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Analysis factors that influence prenatal stress levels and the impact of preparation on labour and delivery

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Abstract

Background: Pregnancy is a crucial period that significantly influences both the physical and psychological well-being of mothers. One of the most common health concerns during pregnancy is the mother's mental health, which can influence both her weight gain and the estimated weight of the fetus.

Purpose: To identify the factors that influence prenatal stress levels and the impact of preparation on labour and delivery.

Method: This cross-sectional study involved 120 third-trimester pregnant women, recruited using a total sampling technique. Data were obtained through questionnaire-based interviews and analyzed using ordinal logistic regression.

Results: Mild stress levels was experienced by 63.33% of participants. Variables associated with prenatal stress included maternal age, education, income, occupation, social support, pregnancy complications, pregnancy status, antenatal care (ANC) visits, and parity. Prenatal stress was found to influence both maternal weight gain and estimated fetal weight.

Conclusion: Maternal age and parity were identified as protective factors against prenatal stress. The multivariate model accounted for 63% of the variation in mental health observed.

Keywords: Estimated Fetal Weight; Maternal Weight Gain; Prenatal Stress Level.

INTRODUCTION

Pregnancy is a crucial stage in a woman's life, marked by significant physical, psychological, and emotional changes that can affect mental health. These changes are largely driven by hormonal fluctuations that influence both physical and psychological aspects of pregnancy (Wazana, Székely, & Oberlander, 2021). stress levels during pregnancy may stem from factors such as fluctuating hormone levels, uncertainty about the future, physical discomfort, or pre-existing psychological conditions. Socioeconomic challenges—including the cost and quality of prenatal and postnatal care, work

demands, and adjustments after childbirth—also contribute. Additional influences include family support, economic stability, social environment, and the mother's pregnancy knowledge and experience.

Stress levels during pregnancy require serious attention because they can lead to personal, social, and pregnancy-related complications. These issues are significant risk factors for both maternal and fetal health, potentially leading to outcomes such as premature birth, low birth weight (LBW), preeclampsia, postpartum depression, anxiety, fetal

distress, and impaired child neurodevelopment (Alves, Cecatti, & Souza, 2021).

The fetal and infancy stages are highly sensitive for organ development and system function. According to the Developmental Origins of Health and Disease (DOHaD) hypothesis, adverse conditions during pregnancy can have lifelong health impacts. Prenatal stress levels can influence fetal development through the placenta, which mediates stress-related biological processes (Van den Bergh et al., 2020).

In Banda Aceh City, 20% of pregnant women face complications such as Chronic Energy Deficiency (CED), anemia, preeclampsia, and diabetes mellitus, with anemia being the most common (43%). Birth complications occur in 16% of cases (Dini, Riono, & Sulistiyowati, 2016). The prevalence of LBW is particularly concerning—15.48% in Aceh Province and 45.8% in Banda Aceh City—often caused by premature birth or inadequate fetal weight gain due to insufficient maternal nutrition, high stress levels, and physical strain.

Stress levels are more prevalent in low- and middle-income countries due to factors such as poverty, interpersonal violence, and concerns about poor pregnancy outcomes linked to high maternal and infant mortality rates (Mah, Pringle, Weatherall, Keogh, Schumacher, Eades, & Rae, 2019). Prolonged stress in pregnancy increases susceptibility to various disorders, including preeclampsia, with affected women facing a fourfold higher risk (OR 4.103) (Asih & Yuli, 2020). Common contributors include physical discomforts (nausea, vomiting, constipation, back pain), work pressures, childbirth concerns, and hormonal shifts.

Severity of stress levels often increases as pregnancy progresses, with the second and third trimesters showing nearly double the intensity compared to the first trimester. The third trimester is especially challenging due to heightened anxiety over childbirth, the baby's health, and physical fatigue. To prevent adverse effects on both mother

and fetus, early screening and appropriate interventions from nurses, midwives, obstetricians, and mental health professionals during antenatal care are essential (Slamet, Wahyuni, & Mardiana, 2021).

RESEARCH METHOD

This descriptive study employed a cross-sectional survey design to examine the relationship between independent and dependent variables simultaneously, aiming to identify factors influencing prenatal mental health and their outcomes, namely maternal weight gain and estimated fetal weight. The research population comprised 126 third-trimester pregnant women within the working area of Baiturrahman Health Center. Using a total sampling technique, all members of the population were considered as potential participants. Inclusion criteria required participants to be willing to take part in the study, have a gestational age of 28–43 weeks, and possess records of maternal and fetal weight or have undergone an ultrasound examination. Following eligibility screening, 121 women met the criteria, with the sample size rounded to 120 respondents for analysis.

Data were collected using a questionnaire, including the measurement of mental health levels using the Perceived Stress Scale (PSS), which assesses the frequency of feelings of lack of control, pressure, and being overwhelmed in recent weeks. The PSS score was then categorized into low, moderate, or high stress. Additional data were obtained from medical records regarding maternal and fetal weight. Data analysis was conducted using univariate, bivariate (with correlation tests), and multiple linear regression to examine the influence of factors such as age, social support, and education level on stress levels and pregnancy outcomes. Normality and homoscedasticity tests were also performed to ensure the validity of the analytical model.

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RESEARCH RESULTS

Table 1. Characteristics of the Respondents (N=120)

Variable	Results	Mean ($\pm$ SD)	Min-Max	OR	95% CI	p-value
Prenatal stress levels (n/%)		17.57 ($\pm$ 6.99)	1-33			
Normal	34/28.3					
Mild	76/63.3					
Severe	10/8.4					
Age (n/%)		32.97 ($\pm$ 6.57)	19-46	1.07	1.01-1.14	0.012
>35 years old	45/37.5					
$\geq$ 20-35 years old	74/61.7			0.291	0.13-0.68	0.004
<20 years old	1/0.8				1.02-54.27	1.000
Education (n/%)						
High	69/57.5			2.99	1.36-1.59	0.007
Intermediate	51/42.5					
Income (n/%)						
$\geq$ District Minimum Wage	36/30.0	3,100,000	800,000-	101.37	26.76-	0.000
< District Minimum Wage	84/70.0	1,500,000	8,000,000		383.93	
Work (n/%)						
No	69/57.5			2.58	1.18-5.61	0.017
Yes	51/42.5					
Social Support (n/%)		9.48 ($\pm$ 1.65)	2-12			
Yes	55/45.8					
No	65/54.2			21.95	7.05-68.32	0.000
Complications (n/%)						
No	105/81.5					
Yes	15/12.5			6.43	1.81-22.87	0.004
Pregnancy Status (n/%)						
Planned	90/75.0					
Not planned	30/25.0			5.04	1.88-13.50	0.001
ANC Visit (n/%)		4.10 ($\pm$ 0.95)	2-6			
Complete	88/73.3					
Incomplete	32/26.7			2.89	1.20-6.96	0.018
Pregnancy (n/%)		2.62 ($\pm$ 1.20)	1-6	1.26	0.92-1.72	0.155
Grand multigravida	25/20.8					
Multigravida	71/59.2			0.38	0.14-1.05	0.063
Primigravida	24/20.0			0.42	0.13-1.36	0.148

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Variable	Results	Mean ($\pm$ SD)	Min-Max	OR	95% CI	p-value
Parity (n/%)		1.48 ($\pm$ 1.16)	0-5	1.50	1.07-2.10	0.019
Primipara	69/57.5					
Multipara	45/37.5			2.58	1.15-5.82	0.022
Grandemultipara	6/5.0			6.97	1.06-45.60	0.043
Maternal Weight Gain (n/%)		11.37 ($\pm$ 3.80)	3-19			
Normal	66/55.0					
Abnormal	54/45.0					
Estimated Fetal Weight (n/%)		1,768.958	790-3700			
Normal	73/60.8	($\pm$ 806.5285)				
Abnormal	47/39.2					

Table 1 indicates that among 20 respondents, most experienced mild (63.33%), followed by normal (28%) and severe stress levels (8.33%). Demographically, the majority were aged 20–35 years (61.67%), held a college degree (57.5%), and earned below the District Minimum Wage (70%). Psychosocially, over half were unemployed (57.5%) and lacked social support (54.17%). Regarding obstetric factors, most had no pregnancy complications (87.5%), pregnancies were planned (75%), and ANC visits were complete (73.33%). For previous pregnancy status, most were multigravida (59.17%) and primipara (57.5%).

In terms of outcomes, more than half had normal maternal weight gain (55%), and most had normal estimated fetal weight (60.83%). The analysis shows significant links between certain demographic and psychosocial factors and prenatal stress level. Maternal age >35 years was associated with a higher risk of severe stress compared to the 20–35 age group. Education level, income, and employment also influenced stress, with mothers having only secondary education, earning below minimum wage, and being employed showing greater risk. Lack of social support was a major determinant, increasing the likelihood of severe stress nearly 22-fold.

Pregnancy complications and unplanned pregnancies significantly raised the risk of prenatal stress levels. Other obstetric factors such as incomplete ANC visits, gravida status, and parity also played a role. Although gravida status was not statistically significant, grande-multigravida mothers tended to have higher stress levels than primigravida, while multigravida and primigravida showed a protective trend. In terms of parity, a higher number of children correlated with increased stress risk, with grande-multipara mothers having nearly seven times greater risk. These findings highlight the need to monitor pregnant women's psychological well-being with consideration of these risk factors.

Table 2. Relationship Between Prenatal Stress Level and Maternal Weight Gain

Variable	Maternal Weight Gain		OR	95% CI	p-value
	Normal (n = 66)	Abnormal (n = 54)			
Prenatal stress level (n/%)					
Normal	26/39.4	8/14.8	1.60	1.009-1.127	0.023
Mild	36/54.5	40/74.1	3.61	1.451-8.983	0.006
Severe	4/6.1	6/11.1	4.87	1.095-21.69	0.038

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Table 2 shows that there is a significant relationship between prenatal stress levels and maternal weight gain during pregnancy. Respondents who experienced severe stress levels had the highest proportion of abnormal weight gain, followed by mild stress levels (74.1%) and normal stress levels (14.8%). Statistical tests showed that every increase in one stress score increased the risk of abnormal weight gain by 1.06 times (OR=1.06; 95%CI=1.009–1.127; p=0.023). In addition, mothers with mild stress levels were 3.61 times more at risk and mothers with severe stress were almost 5 times more at risk of experiencing weight gain that was not in accordance with pregnancy standards. These findings indicate that prenatal stress contributes significantly to inappropriate maternal weight gain during pregnancy.

Table 3. Relationship Between Prenatal Stress Level and Estimated Fetal Weight

Variable	Estimated Fetal Weight		OR	95% CI	p-value
	Normal (n = 73)	Abnormal (n = 47)			
Prenatal stress level (n/%)			1.09	1.027-1.158	0.004
Normal	30/41.2	4/8.5			
Mild	37/50.6	39/83.0	7.90	2.538-24.622	0.000
Severe	6/8.2	4/8.5	5	0.970-25.771	0.054

Table 3 indicates a significant association between prenatal stress level and estimated fetal weight. The highest proportion of abnormal fetal weight was found in respondents with mild, followed by those with severe (83.0%) and no stress levels (8.5%). Statistical analysis revealed that each one-point increase in stress score elevated the risk of reduced fetal weight by 1.09 times (OR = 1.09; 95% CI = 1.027–1.158; p = 0.004). Pregnant women with mild stress were nearly eight times more likely to experience fetal weight loss, while severe stress increased the risk fivefold. These results emphasize that even mild prenatal stress level can have a substantial impact on fetal growth.

Table 4. Multivariate Analysis of Factors Influencing Prenatal Stress Level

Variable	Model 1		Model 2		Model 3	
	AOR 95% CI	p-value	AOR 95% CI	p-value	AOR 95% CI	p-value
Age						
>35 years						
≥20-35 years	0.18 (0.06-0.56)	0.003	0.23 (0.0-0.77)	0.017	0.25 (0.06-1.10)	0.067
<20 years	0.09 (0.00-45.48)	0.451	0.05 (0.00-277.52)	0.501	0.07 (3.92-14195.94)	0.676
Education						
High	1.61		0.90		0.99	
Intermediate	(0.51-5.08)	0.418	(0.27-2.97)	0.865	(0.23-4.36)	0.988
P Income						
≥District						
Minimum Wage	104.62	0.000	144.08	0.000	278.70	0.000
<District	(23.98-456.43)		(23.21-894.344)		(31.97-2429.70)	
Minimum Wage						

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Variable	Model 1		Model 2		Model 3	
	AOR 95% CI	p-value	AOR 95% CI	p-value	AOR 95% CI	p-value
Work						
No						
Yes	3.40(1.09-10.62)	0.035	2.18 (0.67-7.05)	0.191	2.61 (0.65-10.52)	0.178
Social Support						
Yes			22.04			
No			(3.75-129.51)	0.001	44.02 (6.19-313.00)	0.000
Complications						
No						
Yes					23.56 (4.04-137.25)	0.000
Pregnancy Status						
Planned					1.01 (0.21-4.90)	0.992
Not planned						
ANC Visit						
Complete						
Incomplete					1.13 (0.27-4.75)	0.867
Pregnancy						
Grand						
multigravida					1.16 (0.22-6.00)	0.859
Multigravida					1.06 (0.99-11.37)	0.961
Primigravida						
Parity						
Primipara						
Multipara					1.66 (0.36-7.56)	0.529
Grandemultipara					8.19 (0.72-92.89)	0.134
Pseudo R2	0.45		0.54		0.63	

Table 4 shows that income is the most influential factor associated with prenatal stress levels. In Model 1, mothers earning below the District Minimum Wage had a 121-fold higher risk of severe stress levels compared to those earning at or above the minimum wage, with a Pseudo R² of 0.45, indicating the model could explain 45% of prenatal stress levels. In Model 2, after adding social support as a variable, income remained the strongest predictor, with the risk increasing to 144 times and

the model's explanatory power rising to 54% (Pseudo R² = 0.54). In Model 3, which also included obstetric factors—particularly pregnancy complications—income below the minimum wage continued to be the highest-risk factor, with the risk climbing to 281 times. The Pseudo R² increase to 0.63 suggests that the combination of all variables in this model can account for 63% of prenatal stress levels occurrences.

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DISCUSSION

The study found that maternal age is significantly associated with prenatal stress levels. Mothers under 20 years showed the highest stress levels prevalence (100%), while stress-free mothers were more common in the 20–35 age group (35.14%). Statistical analysis (OR = 1.07; 95% CI = 1.01–1.14; $p = 0.012$) indicated that each additional year of age increased stress scores by 1.07 points. Logistic regression showed that being 20–35 years old reduced the likelihood of stress by 71% compared to mothers over 35 ($p < 0.05$) (Effati-Daryani, Zarei, Mohammadi, Hemmati, Ghasemi Yngykd, & Mirghafourvand, 2020). Younger mothers tend to have less experience, emotional instability, and difficulty adapting to pregnancy changes, whereas older mothers have greater knowledge and coping ability, though advanced maternal age (>35) carries risks such as congenital abnormalities.

Educational level also influenced stress. Severe stress was more frequent among those with secondary education (9.80%), while stress-free mothers were more likely to have college-level education (39.13%). Statistical results (OR = 2.99; 95% CI = 1.36–1.59; $p = 0.007$) showed that mothers with secondary education were nearly three times more likely to experience stress than those with higher education. Higher education facilitates better knowledge, problem-solving, and coping mechanisms, leading to lower stress (Kawungezi, AkiiBua, Aleni, Chitayi, Niwaha, Kazibwe, & Nakubulwa, 2015).

Income was another key factor. Severe stress was higher among mothers earning below the District Minimum Wage (11.90%), and mild stress occurred in 83.33% of this group. Mothers with lower income were 101 times more likely to experience stress than those earning above the minimum wage (OR = 101.37; 95% CI = 26.76–383.93; $p < 0.001$). Financial strain during pregnancy—covering medical care, nutrition, clothing, and childbirth expenses—was a major stressor. (Vijayaselvi, Beck, Abraham, Kurian, Regi, & Rebekah, 2015).

Employment status also affected stress levels. Severe and mild stress were more common among working mothers (9.80% and 74.51%, respectively),

whereas 37.68% of non-working mothers reported no stress. Working mothers had almost triple the risk of stress compared to non-working mothers (OR = 2.58; 95% CI = 1.18–5.61; $p = 0.017$), largely due to workload, job-related pressures, and balancing dual roles at work and home. Non-working mothers generally experienced less stress, though prolonged routine household activities could also be a source of mental strain. (Ayu, Sofiana, & Sabrina, 2021).

The study found that stress levels were higher among mothers lacking social support. Severe stress occurred in 13.85% and mild stress in 81.54% of mothers without social support, while mothers with support had the highest proportion without stress (56.36%). Statistical analysis (OR = 21.95; 95% CI = 7.05–68.32; $p < 0.001$) indicated that the absence of social support increased the risk of prenatal stress nearly 22-fold. Partner and family support—particularly from husbands in the form of emotional, instrumental, and informational assistance—was shown to improve maternal well-being, especially in the third trimester. Limited support can lead to social withdrawal, reduced coping ability, and greater vulnerability to stress.

Pregnancy complications were also linked to higher stress levels (Hayase, Shimada, & Seki, 2024). Severe stress was present in 33.33% of mothers with complications, while 64.76% of those without complications experienced mild stress, and 30.48% had no stress. Mothers with complications were six times more likely to experience stress (OR = 6.43; 95% CI = 1.81–22.87; $p = 0.004$) (Egan, Dunne, Lydon, Conneely, Sarma, & McGuire, 2017). Conditions such as anemia, preeclampsia, diabetes, miscarriage, and chronic energy deficiency can heighten stress, often through disrupted sleep and sympathetic nervous system activation. Some studies suggest the reverse relationship—where stress increases the likelihood of complications such as preeclampsia ($p = 0.001$) and hypertensive disorders in pregnancy (OR = 1.50; 95% CI = 1.06–2.12) (Khayati and Veftisia, 2018; Caplan, Keenan-Devlin, Freedman, Grobman, Wadhwa, Buss, & Borders, 2021). Stress hormones may impair uteroplacental blood flow, contributing to adverse

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obstetric outcomes. (Widowati, Kundaryanti, Julian, & Raushanfikri, 2021).

Unplanned pregnancies were strongly associated with stress. Severe stress was reported in 16.67% of these mothers, and mild stress in 76.67%, compared to higher rates of no stress among planned pregnancies (35.56%). Unplanned pregnancies increased the risk of stress fivefold (OR = 5.04; 95% CI = 1.88–13.50; $p = 0.001$), with some studies reporting up to an eightfold risk (OR = 8.4; 95% CI = 3.62–19.57) (Buss, Davis, Hobel, & Sandman, 2021). Such pregnancies often lead to reduced motivation for prenatal care, poor nutritional intake, delayed disclosure, and avoidance of health services, increasing stress and depression risks.

Incomplete Antenatal Care (ANC) visits were also a significant factor. Severe stress occurred in 9.38% of mothers with incomplete visits, and mild stress in 81.25%, whereas 35.23% of mothers with complete visits reported no stress. Mothers with incomplete ANC were almost three times more likely to experience stress. ANC provides crucial monitoring and information to prevent complications, and guidelines recommend at least four visits per pregnancy. Complete ANC attendance was associated with lower stress, especially among first-time mothers (Kaya, Okuyan, Erboğa, Güzel, Yılmaz, & Karaboğa, 2023; Lanjarto & Fitriana, 2021).

The study found that severe stress was more prevalent among grand multiparous mothers (20%), mild stress was most common in primigravida mothers (75%), and absence of stress was highest in multigravida mothers (32.39%). Statistical analysis (OR = 1.26; 95% CI = 0.92–1.72; $p = 0.155$) indicated no significant association between gravidity and prenatal mental health, although primigravida women were 1.26 times more likely to experience severe stress. Multigravida mothers could potentially prevent 62% of prenatal stress cases, while primigravida mothers could prevent 58%. Another analysis revealed no relationship between gravidity and mental health ($p = 0.967$) but found a significant link between gravidity and stress during pregnancy ($p = 0.001$). Women with 2–5 pregnancies had almost 10 times higher odds of experiencing stress compared to those with more than six pregnancies

(AOR = 9.82; CI = 1.08–89.5) (Engidaw, Mekonnen, & Amogne, 2019). Gravidity refers to the total number of pregnancies, including miscarriages and live births. For primigravida women, the third trimester often feels more burdensome due to its proximity to labor.

In another dataset, severe stress levels was highest among grand multiparous mothers (33.33%), mild stress among multiparous mothers (71.11%), and no stress among primiparous mothers (36.23%). Logistic regression showed that grand multiparous mothers were 1.50 times more likely to experience severe stress than primiparous mothers (OR = 1.50; 95% CI = 1.07–2.10; $p = 0.019$). Each additional child increased prenatal stress scores by 1.50 points. Multiparity carried a 2.6-fold higher risk, while grand multiparity carried nearly a sevenfold higher risk. Parity and stress were significantly correlated ($R = 0.075$; $p = 0.008$), with most participants being multigravida (median parity = 2, range 1–5). Stress was attributed to increased childcare demands and financial strain (Glover, O'Donnell, O'Connor, & Fisher, 2018).

The study also found that abnormal maternal weight gain occurred more frequently among those with severe stress (60%), while normal weight gain was more common in women without stress (76.47%). Each one-point increase in stress score increased the likelihood of abnormal weight gain by 1.06 times (OR = 1.06; 95% CI = 1.009–1.127; $p = 0.023$). Mild anxiety was associated with a 3.61-fold risk and severe stress with nearly a fivefold risk of abnormal weight gain. Appropriate weight gain during the second and third trimesters (0.36–0.45 kg/week for women with normal pre-pregnancy BMI) is important for optimal pregnancy outcomes.

For fetal growth, abnormal estimated fetal weight was more frequent among mothers with mild stress (51.32%), while normal fetal weight predominated in non-stressed mothers (88.24%). Each one-point increase in stress score raised the risk of reduced fetal weight by 1.09 times (OR = 1.09; 95% CI = 1.027–1.158; $p = 0.004$). Mild stress increased the risk of fetal weight reduction nearly eightfold, and severe stress increased it fivefold. High maternal stress can negatively impact fetal development

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through elevated stress hormones crossing the placenta, reducing blood flow and oxygen delivery, and triggering premature birth. Chronic stress raises cortisol levels, narrowing blood vessels and impairing nutrient and oxygen transfer. Emotional distress can also elevate norepinephrine, further restricting blood supply (Johnson, 2018).

Overall, evidence shows that prenatal stress can influence pregnancy outcomes, maternal health, and long-term child development, either directly through physiological effects on the fetus or indirectly through impacts on maternal health and pregnancy conditions (Coussons-Read, 2023).

CONCLUSION

Most pregnant women in the study experienced mild prenatal stress levels, with significant contributing factors including age, education, income, occupation, social support, pregnancy complications, pregnancy status, ANC visits, and parity, while gravidity showed no significant association. Prenatal stress levels was linked to adverse pregnancy outcomes, particularly inadequate maternal weight gain and abnormal estimated fetal weight. Income below the District Minimum Wage emerged as the most influential risk factor, increasing the likelihood of prenatal stress by up to 281 times. The multivariate analysis indicated that all variables combined could predict 63% of prenatal stress levels cases. Future research could employ a longitudinal design to examine the long-term effects of prenatal stress levels on maternal and infant health and further investigate protective factors, such as psychosocial interventions and family support.

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