

# Study of Effect of Stress on Lactation in Postnatal Women

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## ABSTRACT

### BACKGROUND

Stress is a physiological response to psychological and physical demands. Cortisol is a stress hormone that is released in increasing quantities as pregnancy progresses. Stress is a cumulative effect of changing life events with failure of coping reflex that leads to chronic stress which repeatedly activates hypothalamic-pituitary-adrenal (HPA) axis without relaxation response, to release excess cortisol. Duration of stress and its sites of action lead to decrease in lactation. In this study, we wanted to determine the relationship between stress and levels of maternal serum cortisol before and after the delivery and assess the relation between stress and milk output in the first week of post-partum period.

### METHODS

A cross-sectional study was carried out among 96 pregnant women, using HOLMES-RAHE STRESS SCALE: categorized into mild, moderate, and severe stressed. Serum cortisol levels are assessed using electrochemiluminescence immunoassay before and after delivery. Postnatal mothers were advised to breastfeed their newborns ten times a day after delivery and the baby's weight is measured using the baby-test weighing method using digital weighing machine at regular intervals for seven days. Mean serum cortisol levels were computed and compared with milk production.

### RESULTS

48.9 % pregnant women were mildly, 29.1 % were moderately and 21.8 % severely stressed. Serum cortisol levels were significantly high ( $p < 0.05$ ) in moderately and severely stressed women with significant reduction in milk volume when compared to mildly stressed women.

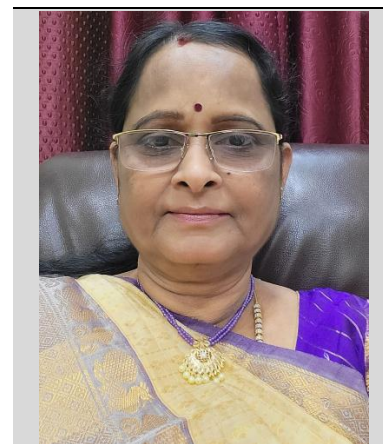
### CONCLUSIONS

Findings of this study indicates that moderate and severe stressful events reduce lactation in post-natal women. More research is needed to understand relationship between stress, other maternal factors, and their impact on breastfeeding outcomes.

### KEY WORDS

Pregnancy, Maternal Stress, Lactation, Serum Cortisol, Holmes-Rahe Scale.

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DOI: 10.14260/jemds.v12i1.323

How to Cite This Article:  
Madhuri TS, Harsulkar SG, Sirisha P. Study  
of effect of stress on lactation in postnatal  
women. J Evolution Med Dent Sci  
2023;12(01):26-29, DOI:  
10.14260/jemds.v12i1.323

Submission 18-11-2022,  
Peer Review 27-12-2022,  
Acceptance 02-01-2023,  
Published 31-01-2023.

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## BACKGROUND

As the duration of pregnancy increases, physical and mental stress increases. The physical and psychological stress of pregnancy is also another factor responsible for the increasing serum cortisol levels during pregnancy (Meyer, 2015) that affects the maternal hypothalamic-pituitary-adrenal (HPA) axis,<sup>[1]</sup> resulting in progressive rises in CRH, ACTH, and cortisol. Stress interferes with lactation performance of humans.<sup>[2,3]</sup> Studies indicate that high stress or anxiety levels during pregnancy are at increased risk for pre-eclampsia, spontaneous abortion, preterm labor and delayed foetal growth. Lactation insufficiency is frequently blamed on stresses, such as those imposed on preterm delivery, infant medical condition, and maternal stress. Therefore, to safeguard lactation, one must understand not only the physiology of lactation but also how to initiate and maintain maternal interest in breastfeeding or pumping, particularly in times of stress.

Lactation insufficiency is frequently blamed on stresses, such as those imposed by preterm delivery, infant medical condition, or maternal lifestyle. The initiation and maintenance of lactation requires appropriate hormonal changes and maternal behaviour. Depending upon duration of stress and its site(s) of action, suppression of lactation may result from decrease in milk synthesis and ejection. When lactation insufficiency cannot be explained with inadequate mammary development, it is routinely blamed on maternal stress. The prevalence of stress during pregnancy has been found to range from 6 % to as high as 52.9 % in developing countries.<sup>[4-7]</sup> There are three major interplays between mother and infant that need to develop to preserve lactation. First, the primary function of lactation is to provide nutrition to the newborn. Second, lactation is affected by maternal interest in providing milk to infants. Third, maternal interest in initiating and maintaining breastfeeding or pumping also is a function of her relationship with her infant.

The study was conducted to assess the interaction between stress and cortisol levels before and after labor, also relation between stress and milk volume output. Following Holmes and Rahe that they demand social adjustment, and exposure to life events as stressors assuming events causing stress. The assumption is that degree of stress corresponds to the degree of exposures to stressors.

### Objectives

1. To determine the relationship between stress and levels of maternal serum cortisol before and after the delivery.
2. To assess the relation between stress and milk output in the first 7 days of postpartum period.

## METHODS

A hospital based cross-sectional analytical study was conducted from January 2021 to December 2021 at Department of Gynaecology and Obstetrics, King George Hospital, Visakhapatnam. With an expected prevalence of 50 %, a sample size of 96 antenatal women was considered adequate. Informed consent was taken from the participants

before enlisting them in the study. Detailed history was noted and clinical examination done. Measurement of stress was done by taking history of any stress full events during the period of pregnancy by using HOLMES AND RAHE STRESS SCALE<sup>[8,9,10]</sup> questionnaire- which contains a list of life changing units (LCU) - questionnaire. Depending upon the score, postnatal women were categorized into three groups (mild stress - LCU < 150, moderate stress - LCU < 150 - 299, severe stress - LCU ≥ 300). Serum cortisol levels are estimated before and after delivery. Blood samples are (3 - 5 ml) are collected by venipuncture between 8 am - 9 am with all sterile precautions. Serum cortisol levels are estimated by electrochemiluminescence immunoassay. After delivery, postnatal mother is advised to breastfeed the baby for 10 times - per day for first 7 days of the postpartum. Measurement of milk volume (ml) is done - at regular intervals following breast feed, weight of the baby is recorded by baby-test weighing method using digital weighing machine up to 7 days of post-partum period. Mean serum cortisol levels were calculated and compared with milk output between the three groups. Data obtained will be entered on the pre-designed case proforma and results are analyzed.

### Sample Size

With 95 % confidence level and margin of error of ± 10 %, a sample size of 96 subjects were allowed to participate in the study.

$$\frac{Z^2 p(1-p)}{d^2} = 96.04$$

Where, n = sample size

z = z statistic at 5% level of significance (1.96)

d = margin of error = 0.1

p = anticipated prevalence rate (50 %) = 0.5

### Inclusion Criteria

1. Post-natal women.
2. Subjects who gave consent to study.
3. Women who agreed to be in the study group till 7 days of postpartum.
4. Women who were in reproductive age between 21 - 40 years.

### Exclusion Criteria

1. Subjects who are not willing to give a valid consent.
2. Pregnant women with history of non-lactogenesis.
3. Women with no intention to breastfeed.
4. Alcoholics, smokers, known diabetic with history of major endocrinal abnormality.
5. Women who were HbsAg or HIV positive.

### Ethical Considerations

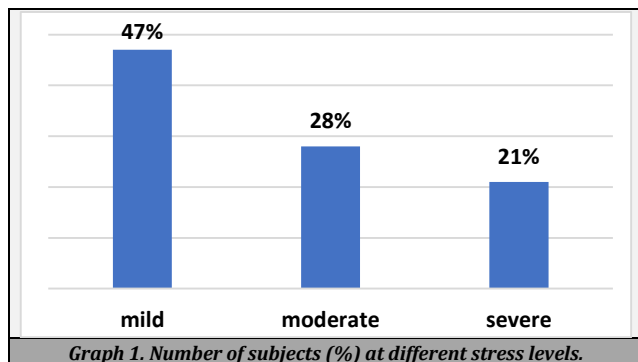
The study was conducted after obtaining the prior permission from Institutional Ethics Committee, Andhra Medical College, Visakhapatnam. A written informed consent

will be taken from every included in the study. Confidentiality of the data is maintained.

**Statistical Methods**

Results were recorded. Data was analyzed. All characteristics were summarized descriptively. For all continuous variables, the summary statistics of N, mean and standard deviation (SD) were used. For all categorical data, numbers and percentages (%) were used in the data summaries. The difference of the means of analysis variables between two independent groups was tested by unpaired t test. The difference of the means of analysis variables between two time points in same group was tested by paired t test. The difference of the means of analysis variables between more than two independent groups was tested by ANOVA and F test of testing the equality of Variance. Data was analyzed using Statistical Package for Social Sciences (SPSS) version 27.

**RESULTS**



Graph 1: A total of 96 pregnant women were included in the study group, in the age range of 21 - 40 years. It was observed that 47 (48.9 %) women were mildly stressed, 28 (29.1 %) women were moderately stressed and 21 (21.8 %) women were severely stressed (Table-I).

	Mildly	Moderately	Severely
Day 1	50.38 ± 1.53	47.17 ± 1.41	41.71 ± 11.71
Day 3	355.23 ± 7.89	185.14 ± 5.91	141.85 ± 4.63
Day 4	553.55 ± 10.67	309.42 ± 8.12	258.95 ± 14.63
Day 5	716.42 ± 13.06	433.42 ± 12.31	371.14 ± 16.00
Day 6	709.02 ± 8.15	439.75 ± 8.97	373.23 ± 16.25
Day 7	725.85 ± 11.54	456.46 ± 6.74	378.66 ± 10.81

**Table 1. Mean Serum Cortisol Levels Deviation Before and After Delivery**

Mean serum cortisol levels were found to be different among groups with mild, moderate and severe stress, both before and after delivery. The difference among the groups was found to be statistically significant at P < 0.01.

	Cortisol level before delivery	Cortisol level after delivery	P Value	
Mild stress	25.52 ± 2.94	23.67 ± 3.14	< 0.0001	Within mild stress
Moderate stress	27.5 ± 3.28	26.73 ± 3.84	< 0.0008	Within moderate stress
Severe stress	28.75 ± 4.49	30.45 ± 6.91	< 0.0001	Within severe stress

**Table 2. Comparison of Milk Volumes for First 7 Days of Postpartum at Different Stress Levels**

Milk volumes were reduced gradually (with p < 0.05) in moderately and severely stressed women when compared with the milk volumes of mildly stressed women. Lower milk volumes were observed in moderately stressed subjects when compared with milk volumes of mildly stressed subjects. Similarly, milk volumes were still lower in severely stressed subjects when compared with the milk volumes of moderately stressed subjects. The difference in milk volumes between the three groups was found to be significant with p ≤ 0.05.

**DISCUSSION**

This study demonstrated the prevalence of antenatal stress in expectant mothers and the strong correlation between stress intensity and serum cortisol levels, which has a major impact on lactation. When compared to moderately and mildly stressed mothers, it was shown that highly stressed women's milk quantities were much lower. Those who were moderately and severely stressed had significantly higher serum cortisol levels than women who were only mildly stressed.

Milk ejection is a neuroendocrinal reflex. When milk synthesis is decreased, there is negative effect over the reflex action leading to decreased milk output. It indicates that milk ejection is affected due to decreased secretion of oxytocin.

A possible link between naturally occurring variations in HPA activity during pregnancy and neuroendocrine parameters in lactation has not yet been assessed in animal's studies. However, pregnancy stress significantly increases HPA reactivity in lactating rats bred for high anxiety -related behaviour (Neumann et al. 2005)<sup>[11]</sup>, providing evidence that during pregnancy may influence maternal HPA reactivity postpartum.

Studies indicate that about 20 % of pregnant women experience severe stress due to marital difficulties, lack of partner, socio-demographic parameters such as low socio-economic status, occupational status, low literacy rate etc.<sup>[12]</sup>

The first study conducted by Newton and Newton in 1948, indicated that, the maternal acute stress suppresses the lactation.<sup>[13-16]</sup> Similar study by Feher, Berger et al. estimated the milk volume output from the mothers who gave birth prematurely.<sup>[17]</sup> They observed that the milk volume was reduced in mothers who were stressed when compared with the milk volume of controls. So, lactation insufficiency can be because of maternal stress.

Similar results were observed by Dallman et al,<sup>[18]</sup> Harvaline et al,<sup>[19]</sup> and Obel et al,<sup>[20]</sup> and also by few other studies.<sup>[21-24]</sup> When the body is subjected to multiple stressors or a single stressor repeatedly for an extended period of time, it lacks the chance or ability to activate the relaxation response, which results in the HPA axis malfunctioning and excessive cortisol production.

**CONCLUSIONS**

Stress is a substantial public health problem among pregnant women. Findings of this study indicates that pregnancy maternal stress score which is determined by Holmes-Rahe-

questionnaire had significant correlation with serum cortisol levels which further effected milk volume output in postnatal women. Pregnancy stress increases the serum cortisol level which in turn leads to decrease in milk volume output. So, mothers who had higher stress level had been with higher serum cortisol levels which further affected lactation in postnatal women. It is necessary to focus on factors effecting lactation and it is essential to bring awareness in population. Further research is required to gain better understanding of the differential effects of stress on lactation.

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