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Cortisol Hormone Effects in Pregnant Women on Body Weight and Length at Birth of Babies

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Abstract

Other mental disorders with a reasonably high prevalence are pregnancy stress of 92.8% and anxiety of 32.6%. Pregnancy pressure can potentially cause low birth weight and small head circumference. In addition, stress during pregnancy will affect neurobehavioral development, ACTH, cortisol, norepinephrine, and epinephrine levels in neonates. This study aimed to assess cortisol exposure in pregnancy with birth weight and birth length in infants. This study used a cohort study approach. The sample in this study was the third-trimester pregnant women as many as 152 respondents. The research instrument used checklist sheets and laboratory tests using the ELISA method. The resulting data were processed using the unpaired t-test and the Pearson correlation test. The results showed a correlation between cortisol levels and birth weight with a value of p = 0.004 <0.05 and a value of r = -0.230, indicating that both variables had a low correlation and a negative relationship. This means the higher the cortisol level, the lower the baby's birth weight. There was a correlation between cortisol levels and the baby's birth length with a value of p = 0.003 <0.05 and r = -0.239, showing that both variables have a low correlation and a negative relationship. The higher the cortisol level, the shorter the baby's birth length. Maintaining the mental health of pregnant women, primarily through family support and health workers, is essential to avoid excessive stress and depression during pregnancy.

Introduction

Stress, depression, and anxiety are the most commonly reported mental health disorders during pregnancy (Agung Suwardewa *et al.*, 2022). Anxiety and pregnancy stress both had a relatively high prevalence of 32.6% and 92.8%, respectively. The majority of these ailments result from low self-esteem brought on by pregnancy-related bodily changes, increased pain aversion, labor pains, and birth-related problems, which all contribute to anxiety, especially in nulliparous women. (Camerota & Bollen, 2016)but also have lifelong health implications. Despite widespread interest in this hypothesis, few methodological advances have been proposed to improve the measurement and modeling of fetal conditions. A Statistics in Medicine paper by Bollen, Noble, and Adair examined favorable fetal growth conditions (FFGC.

The research results show that stress increases the risk by 8,229 times of experiencing labor complications. According to Su *et al.*, (2015) research, pregnant stress can result in low birth weight and a small head circumference (p-value 0.01). Additionally, neurobehavioral development, ACTH, cortisol, norepinephrine, and epinephrine levels in newborns will be

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impacted by stress throughout pregnancy (p 0.001). (Crane *et al*., 2003; Pan *et al*., 2019) including: respiratory distress syndrome, intraventricular hemorrhage, infection, adrenal suppression, somatic and brain growth; perinatal mortality; and maternal morbidity, including infection and adrenal suppression. EVIDENCE: MEDLINE and PubMed searches 1996 to August 2002 for English-language articles related to antenatal corticosteroid therapy for fetal maturation, the Cochrane Library, and national statements including that of the National Institutes of Health (NIH.

Prenatal maternal stress is typically measured using physiological or psychological self-report methods. Cortisol is a frequently used biomarker to measure maternal stress levels during pregnancy for the later (Nath *et al*., 2017)mid and late pregnancy. Follow up visits after delivery will be done on day 10, 3 months, 8 months and 12 months. The Bayley Scales of Infant and Toddler Development [BSID] (Third edition by analysis of maternal saliva, urine, blood serum, amniotic fluid, or hair samples. In reaction to stresses, the hypothalamic-pituitary-adrenal (HPA) axis releases the glucocorticoid hormone cortisol (Hwang *et al*., 2019). It is essential for the body's proper operation and controls a wide range of activities, including immunity, inflammatory response, and metabolism (Shriyan *et al*., 2023).

For proper acclimatization to extrauterine life, enough endogenous cortisol synthesis is necessary. Among their many impacts are the development of the lungs, the preservation of glucose homeostasis, the management of postpartum hormonal adjustments, and the control of body temperature (Arafa *et al*., 2020). The hypothalamic-pituitary-adrenal (HPA) axis is immature in premature newborns; this may be because the hypothalamus is unable to identify stimulatory signals or because adrenal steroidogenesis is inefficient. Age during pregnancy and after birth are related to how immature the HPA axis is. Antenatal corticosteroids and intrauterine development restriction (Ng *et al*., 1997)yet little is known about their effects on the hypothalamic-pituitary-adrenal axis in these infants. We prospectively evaluated pituitary-adrenal function in 61 preterm (<32 gestational weeks

Method

This study used a prospective design with a cohort study approach. The population in this study were all third-trimester pregnant women in the Makassar City area. The sample in this study was pregnant women in the third trimester and was followed until delivery to assess the anthropometry of newborns. The number of samples in this study was 152 pregnant women. The sampling technique used purposive sampling with the criteria of pregnant women in the third trimester (gestational age 28-30 weeks), the mother's hemoglobin level of at least 10 gr/dL, and mothers who did not experience complications during pregnancy, did not experience depression and were willing to be taken blood. Blood collection is carried out by analysts who have a registration letter. Take three cc of venous blood sample and store it using a purple cap EDTA tube.

The dependent variables in this study are birth weight and birth length of newborn babies. Meanwhile, the independent variable is the mother's serum cortisol level during pregnancy. Characteristic data collected were the mother's age, occupation, education, and number of children. Hemoglobin levels were measured to avoid biased research results due to the influence of hemoglobin levels on the anthropometry of newborn babies. The research instrument used an observation sheet to record birth measurement results for newborns and hormone levels, and laboratory tests were carried out using the enzyme-linked immunosorbent assay (ELISA) method to assess cortisol levels in the mother's blood serum. The resulting data was processed using the unpaired t-test to assess differences between the two groups and the Pearson correlation test to assess the relationship between variables.

Results and Discussions

The results of the study on 152 third-trimester pregnant women who were followed until delivery in the work area of the puskesmas in Makassar City obtained the following results:

Table 1. Characteristics of Respondents

Variables	N(%)/Mean±SD
Mother's age (years)	
<20	11 (7.23)
20-35	117 (76.97)
>35	24 (15.8)
Mother's job	
Work as a housewife	83 (54.6)
Private employees	48 (31.57)
Government employees	21 (13.83)
Education	
Primary school	5 (3.28)
Junior High School	13 (8.55)
Senior High School	107 (70.39)
College	27 (17.78)
Parity	
Primigravida	65 (42.76)
Multigravida	87 (57.24)
Mother's Hb Level	10.81±0.74
Total	152

Table 1 shows the age of most respondents in the 20-35 year category, namely 117 respondents (76.97%). Most mothers are housewives, namely 83 respondents (54.6%). The most education was in the high school category, namely 107 respondents (70.39). Most respondents with multigravida status were 87 people (57.24%)—furthermore, the mother's Hb level averages 10.81 gr/dL.

Table 2. Frequency Distribution of the Variables Researched

Variables	Min-Max	Mean±SD
Mother's Cortisol Levels	47.0- 479	102.64 ±51.23
Baby's Birth Weight (grams)	2300-3800	2810±355.35
Body Length at Birth (cm)	43-50	47.76±1.49

Table 2 shows that the average cortisol level of the respondents was 102.64 nmol/L, the average birth weight of the baby was 2810 grams, and the average birth length of the baby was 47.76 cm.

Table 3 shows that cortisol levels in the group of babies with average birth weight had a mean ± SD of 94.47 ± 12.97 nmol/L, while those in the group of babies with low birth weight had a mean ± SD of 132.07 ± 103.07 nmol/L. For cortisol levels in the group of babies with standard birth length, the mean ± SD was 94.78 ± 12.30 nmol/L, while those in the group with short body length had a mean ± SD of 112.59 ± 75.05 nmol/L. The analysis results used the t-independent test. For birth weight, the value was p = 0.000 <0.05, and for body length at birth, the value was p = 0.033 <0.05. These results show differences in cortisol levels in babies with low birth weight and standard and birth length. There are significant differences in cortisol levels in children born with standard body length and short birth length.

Table 4. Analysis of the Correlation Between Cortisol and Hemoglobin Levels with Birth Weight and Body Length at Birth

Variable	Mark	
	P	R
Cortisol levels with baby's birth weight	0.004	-0.230
Cortisol Levels with Baby's Birth Length	0.003	-0.239
Hemoglobin Level with Birth Weight	0.930	0.007
Hemoglobin level with baby's birth length	0.118	0.127

p = Pearson Correlation Test

Table 4 shows the results of the Pearson correlation test, where there is a correlation between cortisol levels and birth weight with

Table 3. Analysis of Differences in Cortisol Levels Based on Birth Weight and Birth Length

Variable	Mean±SD	P
Cortisol Levels (nmol/L)		
Newborns (n= 119)	94.47±12.97	0.000*
LBW (n=33)	132.07±103.07	
Cortisol Levels (nmol/L)		
Normal Body Length (n=85)	94.78±12.30	0.033*
Short body length (n=67)	112.59±75.05	

*p = Unpaired T test

a value of p = 0.004 <0.05 and a value of r = -0.230, indicating that both variables have a low correlation and a negative relationship. This result means that the higher the cortisol level, the lower the baby's birth weight. There is a correlation between cortisol levels and the baby's birth length with a value of p = 0.003 <0.05 and r = -0.239, showing that both variables have a low correlation and a negative relationship. This result means the higher the cortisol level, the shorter the baby's birth length. This study had no correlation between hemoglobin levels on birth weight and birth length, with p = 0.930 > 0.05 and p = 0.118 > 0.05.

The results of our study contribute to the expanding body of evidence showing that maternal psychological stress during pregnancy affects the child's growth and development in the years that follow (Prabhu *et al*., 2020). While maternal endogenous cortisol estimate can serve as a biomarker of prenatal psychological stress, mother anxiety, and depression can be assessed using self-reporting tools. The above-mentioned subjective and objective measurements might be combined to offer a more accurate assessment of mental stress during prenatal care (Woolhouse *et al*., 2014). The study's findings can be utilized to emphasize the burden of mental health issues during pregnancy that have negative effects and to think about ways to enhance prenatal mental health care in both public and private health settings (Hall *et al*., 2020)and its impact on symptoms of antenatal anxiety, stress and depression. Methods A feasibility randomised controlled trial was conducted to compare partner-delivered relaxation massage (intervention.

The hypothalamus releases Corticotropin Releasing Hormone (CRH) in response to persistent and continuous stress, which prompts the anterior pituitary to release ACTH. Adequate ACTH can stimulate the adrenals to secrete the hormones cortisol, epinephrine, and norepinephrine in the body's response to suppressing the stress it receives(Peterson *et al*., 2020). The mother's body's rejection response by increasing cortisol levels in the blood to increase energy catabolism processes can directly affect the placenta and fetus. In an advanced state, the hormone cortisol will increase catabolism in the pregnant woman's body, eventually leading to a decrease in maternal nutrition that the fetus will receive (Heckmann *et al*., 1999). An increase in the body's cortisol levels will affect all physiological activities of the body down to the biomolecular level, this results in improper prenatal growth, including low birth weight and short stature; increased cortisol levels cause this in response to increased levels of progesterone in pregnancy which is needed for homeostasis, with an increase in the hormone cortisol can affect the entire body's metabolism (Caparros-Gonzalez *et al*., 2022). This condition is what can occur during pregnancy. There are many changes in the increase in hormones to maintain the results of conception until birth occurs. This syndrome is brought on by a rise in cortisol levels in response to a rise in progesterone levels during pregnancy, which is essential for maintaining homeostasis. An increase in cortisol can impact the metabolism of the entire body (Shim, 2023).

This condition is what can occur during pregnancy. There are many changes in the increase in hormones to maintain the results of conception until birth occurs. This is caused by an increase in cortisol levels in response to an increase in progesterone levels in pregnancy which is necessary for a state of homeostasis, with an increase in the hormone cortisol can affect the entire body's metabolism (Pitri & Hirowati, 2019). This condition is what can occur during pregnancy. There are many changes in the increase in hormones to maintain the results of conception until birth occurs. Besides hurting the mother, stress also impacts the fetus(Phillips *et al*., 2000). This impact is the risk of Low Birth Weight Babies (LBW), increased risk of congenital heart defects, as well as the risk of children with autism. If the mother's cortisol increases, the fetus's cortisol will also increase, affecting the function of specific brain parts. This condition will affect their growth. A region of the baby's brain involved in their emotional and social development, the amygdala, may undergo "structural changes" as a result of the mother's higher cortisol levels, according to a new study (Hwang *et al*., 2019).

Placental growth becomes stunted when pregnant women experience stress. In conditions

of severe stress, the body will produce excessive cortisol. "Excessive production of cortisol in the body will result in decreased growth of the placenta (Magee *et al*., 2018). As a result, the placenta in stressed pregnant women will be smaller than in healthy pregnant women. The placenta supplies oxygen and nutrients to the fetus and removes metabolic waste that is not needed by the fetus(Brummelte *et al*., 2011).

Conclusion

The findings from our research conclude that exposure to stress, assessed in the form of cortisol levels, can affect growth in the fetus. Infants' different birth weights and lengths provide evidence for this disorder. Babies with lower body weights and shorter body lengths were found to have greater cortisol levels. So that these findings can be used as information by policymakers to develop policies to protect pregnant women's mental health. The importance of providing support to mothers during pregnancy, especially from family and health workers, so that pregnancy can usually occur.

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