

Effect of psychosocial stress during pregnancy against prostaglandin hormone levels in maternity

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ABSTRACT

Stress is a mental health problem in pregnancy and affects the birthing process of breastfeeding. Stress can affect physiological processes in the body, including hormones in labor. This study evaluated the effects of stress during pregnancy on prostaglandin hormone levels in the mother during maternity. This research is an observational study using a prospective cohort approach. The number of samples in this study was 121 samples. Stress change data were analyzed using the Wilcoxon rank test and 1-way test ANOVA. The results showed there was a change in stress from first trimester to second trimester there were 23 respondents who experienced increased stress ($p=0.000$), second trimester to third trimester there were 102 respondents who experienced increased stress ($p=0.000$), and first trimester to third trimester there were 78 respondents who experienced increased stress ($p=0.000$). There were different prostaglandin levels based on stress levels. The mother's high stress that elevated prostaglandin levels. Stress can positively or negatively impact the processes in the mother's body, including in the delivery process effects of stress, especially on uterine contractions. Therefore, health workers can provide care by paying attention to the psychological aspects of the mother because psychological conditions can affect the processes in the mother's body.

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1. INTRODUCTION

The perinatal period begins early in pregnancy, and the postpartum period is transitional to becoming a parent [1]. There is a close relationship between a healthy mother and perinatal health [2]. In addition, the implications are socially and emotionally significant since pregnancy, childbirth, and readiness to become a mother [3]. For him, paying attention to the mother's physical and mental health is necessary to achieve fetal well-being at birth [4]. Among mental problems during pregnancy, stress, depression, and anxiety are the most frequently reported issues during pregnancy [5]. Other mental disorders that are quite high are pregnancy stress by 92.8% and anxiety by 32.6% [6]. Most of this situation comes from a lack of self-confidence, a self-inflicted change in the body during pregnancy, fear of excessive pain, the birth process, and defects in the baby [7].

Psychological disorders experienced by women during pregnancy, there is a tendency to result in sub-optimal infant growth. Including death and morbidity, premature and heavy labour, lower birth weight, postpartum depression, and long-term adverse neurobehavioral outcomes for the baby, even if it persists into

postpartum. Can affect breastfeeding [5], [6], [8]. During labor can interfere with the length of labor or cause the mother to give birth prematurely. Therefore, it is necessary to pay attention to the mother's psychological condition during pregnancy and breastfeeding [9].

Globally, 80% of maternal deaths are caused by direct factors such as bleeding, eclampsia, sepsis, hypertension in pregnancy, complications of abortion and obstructed labour or prolonged labour [10]. Obstructed or prolonged labour contributes to around 8% of maternal deaths globally [11]. Long labour refers to the duration or length of delivery; the length of delivery in the mother will differ based on the conditions of the birthing mother. Meanwhile, perinatal mortality and morbidity among premature infants represent 63% of all deaths in children less than five years of age [12]. More than 2/3 of all perinatal deaths are related to preterm birth. Long and premature labour can be caused by psychological factors in the mother [13].

The unsupportive psychological atmosphere of the mother will complicate the delivery process. Excessive anxiety, worry and fear for no reason eventually lead to stress [14]. Anxiety in women giving birth can have an impact on increasing adrenaline secretion. One of the effects of adrenaline is constraining blood vessels so that the oxygen supply to the fetus decreases. Decreased blood flow also causes the weakening of uterine contractions and results in lengthening the labour process [4]. Not only does adrenaline secretion increase, but Adrenocorticotrophic hormone or ACTH secretion also increases, causing an increase in serum cortisol levels and blood sugar. Anxiety can arise from a person's reaction to pain. This condition will slow down the birthing process [15]. Therefore, the mother's psychological state in labour will significantly affect the length of the delivery process [5].

Among women who experienced stress during pregnancy, 54% gave birth prematurely, with stress as a risk factor. Stress during pregnancy can increase the risk of 1.18–3.92 times premature delivery [16]. In addition, the results of previous studies [17] found that stress is one of the possible regulatory triggers of prostaglandin release in rats. Maternal high chronic stress can cause elevated corticotropin-releasing hormone (CRH) levels in pregnancy, and labour hormones play a role in labour, including ACTH, cortisol, estrogen, progesterone, prostaglandins, and other hormones [18]. Cortisol levels in late pregnancy or at term will increase or be needed to trigger the production of prostaglandins [19], [20]. Cortisol levels strengthen the relationship with stressful conditions in the mother. Previous research has examined the relationship between stress and the hormone cortisol and the relationship between the hormone cortisol and prostaglandins in experimental rats. No study examines exposure to psychosocial stress with prostaglandin hormones that can affect delivery. Hence, the researchers wanted to prove the relationship between exposure to psychosocial stress during pregnancy and prostaglandin levels during childbirth.

2. RESEARCH METHOD

2.1. Research design

This research is an observational study using a prospective cohort approach. The variables in this study were pregnancy stress and prostaglandin levels. Pregnancy stress was assessed from the first to the third trimester and then evaluated for maternal prostaglandin levels during labour. The results of this study were conducted from September 2021 to October 2022. This research has received ethical approval from the ethical commission of the Faculty of Medicine, Hasanuddin University, Indonesia with number 810/UN4.6.4.5.31/PP36/2020.

2.2. Research sample and place

The sample in this study was pregnant women who checked themselves in a health facility in Makassar. The sampling technique used purposive sampling method, with the criteria, primigravida mothers, pregnant women starting in the early trimester, had never had a miscarriage before, had no history of diseases such as diabetes mellitus, thyroid disorders, malignancy, and other diseases, and was willing to be respondents. Exclusion criteria in this study were mothers who experienced depression and stopped being respondents in the middle of the research and mothers who gave birth by caesarean section. The number of samples in this study used the Lemeshow formula with a full selection of 130 people. But in this study, the data analyzed were 121 samples. This result is because nine samples were excluded. In addition, seven respondents gave birth by caesarean section, and two lost contact. The results of this study were carried out at primary health facilities in the Makassar City, and the Hum-RC laboratory at Hasanuddin University.

2.3. Research instruments and variabel

The variables in this study were stress and prostaglandin levels during childbirth. Stress is a pressure within pregnant women due to the discrepancy between expectations and reality experienced during pregnancy and before delivery. The variable is measured by the n Prenatal Distress Questionnaire (PDQ) with a score range of 0-36. The prostaglandin hormone is a hormone that can trigger uterine contractions, which can affect labor with the measurement unit pg/ml. The data collection tool used to assess stress in

pregnant women uses the prenatal distress questionnaire (PDQ) questionnaire with 12 statements with answer choices using a Likert scale (never, sometimes, quite often, very often) [21]. The characteristic data include age, occupation, education, ethnicity, income, and pregnancy status. Laboratory examination is carried out by taking three ml of maternal blood through a vein. Terms of the collection are done at a minimum opening of five cm with an adequate frequency of at least 4-5 times in 10 minutes. Examination of prostaglandin hormones using the Enzyme-Linked Immunosorbent Assay (ELISA) method. Table 1 shows the results of the validity test of the Prenatal Distress Questionnaire (PDQ)

Table 1. the validity test of the PDQ

Item	Item total correlation	Information
PDQ1	0.529	Valid
PDQ2	0.391	Valid
PDQ3	0.535	Valid
PDQ4	0.378	Valid
PDQ5	0.436	Valid
PDQ6	0.410	Valid
PDQ7	0.372	Valid
PDQ8	0.533	Valid
PDQ9	0.414	Valid
PDQ10	0.456	Valid
PDQ11	0.398	Valid
PDQ12	0.592	Valid

Value of r table: 0.361

The calculations using SPSS version 16 obtained a Cronbach's alpha value of 0.473 with 12 questions. After everything is declared valid, it continues with the reliability test. The results of this research have a Cronbach's alpha value of 0.473, so the data is declared reliable and trustworthy.

2.4. Data analysis

The results of the stress questionnaire were collected every trimester so that three times the stress measurement was carried out until delivery. The prostaglandin hormone data is assessed once, during the delivery process. Data collected in Microsoft Excel were then processed using the SPSS version 16 application with descriptive tests, Wilcoxon rank tests, and 1-way ANOVA tests to assess changes in stress and the relationship between stress and prostaglandin levels.

3. RESULTS AND DISCUSSION

The research aims to assess the psychosocial stress experienced by pregnant women from the beginning to the end of pregnancy. Then during the delivery process, the researchers evaluated the impact caused by psychosocial stress on labor hormones, namely the prostaglandin hormone. The results of the research conducted on 121 respondents in the Makassar City area were described in the form of univariate and bivariate analyses.

3.1. Characteristics of respondents

Some of the characteristics of the respondents collected from the study's results included the mother's age, occupation, education, ethnicity, income, and pregnancy planning status. These characteristics are an essential part of the value researchers in this study. Characteristic data obtained from a questionnaire with the results of univariate analysis can be seen in Table 2.

Table 2 shows the most respondents in the 20-35 year category, namely 106 respondents (87.6%). This result is because the average reproductive age is in the 20-35 year category, so many pregnant women in this professional age category are primarily housewives, namely 107 respondents (88.4%). Most of the respondents' education was in the high school category, namely 69 respondents (57%). The link between a mother's education and work is because a mother's education is more in the high school category and below, so the chances of getting a more decent job are smaller. The highest number of respondents' family income was below the minimum wage, namely 88 respondents (72.7%). Economic conditions can affect these conditions psychologically. Pregnant women face labour and birth, especially in the preparedness theory [22]. In this case, there were 35 respondents with unplanned pregnancy status. This appropriate research by Răchită *et al.* shows that the quality of pregnancy is related to support from the community and readiness to have children. An unplanned pregnancy can trigger increased stress experienced by the mother [23].

Table 2. Characteristics of respondents

Variable	N	%
Mother's age (years)		
<20	8	6.6
20-35	106	87.6
>35	7	5.8
Mother's job		
Work as a housewife	107	88.4
Work not housewife	14	11.6
Education		
Primary school	7	5.8
Junior high school	23	19
Senior high school	69	57
College	22	18.2
Ethnic group		
Macassar	67	55.3
Bugis	40	33.1
Toraja	6	5
Java	4	3.3
Bima	4	3.3
Income (rupiah/ month)	2,217,000 ± 1.00	3,545,000 ± 2,4,000
According to regional minimum wage	33	27.3
Under regional minimum wage	88	72.7
Pregnancy status		
Planned	86	71.1
Not planned	35	18.9
Total	121	100

3.2. Changes in stress in each trimester

The stress analysis changes from each trimester during pregnancy to delivery. The Wilcoxon rank test analysis results in Table 3 show changes in stress from the first trimester to the second trimester; 98 respondents experienced a reduction in stress. The 23 respondents experienced an increase in stress. Most respondents have a condition of adaptability when entering the second trimester. Changes in the first trimester significantly change physiology, causing mothers to worry about their condition, especially when they experience nausea and vomiting [24]. When entering the second trimester, these complaints are reduced, making the mother feel more comfortable [25]. However, there are experienced respondents with increased stress status due to the employment status of working mothers and planned non-pregnant classes. The level of psychological pressure is high and can often be obtained from a professional condition of the mother so that the mother's stress level does not decrease but increases [26].

Table 3. Analysis of changes in stress in each trimester

Variable	N	Mean of rank	Sum of rank	p-value
Trimester I to trimester II				
Negative rank	98	67.58	6649.00	0.000
Positive rank	23	31.83	732.00	
Ties	0			
Trimester II to trimester III				
Negative rank	17	21.97	373.50	0.000
Positive rank	102	66.34	6766.50	
Ties	2			
Trimester I to trimester III				
Negative rank	33	47.44	1565.50	0.000
Positive rank	78	59.62	4650.50	
Ties	10			
Total	121			

The change in stress from the second to the third trimester is almost the same as the change in stress from the first to the third trimester; the number of respondents experienced an increase, 102 respondents. The third trimester of pregnancy is critical because of the many physical and emotional changes that occur before birth [27]. In addition, fear of childbirth and fear of birth defects causes maternal stress to increase and can even cause anxiety [28]. However, respondents who are experienced in reducing stress are 17 respondents. This result is due to the condition of the respondents who received good service during pregnancy following the yoga program and parenting classes for families with income above the minimum wage so that the mother's readiness for childbirth is better [29]. Previous research Shishehgar *et al.* [30] found that family

income affect the stress level of a pregnant woman in various ways. Found a higher level of stress in families with low economic status. In this study, differences in stress patterns were found in each trimester. Changes in stress in the first trimester, second trimester, and third trimester are shown in Figure 1.

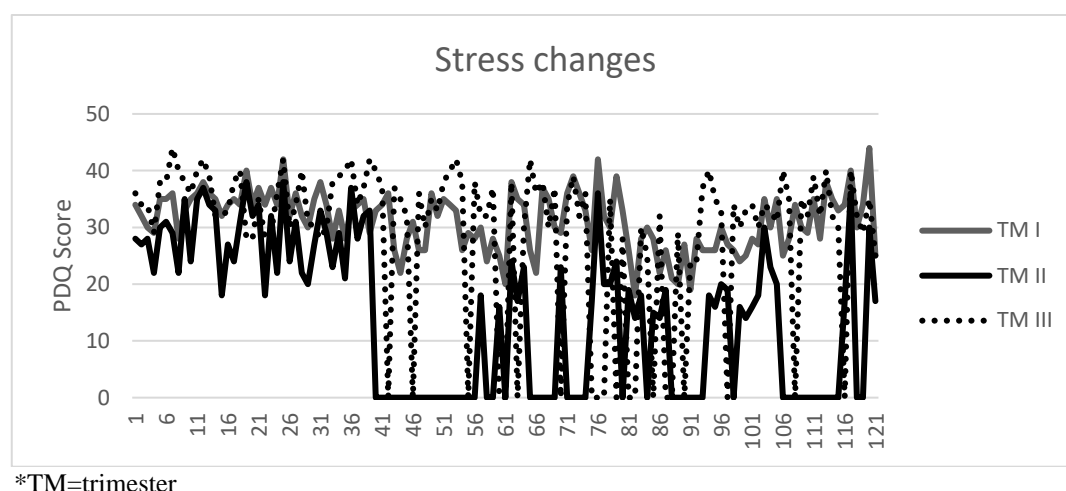


Figure 1. Stress chart changes in pregnancy

The diagram above shows changes in stress in the first to third trimesters of primigravida mothers. The highest stress level was experienced in the third trimester of pregnancy, and the lowest was experienced in the second trimester. Stress in early pregnancy is associated with hormonal changes that cause the mother to experience various complaints, including nausea and vomiting, which disturb the mother. This initial vomiting condition will increase the mother's stress about her pregnancy, including fear of the impact on herself and her fetus. When entering the second trimester, you have started to be able to adapt to this condition so that your stress will decrease [29].

3.3. The relationship between stress levels in pregnant women and prostaglandin levels

The ratio of prostaglandin levels in pregnant women based on the level of stress experienced in the third trimester of pregnancy was analyzed using the 1-way test ANOVA. Table 4 compares prostaglandin levels to the stress experienced by pregnant women. Prostaglandin levels in mothers with mild stress were lower, namely 22.99 pg/ml, compared to mothers with severe stress, namely 27.23 pg/ml. The significance obtained was $p=0.039 < \alpha=0.05$; this indicates differences in prostaglandin levels based on the stress level of pregnancy in the mother.

Table 4. Comparison of prostaglandin levels in mothers in birth based on stress experienced by mothers in trimester III

Group	Means	std. deviation	95% CI	p-value
Third trimester stress (n=121)				
Mild stress (n=8)	22.99	4.63	11.11-26.86	0.039
Moderate stress (n=66)	26.57	4.23	25.53-27.61	
Severe stress (n=47)	27.23	4.34	25.96-28.51	

Stress, anxiety and depression are different psychological problems. All three can affect the physiology of labour in different ways [31]. Stress can stimulate the sympathetic-adrenal medullary axis (SAM) embarrassment, while worry activates the hypothalamic-pituitary-adrenal (HPA) axis [32]. Stress is divided into distress and eustress. Distress is a response to stress, a negative trigger for the appearance of non-specific mental and physical symptoms [33]. Temporary Stress is stress that leads to a positive answer that is suitable both physically and mentally [34].

In response to stress, the hypothalamus, by way of life, activates the sympathetic nervous system [35]. Secrete CRH to stimulate the secretion of ACTH and cortisol [36]. In addition, triggering the release of vasopressin aims to suppress stress [37]. However, with increasing levels of CRH and cortisol, they found that maternal psychosocial stress levels significantly predicted the magnitude of increases in maternal adrenocorticotrophic hormone and cortisol levels in mid-pregnancy near the end of pregnancy [18], [38].

Fetal pituitary ACTH secretion stimulates the adrenal synthesis of dehydro-epiandrosterone sulfate (DHEA), which is converted to 16-hydroxy-DHEA-S in the fetal liver [39]. Placental CRH can also increase fetal adrenal cortisol production and DHEA-S in a viable way through activation of the fetal HPA axis [40]. The placenta converts androgenic precursors into estrone (E1), estradiol (E2), and estriol (E3). This condition, in turn, allows for the activity of prostaglandins, oxytocin receptors, and enzymes responsible for myometrial contraction of the muscles [19].

This study is in line with previous surveys [41] that psychological stress and environmental factors trigger cascade pathways in the central nervous system (CNS) and peripherals, which in turn enable the stress response in the autonomic nervous system (ANS) and the HPA axis [18], [42]. Therefore, stress is very beneficial for assisting in childbirth because it can trigger the production of prostaglandins which function for cervical ripening and stimulate uterine contractions to speed up labour [43]. Prolonged stress can trigger worry, so worry can affect the length of the labour process by stimulating the release of catecholamines which can inhibit uterine contractions.

4. CONCLUSION

The research found changes in stress patterns in primigravida pregnant women, where stress in the first trimester of pregnancy will increase. Stress will decrease in the second trimester because Mother adapts to these conditions. Stress will increase again in the third trimester before the birth process the more, the higher the production of high-stress prostaglandin hormones. Characteristics of austress will greatly assist childbirth, triggering the prostaglandin hormone to speed up the delivery process. Suggestions for health workers to provide care not only focus on the physical mother but also on the mother's psychological aspects because psychological conditions can affect physiological processes in the body.

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