about illness during pregnancy, concerns about delivery complications, concerns regarding labour pains, concerns regarding attitude of doctors and nurses in labour room, concerns regarding communication with doctors regarding any illness during pregnancy, are you worried regarding inadequate rest periods at hone as well as during your job, concern about not getting help from anybody both at home and workplace, concern about husband's alcoholism and concern about husband's violence.

The items were set in a question format and the response was set in a 3 point scale - Thurstone's method of anchoring: 0- never / not applicable, 1- often, 2- always.

The minimum possible score is zero and maximum possible score is 20. A score below 25th percentile (score of 7.75) is taken as low stress, a score between 25th-75th percentile (7.75-13) is taken as moderate stress and a score more than 75th percentile (a score of >13) is taken as high/ severe stress.

Ethical considerations

Approval of the study was taken from Human Ethics Committee, Medical College, Thiruvananthapuram. After getting institutional consent, the participants were approached for obtaining their willingness to participate in the study. During data collection prime consideration was given for privacy and autonomy of the participants. Confidentiality of the entire data obtained from each participant has been strictly maintained.

RESULTS

Base-line demographic characteristics of the study subjects

Age

Majority (42%) of patients belonged to 21-25 years age group. The mean age is 25.93 years and standard deviation 4.76 and the age ranges from 19- 38 years.

Educational qualification

41.8% of women were educated up to higher secondary, 32.4% went up to high school and 25.5% had a graduate qualification

Income of patients

45.8% belonged to the low income group and remaining were middle socio-economic status.

Occupation of the subjects

74.5% of participants were house wives and the remaining were employed, mostly self employed or in the private sector. 2% were government servants.

Place of residence

Majority (88%) of subjects resided in rural area.

Family type

85.6% were staying as part of extended family and only 14.4% were staying nuclear. Family support was available for most of the subjects.

Base-line obstetric history of the study subjects

Obstetric score

47.7% of subjects were primigravida and 52.3% of participants were multigravida. (second gravida or higher).

Relevant obstetric history

In the study population 21.6% had previous history of abortions and 7.8% of participants were treated for infertility. 65% patients had no previous pregnancy complications.

Medical disorders prior to current pregnancy

17% had thyroid disease, 2% hypertension, 2% cardiac disease, 5.2% epilepsy and 5.2% had diabetes.

Obstetric complications during present pregnancy

In the study population, 28.8 % pregnancies were complicated with gestational diabetes mellitus, among which 22.9% were on medical nutrition therapy while 5.9% were on insulin. 15% patients had associated GHTN. 6.5% had associated anemia. PROM occurred in 8.5%. Oligamnios was seen in 27.5% and FGR in 26.5%. Preterm labour occurred in 32.7%. 7.2% had previous history of neonatal death and 13.1% had previous caesarean section. There was associated fetal distress in 17%, and MSAF in 9.8% (Figure 1).
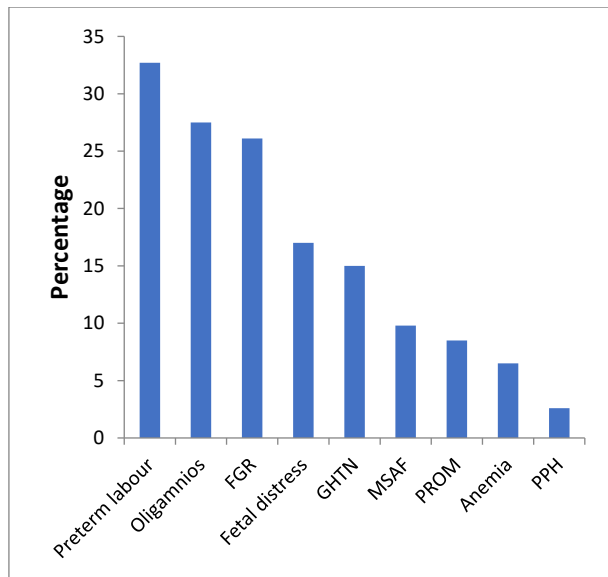
Figure 1: Distribution with respect to obstetric complications during present pregnancy.

Mode of delivery

In the study population, 54.2% (n=83) underwent normal delivery while 45.8% (n=70) underwent caesarean. (Table 1)

Table 1: Distribution with respect to mode of delivery.

Mode of delivery	Frequency	Percentage (%)
LSCS	70	45.8
Normal delivery	83	54.2
Total	153	100.0

Birth weight

49% patients had their babies weighing more than 2.5 kg (n=75), and 20% weighed below 2 kg (n=32) with mean weight of 2.42 kg with standard deviation of 0.56.

APGAR

Infants born to 32.7% (n=50) of study population had APGAR score less than 7 at 1 minute and 7.8% (n=12) had APGAR score less than 7 at 5 minutes also.

Stress level and obstetric outcome

Stress levels

Based on the standard psychosocial stress scale questionnaire, the pregnant mothers were divided into three stress groups of mild, moderate and severe. The stress scale was from 0-20. Stress levels of 0-7.75 were classified mild, 7.75-13.0 were categorized moderate and that between 13.1-20.0 were categorized to be severe. The average stress scores among mild stress group, moderate

and severe stress group 6.31, 9.18, 14.82 respectively. (Table 2)

Table 2: Distribution with respect to stress level.

Stress level	Stress score				
	N	Mean	SD	Min.	Max.
Mild (0-7.75)	51	6.31	1.17	3.00	7.00
Moderate (7.75-13.0)	51	9.18	1.26	8.00	13.00
Severe (13.1-20.0)	51	14.82	0.91	14.00	17.00
Total	153	10.10	3.72	3.00	17.00

Relation between demographic variables and maternal stress score

The variable studied were age, education, income, family type and place of residence (Table 3).

Age

51% of the mild stress group, 39.2% of moderate stress group and 37.3% of severe stress group were of the age group 21-25 years. Stress score was comparatively similar in all age group. There was no significant difference in stress score among the age group (p>0.05).

Relation between education and maternal stress

31.4% of Mild stress group, 19.6% of moderate stress group and 25.5% of the severe stress group had education of degree and above. There was no significant association between education and stress (p>0.05).

Relation between income and maternal stress

In the study population, 39.2% of mild stress group, 49% of moderate stress group and 49% of severe stress group belonged to low income group. No significant association seen between stress levels and income were found (p>0.05).

Relation between place of residence and maternal stress

92.2% of mild stress group 90.2% of moderate stress group and 80.4% of severe stress group resided in rural area. There was no statistical difference in stress levels according to place of residence (p>0.05).

Relation between family type and maternal stress

There was no statistical difference in stress levels based on type of family (p>0.05).

Relation between obstetric variables and maternal stress score (Table 4).

Table 3: Relation between demographic variables and maternal stress score.

Variables	X^2	Df	P value
Age	6.997	8	0.537
Education	4.876	4	0.30
Income	5.694	4	0.223
Place of residence	3.726	2	0.155
Family type	0.841	2	0.657

Table 4: Relation between obstetric variables and maternal stress score.

Variables	X^2	Df	P value
Obstetric score	2.491	4	0.646
Duration of hospital stay	2.581	4	0.706
Meconium staining	3.991	2	0.136
Birth weight	4.876	4	0.300
Baby cried soon after birth	7.286	2	0.026

Relation between obstetric score and maternal stress

There was no statistical difference in stress levels between primigravida and multigravida. (p>0.05)

Relation between meconium staining and maternal stress

3.9% of the mild stress group, 9.8% of moderate stress group and 15.7% of severe stress group, were complicated with meconium stained amniotic fluid. There was no significant association seen between stress levels and MSAF. (p>0.05)

There was no statistical significance between stress levels and neonatal deaths. (p>0.05). There was only 1 death in the study group in a woman with a high stress score.

Relation between birth weight and maternal stress

27.5% of mild stress group 21.6% of moderate stress group and 41.2% of moderate stress group had baby weight ranging 2-2.5kg. No statistical significance obtained between birth weight and stress levels. (p>0.05)

There was no statistical significance obtained between duration of hospital stay and stress levels. (p>0.05)

Relation between baby's cry and maternal stress

2% of babies in mild stress group did not cry soon after birth when compared to 9.8% in severe stress group. There was significant association between stress levels and whether the baby cried soon after birth or not. (p<0.05) (Table 4)

Relation between past obstetric complications and maternal stress

No statistical significance obtained between stress levels and history of complications in previous pregnancy. (p>0.05) (Table 5)

Relation between current obstetric complications and maternal stress

No statistical significance obtained between incidence of PROM, GHTN, anemia, placenta previa, oligamnios, fetal growth restriction, fetal distress and PPH with stress levels (p>0.05) (Table 6).

Relation between preterm labour and maternal stress

23.5% of mild stress group, 23.5% of moderate stress group and 51% of severe stress group had preterm delivery. There was significant association between incidence of preterm labour and stress levels. Incidence of preterm delivery was high in severe stress group (p<0.05). (Refer table 7a and7 b)

Relation between mode of delivery and maternal stress

29.4% of mild stress group, 47.1% of moderate stress group and 60.8% of severe stress group were caesarean sections. There was significant association between stress levels and caesarean sections (p<0.05) (Table 8).

DISCUSSION

Psychosocial stress factors are known to be associated with adverse birth outcomes like preterm delivery, low birth weight, still birth, pre-eclampsia etc. Several prospective, population-based studies in pregnant women of different socio-demographic, racial/ethnic and national backgrounds, it has been proven that high levels of psychosocial stress during pregnancy are at significantly increased risk for preterm delivery, even after accounting for the effects of other established socio-demographic, biophysical, biomedical, and behavioral risk factors.[6-12]

A customized psychosocial stress scale developed in SAT hospital was used to measure stress among antenatal women as available scales developed in western countries were not culturally appropriate, locally acceptable, and applicable in our set up. A 10 item questionnaire was used to assess stress levels in antenatal women and patients were divided according to stress levels as mild, moderate and severe stress and birth outcomes were studied.

The study population consisted of 153 subjects and the average stress scores among each group were classified as mild stress (0-7.75) moderate stress (7.75-13) and severe stress (>13-20) group (n=51 each) were 6.31±1.17,9.18±1.26,14.82±0.91 respectively with minimum score of 3 and maximum score of 17.

Table 5: Maternal stress and complications in previous pregnancy.

Variables	Stress						Total		χ^2	df	P
	Mild		Moderate		Severe						
	N	%	N	%	N	%	N	%			
Previous history abortion	10	19.6	12	23.5	11	21.6	33	21.6	0.232	2	0.891
Treated for infertility	4	7.8	4	7.8	4	7.8	12	7.8	0.000	2	1.000
Previous CS	4	7.8	8	15.7	8	15.7	20	13.1	1.841	2	0.398
Neonatal death	4	7.8	3	5.9	4	7.8	11	7.2	0.196	2	0.907
Medical disease	0	0	0	0	1	2	1	0.7	2.013	2	0.365
HTN	2	3.9	1	2	0	0	3	2	2.040	2	0.361
Cardiac disease	0	0	1	2	3	5.9	4	2.6	3.594	2	0.166
Epilepsy	2	3.9	1	2	5	9.8	8	5.2	3.429	2	0.180
DM	3	5.9	0	0	5	9.8	8	5.2	5.012	2	0.082
Thyroid disease	6	11.8	10	19.6	10	19.6	26	17	1.483	2	0.476
Other disease	2	3.9	0	0	5	9.8	7	4.6	5.689	2	0.058

Table 6: Maternal stress and Obstetric complications in present pregnancy.

Variables	Stress						Total		χ^2	df	P value
	Mild		Moderate		Severe						
	N	%	N	%	N	%	N	%			
PROM	4	7.8	3	5.9	6	11.8	13	8.5	1.177	2	0.555
GHTN	8	15.7	7	13.7	8	15.7	23	15	0.102	2	0.950
Anemia	3	5.9	1	2	6	11.8	10	6.5	4.066	2	0.131
Placenta praevia	1	2	2	3.9	3	5.9	6	3.9	1.041	2	0.594
Oligamnios	11	21.6	12	23.5	19	37.3	42	27.5	3.741	2	0.154
Other complications	12	23.5	5	9.8	5	9.8	22	14.4	5.203	2	0.074
FGR	12	23.5	12	23.5	16	31.4	40	26.1	1.083	2	0.582
Fetal distress	6	11.8	7	13.7	13	25.5	26	17	3.985	2	0.136
PPH	1	2	1	2	2	3.9	4	2.6	0.513	2	0.74

Table 7a: Maternal stress and preterm labour.

Preterm labour	Stress						Total		χ^2	df	P value
	Mild		Moderate		severe						
	N	%	N	%	N	%	N	%			
Yes	12	23.5	12	23.5	26	51	50	32.7			
No	39	76.5	39	76.5	25	49	103	67.3	11.646	2	0.003
Total	51	100	51	100	51	100	153	100			

Table 7b: Association between preterm birth and stress score.

Preterm labour	N	Stress score		Independent sample t test	
		Mean	SD	t	P value
Yes	50	11.50	3.93		
No	103	9.43	3.43	3.340	0.001

Table 8: Maternal stress and mode of delivery.

Mode of delivery	Stress						Total		χ^2	Df	P value
	Mild		Moderate		severe						
	N	%	N	%	N	%	N	%			
CS	15	29.4	24	47.1	31	60.8	70	45.8			
Normal	36	70.6	27	52.9	20	39.2	83	54.2	10.165	2	0.006
Total	51	100	51	100	51	100	153	100			

A study in psychosocial stress during pregnancy by Woods et al concluded that marital status, employment, education, race, age, and history of pregnancy complication were not significantly associated with high psychosocial stress.[13] The findings in our study was also similar. In our study, also no significant association was seen between age, education, income, residence, employment and stress scores were identified. No association was found between obstetric score, previous history of obstetric complications, previous history of abortions or history of treatment with infertility with stress scores.

However, majority of our antenatal women were from low socioeconomic status thereby preserving the social norms. As women's education and employment system are improving, nuclear family system with less family support is the trend.

In our study population, 47.7% were primigravida and fear and anxiety regarding labour pain was very evident in our questionnaire. Other factors like anxiety regarding additional responsibilities that accompany motherhood was also a factor noted.

A significant association was noted between stress levels and caesarean sections. A study done by Johnson to identify the relation between anxiety during pregnancy and obstetric complications reported that, psychosocial stress, family functioning or fear of child-birth have association with specific complications such as prolonged labour and caesarean sections.[14] Another important finding in our study was that 23.5% of mild stress group, 23.5% of moderate stress group and 51% of severe stress group had preterm delivery which was statistically significant. Incidence of preterm delivery was high in severe stress group (p<0.05).

No statistical significance obtained between birth weight and stress levels. However in a study by Wadhwa et al they have mentioned that, each unit of life event stress was associated with a 55 g reduction in birth weight and an odds ratio of 1.32 for low birth weight.[15] However low birth weight could be due to an interplay of several factors like associated comorbidities, addictions, medications etc.

In studies of life events stressors, 2 factors have consistently emerged as relevant to the risk of preterm birth and they are the timing of the stressor and the woman's perception of it. Elevated endogenous maternal cortisol levels caused by stress early in pregnancy could affect fetal growth and lead to low birth weight babies. A cohort study conducted by Nicholas to investigate the association between maternal anxiety in third trimester and increased uterine artery resistance index identified that strong association exists between uterine artery resistance index and state trait anxiety scores which may contribute to low birth weight.[16]

Vascular disorders in pregnancy such pregnancy-induced hypertension and pre-eclampsia are the major indications for elective preterm delivery. Findings suggest that maternal psychosocial stress is significantly associated with increased risk of hypertensive disorders in pregnancy.[17,18]

Occupational factors like employment related stress may also contribute to preterm birth. Work related ergonomic stressors include factors such as physical exertion (heavy lifting, prolonged standing or sitting work with heavy machinery.[19] Strenuous working conditions and occupational fatigue in pregnancy have been associated with preterm delivery and low birth weight among working women.[20] Majority of our study group were housewives and so did not have to juggle both with household work and that at workplace.

Limitations of the study

SATH, Government medical college, Trivandrum is a tertiary referral centre where most of the antenatal patients attending OP are high risk pregnancies, referred from elsewhere. Hence, the study population may not be reflective of the general population.

Those identified with moderate or severe stress were offered counselling in the OP and relatives were notified regarding the same. The impact of these support measures upon outcome could not be measured. Other than counselling and notifying relatives, interventions like yoga, meditation etc. were not carried out in the severe stress group, and hence not measured.

CONCLUSION

Adverse obstetric outcome were higher in antenatal women with severe stress. Adverse obstetric outcome observed in our study were increased incidence of caesarean sections and preterm delivery. Babies born to antenatal women with severe stress had more chance of not crying soon after birth. In our study, no significant association was observed between socio demographic factors and psychosocial stress.

The commonest adverse fetal outcome noted was preterm birth. (51% in severe stress group). No maternal mortality or still birth were noted in severe stress group. Eventhough gestational diabetes is a far less common condition than depression during pregnancy, women are routinely screened for this disorder. Routine screening for depression or any psychiatric illness or pregnancy stressors are not being done. This is a short coming of public health policy. Pregnancy is an optimal time to perform mental health screening since women are under regular care and thus available for referrals and follow up interventions. Some form of psychotherapy, counseling as well as psychopharmacologic medications have been shown to be effective for depression and anxiety during pregnancy.

Pregnant women's psychological health may have consequences for fetal neurobehavioral development, and consequently child outcomes. These findings underscore the importance of considering the effects of women's mental health on child development during the anteenatal as well postnatal periods. An emphasis on primary prevention would shift the focus to how we can create environments and support systems that promote healthy women and by extension, healthy pregnancies.

REFERENCES

1. American College of Obstetricians and gynaecologists. Psychosocial risk factors : perinatal screening and intervention. ACOG Committee opinion No343. Obstet Gynecol. 2006;108:469-77.
2. Avishai-Eliner S, Brunson KL, Sandman CA, Baram TZ. Stressed-out, or in (utero)? Trends Neurosci. 2002;25:518-24.
3. McEwen B, Lasley EN. The end of stress as we know it. Washington D.C. Joseph Henry Press, 2003.
4. VP Paily, K Ambujam, Betsy Thomas. Why Mothers Die Kerala 2006-2009 Observations, Recommendations. Maternal Fetal medicine Committee KFOG. 211.
5. Shetter CD. Maternal stress and preterm delivery. Prenat Neonat Med. 1998;3:39-42.
6. Hobel CJ, Goldstein A, Barrett ES, Bertakis KD, Roter D, Putnam SM. The relationship of physician medical interview style to patient satisfaction. JF am Pract. 1991;32:175-181.
7. Sontag LW. Differences in modifiability of fetal behaviour and physiology. Psychosom.Med. 1944;6:151-4.
8. Ferreira AJ. Emotional factors in prenatal environment. A review. J Nerv Ment Dis. 1965;141:108-18.
9. Stott DH. Follow-up study from birth of the effects of prenatal stresses. Dev. Med Child Neurol. 1973;15:770-87.
10. Hobel CJ, Arora CP. Korst LM. Corticotrophin – releasing hormone and CRH-binding Protein. Differences between patients at risk for preterm birth and hypertension. Ann N Y Acad Sci. 1999;897:54-65.
11. Sandman CA, Glynn L, Schetter CD, et al. Elevated maternal cortisol early in pregnancy predicts third trimester levels of placental corticotropin releasing hormone (CRH): priming the placental clock. Peptides. 2006;27:1457-63.
12. DiPietro JA, Hodgson DM, Costigan KA, et al. Fetal neurobehavioral development. Child Dev. 1996;67:2553-67.
13. Woods SM, Melville JL, Yuquinig. Psycosocial stress during pregnancy; American Journal of Obstetrics and Gynaecology. 2010.
14. Johnson RC Slade P. Obstetric complications andanxiety during pregnancy – is there a relationship. Journal of psychosomatic Obstetrics and Gynecology. 2003;:24(1):1-14.
15. Wadhwa PD, Sandman CA, Porto M et al. The association between prenatal stress and infant birth weight and gestational age at birth;a prospective investigation Am J Obstet Gynecol. 1993;169:858-65.
16. Vivette N, Glover. Association between maternal anxiety in pregnancy and increased uterine artery resistance index. British Medical Journal. 1999;318:153-57.
17. al'Absi M, Wittmers LE. Enhanced adrenocortical responses to stress in hypertension –prone men and women. Ann Behav Med. 2003;25:25-33.
18. McCubbin JA, Lawson EJ, Cox S, Sherman JJ, Norton JA, Read JA, Prenatal maternal blood pressure response to stress predicts birth weights and gestational age: A preliminary study. Am J Obstet Gynecol. 1996;175(3):706-12.
19. Hickey CA, Cliver SP, Mulvihill FX et al. Employment-related stress and preterm delivery; a contextual examination. Public Health Rep. 1997;110;410-18.
20. Homer CJ. Work related psychosocial stress and risk of preterm baby. Am J Public Health. 1990;80(2):173-7.