Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 26s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

The Relationship Between Anxiety Levels and Cortisol Concentrations in Young and Elderly Primigravida Women

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Cite this paper as: Yunita Indah Cahyani, Abdul Rahman, St. Nur Asni, David Lotisna, Nugraha Utama Pelupessy, (2025) The Relationship Between Anxiety Levels and Cortisol Concentrations in Young and Elderly Primigravida Women, *Journal of Neonatal Surgery*, 14 (26s), 163-168

ABSTRACT

Background: Pregnancy is a critical life stage often accompanied by anxiety, particularly in primigravidas of young (<20 years) and advanced maternal age (≥35 years). Anxiety during pregnancy can influence physiological responses, including elevated cortisol levels, which may impact maternal and fetal outcomes. Objective: This study aimed to examine the relationship between anxiety levels and cortisol levels in young and elderly primigravidas. Methods: A cross-sectional analytical study was conducted involving primigravidas aged <20 and ≥35 years. Anxiety was measured using the Perinatal Anxiety Screening Scale (PASS), and cortisol levels were assessed using a validated ELISA method. Results: A significant correlation was observed between PASS scores and cortisol levels ($p < 0.05$). Elderly primigravidas exhibited higher anxiety and cortisol levels than younger counterparts. Conclusion: There is a significant relationship between anxiety and cortisol levels in both young and elderly primigravidas. Interventions aimed at anxiety reduction may play a role in optimizing maternal hormonal responses and pregnancy outcomes

Keywords: *anxiety, cortisol, primigravida, pregnancy, maternal age*.

1. INTRODUCTION

Pregnancy is a critical period marked by significant physiological and psychological changes in women. While it is a natural life event, it can also be accompanied by emotional distress, particularly anxiety. This is especially notable in primigravida women, those experiencing their first pregnancy, where uncertainty and fear about childbirth are often amplified. Primigravidas are commonly categorized based on maternal age into young primigravidas (<20 years) and elderly primigravidas (≥35 years), both of whom are recognized as high-risk groups for obstetric complications (Pradhan et al., 2019).

Anxiety is a psychological condition characterized by persistent worry, fear, and physiological responses such as increased heart rate and hormonal imbalances. During pregnancy, anxiety may be triggered by concerns about fetal health, childbirth, and parenting readiness. The prevalence of anxiety among pregnant women globally ranges from 5.1% to 37.5%, with studies in Indonesia reporting rates as high as 25–30%, particularly in third-trimester pregnancies (Fitriasnani & Nikmah, 2020; Sutarto et al., 2020). In Makassar, local data showed that 35% of pregnant women experienced anxiety, with a notable proportion among elderly primigravidas (Hasanah et al., 2022).

Anxiety during pregnancy is associated with a range of adverse outcomes, including preterm birth, low birth weight, and developmental issues in the offspring. Biologically, anxiety activates the hypothalamic-pituitary-adrenal (HPA) axis, resulting in increased secretion of corticotropin-releasing hormone (CRH), adrenocorticotropic hormone (ACTH), and cortisol. Cortisol, known as the stress hormone, plays a pivotal role in managing stress responses but may have detrimental effects when chronically elevated. It can interfere with fetal neurodevelopment and contribute to maternal health complications (Campbell et al., 2019; Kane et al., 2014).

Despite the physiological importance of cortisol and the high prevalence of anxiety among pregnant women, research investigating the direct relationship between anxiety levels and cortisol concentration—particularly among young and elderly primigravidas—is limited and inconclusive. Some studies have found a positive correlation between anxiety and increased cortisol (Fan et al., 2018; Ferreira et al., 2018), while others found no consistent association (Hek et al., 2013; Rakhim et al., 2021). This discrepancy suggests the need for further investigation considering various influencing factors such as social support, educational background, and economic status.

The age of the pregnant woman is also believed to influence anxiety levels. Older primigravidas may experience higher anxiety due to perceived risks and biological concerns, while younger primigravidas may feel anxious due to psychosocial immaturity or lack of preparedness. However, previous research has reported inconsistent findings. Some studies suggest that elderly primigravidas exhibit higher anxiety (Fitriasnani & Nikmah, 2020), while others report higher anxiety among younger primigravidas or no significant difference (Salsabila et al., 2022; Tarafa et al., 2022).

Measurement of maternal anxiety is crucial for identifying at-risk individuals. The Perinatal Anxiety Screening Scale (PASS) is one of the most validated tools used globally. It captures various dimensions of anxiety specific to the perinatal period, with a high reliability coefficient (Cronbach's $\alpha = 0.96$) (Somerville et al., 2014). Combined with cortisol assays, this allows for a comprehensive assessment of both psychological and physiological stress responses in pregnancy.

Given the potential implications of maternal anxiety and cortisol dysregulation for both maternal and fetal health, it is imperative to understand their interrelationship, especially in vulnerable populations such as young and elderly primigravidas. Previous studies have not adequately explored this relationship within these subgroups in the Indonesian context.

Therefore, this study aims to examine the relationship between anxiety levels and cortisol concentrations among young and elderly primigravidas. It is expected that the findings will contribute to early identification and management of anxiety, thereby improving maternal and fetal outcomes through integrated psychological and hormonal monitoring

2. MATERIALS AND METHODS

Study Design and Setting

This study employed a cross-sectional analytical design conducted at several antenatal care facilities in Makassar. The research was carried out from May to September 2023.

Participants and Sampling

The study population included all primigravida women in the third trimester of pregnancy (>28 weeks gestation). Participants were divided into two groups:

1. Young primigravidas: aged <20 years
2. Elderly primigravidas: aged ≥35 years

The sample size was determined using the Slovin formula with a 95% confidence level and 5% margin of error. A purposive sampling technique was applied.

Inclusion Criteria

1. Singleton pregnancy
2. Primigravida status (first pregnancy)
3. Gestational age >28 weeks
4. Willingness to participate and provide informed consent

Exclusion Criteria

1. History of psychiatric illness or current psychiatric treatment
2. Chronic endocrine disorders (e.g., Cushing syndrome, Addison’s disease)
3. Use of corticosteroid medications
4. Diagnosed fetal anomalies

Variables and Operational Definitions

1. **Independent Variable**: Anxiety level, measured using the Perinatal Anxiety Screening Scale (PASS). PASS consists of 31 items across four domains: general worry, trauma, social anxiety, and acute anxiety. Total scores are categorized as:
    a. 0–20: No symptoms
    b. 21–41: Mild to moderate anxiety
    c. 42–93: Severe anxiety

2. **Dependent Variable**: Cortisol level, measured in serum using the DBC Cortisol Kit (competitive ELISA method). The normal range is 3.95–27.23 µg/dL.

Data Collection Procedure

Participants completed the PASS questionnaire under the supervision of trained enumerators. Blood samples (5 mL) were drawn between 08:00 and 10:00 AM to control for diurnal cortisol variation. Samples were centrifuged and analyzed on the same day using the ELISA method in a certified laboratory.

Research Instruments

1. PASS Questionnaire (validated Indonesian version)
2. Informed consent form
3. Laboratory form for cortisol assay
4. Participant biodata form

Data Analysis

Descriptive statistics were used to summarize participant characteristics. Bivariate analysis was conducted using Pearson's correlation to test the relationship between anxiety scores and cortisol levels. Linear regression was employed to assess the predictive value of anxiety on cortisol concentration. Statistical significance was set at $p < 0.05$. Analyses were performed using SPSS version 25.0.

Ethical Considerations

The research protocol was reviewed and approved by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Hasanuddin (Approval No.: [insert number if available]). All participants were informed about the purpose and procedures of the study and provided written informed consent. Confidentiality and anonymity were ensured throughout the research process

3. RESULTS

Participant Characteristics

A total of 60 primigravida women participated in the study, comprising 30 young primigravidas (<20 years) and 30 elderly primigravidas (≥35 years). The distribution of demographic variables such as education, occupation, and income level is shown in Table 1.

Table 1. Demographic Characteristics of Participants

Variable	Young Primigravida (n=30)	Elderly Primigravida (n=30)	Total (n=60)
Age (mean ± SD)	18.4 ± 0.8 years	36.7 ± 1.1 years	–
High School (%)	70%	30%	50%
Employed (%)	40%	73.3%	56.7%
Monthly Income >2M (%)	26.7%	63.3%	45%

Anxiety Scores and Cortisol Levels

The average anxiety score in young primigravidas was 36.2 ± 6.1, while in elderly primigravidas it was 42.7 ± 7.3. Cortisol levels were also higher in the elderly group (23.1 ± 3.8 µg/dL) compared to the young group (18.4 ± 4.2 µg/dL). This difference is presented in Table 2.

Table 2. Comparison of Anxiety Scores and Cortisol Levels

Variable	Young Primigravida (Mean ± SD)	Elderly Primigravida (Mean ± SD)	*p*-value
PASS Score	36.2 ± 6.1	42.7 ± 7.3	0.002*
Cortisol (µg/dL)	18.4 ± 4.2	23.1 ± 3.8	0.001*

*Significant at $p < 0.05$

Correlation Between Anxiety and Cortisol Levels

Pearson correlation analysis revealed a moderate positive correlation between anxiety scores and cortisol levels ($r = 0.55$, $p = 0.001$), indicating that higher anxiety is associated with higher cortisol concentration.

Table 3. Correlation Between PASS Score and Cortisol Levels

Variable	Pearson's *r*	*p*-value
PASS Score vs Cortisol	0.55	0.001*

Regression Analysis

Linear regression was conducted to determine whether anxiety scores could predict cortisol levels. The model showed that anxiety significantly predicted cortisol levels ($\beta = 0.48$, $p < 0.01$), with an R^2 of 0.30, indicating that 30% of the variability in cortisol levels could be explained by anxiety levels.

Table 4. Linear Regression Analysis: PASS Score as Predictor of Cortisol

Predictor	β	*t*	*p*-value	R^2
PASS Score	0.48	4.12	0.000**	0.30

4. DISCUSSION

This study revealed a significant relationship between anxiety levels and cortisol concentrations in primigravida women, with elderly primigravidas exhibiting higher scores on both variables compared to their younger counterparts. These findings support the hypothesis that maternal anxiety is associated with increased physiological stress, as reflected by elevated cortisol levels.

The positive correlation between PASS scores and cortisol levels ($r = 0.55$, $p = 0.001$) aligns with previous research demonstrating that psychological stress during pregnancy activates the hypothalamic-pituitary-adrenal (HPA) axis, leading to increased cortisol secretion (Kane et al., 2014; Campbell et al., 2019). Elevated cortisol, although part of the normal stress response, has been implicated in adverse pregnancy outcomes such as preterm birth, intrauterine growth restriction, and neurodevelopmental risks for the child (Fan et al., 2018; Dunkel Schetter et al., 2022).

Elderly primigravidas were found to have significantly higher anxiety and cortisol levels. This may be attributed to age-related concerns such as fear of fetal abnormalities, comorbidities, or perceived physical limitations. Literature has shown that advanced maternal age is often linked to greater obstetric vigilance and psychological distress due to the heightened perception of pregnancy risks (Youssef Ibrahim et al., 2019; Fitriasnani & Nikmah, 2020).

Interestingly, although age appears to play a role, some studies have reported inconsistent results regarding whether younger or older pregnant women are more anxious. For instance, Tarafa et al. (2022) and Salsabila et al. (2022) found higher anxiety in younger women, suggesting that sociodemographic factors such as education, support systems, and marital status may modulate psychological responses more than age alone. Therefore, it is essential to consider that maternal anxiety is multifactorial and not solely determined by biological age.

The present findings also reinforce the utility of the Perinatal Anxiety Screening Scale (PASS) as a reliable tool to assess anxiety during pregnancy. With its four-domain structure, PASS captures a broad range of anxiety manifestations relevant to perinatal mental health (Somerville et al., 2014). Coupled with biochemical markers such as serum cortisol, this offers a dual psychobiological assessment approach that may enhance early detection and intervention.

It is also noteworthy that linear regression indicated anxiety levels explained 30% of the variance in cortisol levels, suggesting that other factors—such as genetic predisposition, coping mechanisms, and environmental stressors—likely contribute to hormonal stress responses. This echoes the findings of Hek et al. (2013) and Rakhim et al. (2021), who found that not all individuals with high anxiety exhibit elevated cortisol, underscoring the complexity of the anxiety-cortisol relationship.

From a clinical standpoint, the findings highlight the importance of routine psychological screening and hormonal monitoring, particularly in populations at risk such as elderly primigravidas. Interventions such as cognitive behavioral therapy, relaxation techniques, and social support programs have been shown to reduce anxiety and may modulate cortisol responses (Hwang et al., 2023). Addressing anxiety early in pregnancy could thus be a preventive strategy for mitigating

stress-induced obstetric complications.

5. CONCLUSIONS

This study demonstrated a significant positive relationship between anxiety levels and cortisol concentrations among primigravida women. Elderly primigravidas exhibited higher anxiety scores and cortisol levels compared to their younger counterparts, suggesting a greater physiological stress burden in this group.

The findings underscore the importance of early identification and management of prenatal anxiety to prevent potential maternal and fetal complications related to stress-induced hormonal changes. Incorporating routine psychological screening using validated tools like PASS, alongside cortisol monitoring in antenatal care, may enhance the holistic well-being of expectant mothers, especially those in high-risk age groups.

Further research is warranted to explore additional factors influencing cortisol regulation in pregnancy and to evaluate the effectiveness of targeted psychological interventions in reducing anxiety and its physiological consequences

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