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Serum Cortisol Levels in Pregnancy and Six Weeks Post-Partum

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ABSTRACT: The aim of this study was to estimate serum cortisol levels during the trimesters of pregnancy and six weeks post-partum. 25 healthy women between the age range of 21 and 35 were recruited for this study. They were divided into five groups (n=5), (group 1: control; group 2: 1st trimester; group 3: 2rd trimester; group 4: 3rd trimester; group 5: Postpartum). Blood samples were collected from the subjects and serum Cortisol level was estimated using a commercially prepared ELISA kit. Results were analysed and a p-value of $p < 0.05$ was considered statistically significant. The Results from this study showed an increase in serum cortisol levels in the three trimester of pregnancy, but only the 3rd trimesters was significantly higher ($p<0.05$) than the control, 1st and 2nd trimesters and post-partum groups. The serum cortisol level in the post-partum group was significantly decreased compared to the 3rd trimester of pregnancy. Conclusively, serum cortisol level was observed to increase mainly in the 3rd trimester of pregnancy and reduced during post-partum period.

Keywords: Serum cortisol, Pregnancy, Post-partum

Introduction

Cortisol is a stress hormone that is released in increasing quantities as pregnancy progresses (Meyer, 2005). The release of cortisol (or glucocorticoids) begins with corticotrophin-releasing hormone (CRH) and vasopressin production in the hypothalamus which then stimulates the release of adrenocorticotropic hormone (ACTH) from the anterior pituitary and consequent release of cortisol from the adrenal cortex.

Pregnancy, also known as gravidity or gestation, is the time during which one or more offspring develops inside a woman. A multiple pregnancy involves more than one offspring, such as with twins. It usually last around 40 weeks (10 lunar months) from the last menstrual period (LMP) and ends in childbirth (Richard and Steven, 2011). Maternal cortisol is regulated by the hypothalamic-pituitary-adrenal (HPA) axis. Perception of physical and psychological challenges prompts a stress response and is characterized by the activation of the HPA axis. HPA axis activation involves a cascade of events that starts with the release of corticotrophin-releasing hormone (CRH) from the hypothalamus. This leads to the release of adrenocorticotropic hormone (ACTH) by the pituitary, resulting in adrenal cortex release of glucocorticoids (cortisol) and adrenal medulla release of norepinephrine and epinephrine (Becker *et al.,* 2002; Mastorakos and Llias, 2003). Although short-term stress responses function to re-establish homeostasis, extreme and/or chronic HPA axis activation is maladaptive and can result in health problems such as cardiovascular disease, ulcers, immunosuppression, neural degeneration, energy stores expenditure (resulting in fatigue, myopathy and steroid diabetes), bone decalcification, and growth impairments (Becker *et al.,* 2002). Cortisol can be considered a culprit stress variable inasmuch as various immune and psychological challenges have been noted to increases its production (Altemus *et al.,* 2001; Padgett and Glaser, 2003). This may be particularly true during pregnancy, when several stress-related states including depression, anxiety and anger have been associated with elevated cortisol (Field *et al.,* 2005).

Review showed paucity of data on this subject topic in our region. The aim of this work was therefore to evaluate cortisol levels during the three trimesters of pregnancy and six weeks post-partum.

Materials and methods

Ethical approval: Ethical approval was obtained from Evangel Hospital, Benin City (6°20'5.95"N, 5°36'13.49"E) where the study subjects were obtained and signed informed consent was retrieved from the all the subjects that participated in this work.
Sample size and technique: The sample size consisted of 25 women shared into five groups. The age range of these women was from 21 to 35 years and cross sectional sampling technique was used in selecting the subjects.
Study design: The subjects were divided into the following groups;
Group 1: consisted of 5 non-pregnant women (control group)
Group 2: consisted of 5 pregnant women in their first trimester of pregnancy
Group 3: consisted of 5 pregnant women in their second trimester of pregnancy
Group 4: consisted of 5 pregnant women in their third trimester of pregnancy
Group 5: consisted of 5 women six weeks postpartum
Subject preparation: The 25 consented study subjects were subjected to preliminary anthrometric data collection such as weight, height, body mass index (BMI), and blood pressure. Questionnaires were then distributed to the apparently healthy subjects to find out the following: age, presence of gynaecological, metabolic, neurologic or any other form of illness. After these preliminary assessments, two millilitres fasting blood sample was drawn from the ante cubital vein of each consented subject.
Measurement of serum cortisol: Serum cortisol level was estimated by using a commercially prepared ELISA Kit (Human Diagnostic Laboratory, Wiesbaden Germany) or the cortisol Kit for short.
Statistical analysis: All results are presented as Means ± SEM. All statistical analyses were carried out using Graphpad instat 3 statistical software, and the graphs were plotted using Microsoft Office Excel 2013. Differences between the groups were analyzed using the one way analysis of variance (ANOVA). A simple linear graph was drawn for possible association in the different groups. Results were considered to be statistically significant at a p value of ($p<0.05$).

Results

The serum cortisol level was highest in the 3rd trimester of pregnancy, and this was significant when compared to the non-pregnant, 1st and 2nd trimesters and the post-partum groups. Although the serum cortisol level of the 1st and 2nd trimesters were higher than that of the non-pregnant, it was not statistically significant. The postpartum serum cortisol level was lower than the three trimesters and even the non-pregnant groups, but significance is seen only when compared with the 3rd trimester group (Fig. 1 & 2).

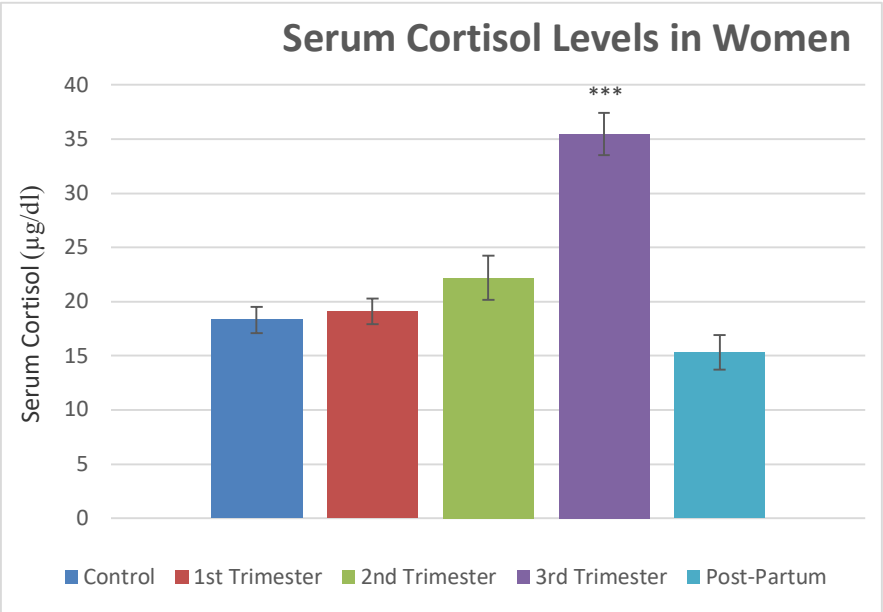

Figure 1: Fasting serum cortisol levels in women in the three trimesters of pregnancy and six weeks post-partum and the control group (n=5). There was a very significant statistical difference ($P < 0.05$) between the mean cortisol level of the control group and the third trimester.

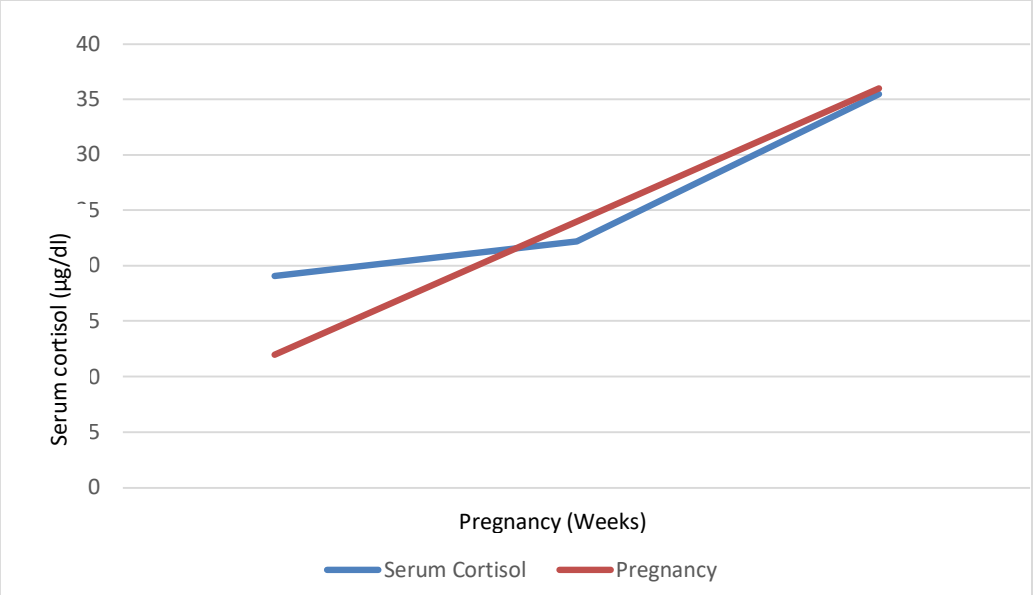

Figure 2: Relationship between serum cortisol level and pregnancy (n=5). Serum cortisol levels increases throughout pregnancy from the first trimester to the third trimester.

Discussion

Results from this study (Figures 1 and 2) show a very significant statistical difference ($P < 0.005$) in serum cortisol levels between the control and the third trimester. Results also show a very significant statistical difference ($P < 0.005$) between serum cortisol levels among the third trimester and the first trimester, second trimester, and post-partum group respectively. Finally, the results show a progressive increase in cortisol levels from the first trimester to the third trimester and a decline in post-partum women. Several studies report that the progressive increase in maternal cortisol levels from the first to the third trimester of pregnancy could be as a result of so many factors. During pregnancy, maternal corticotrophin-releasing hormone (CRH) levels increase dramatically, predominantly as a result of placental production of CRH (Smith *et al.,* 2001). Placental CRH enters both the maternal and fetal circulation. This increases the amount of circulating CRH. This increased maternal plasma CRH stimulates the anterior pituitary gland to secrete more adrenocorticotrophic hormone which in turn stimulates the zona fasciculata and the zona reticularis of the adrenal cortex to produce and release more cortisol into the blood stream. Placental CRH production is stimulated by circulating glucocorticoids, which is in contrast to the negative feedback on the hypothalamic production of CRH (McLean and Smith, 1999). Also, ACTH levels increases approximately twofold after the first trimester. This increase is, in part, placental in origin and may be a local paracrine effect of placental CRH production (McLean and Smith, 2001). Placental ACTH is not suppressed by the normal negative feedback mechanism. This results in increased serum cortisol levels during pregnancy.

The physical and psychological stress of pregnancy is also another factor responsible for the increasing serum cortisol levels during pregnancy (Meyer, 2015). As the duration of pregnancy increases, physical and mental stress increases. Consequently, serum cortisol levels increases from the first trimester to the third trimester of pregnancy. The stress of labour causes ACTH levels to increase rapidly and then decrease within two days post-partum. Some studies also report that cortisol levels decline a few days after childbirth. However, cortisol levels remain high in some post-partum women and cortisol may not return to pre-pregnant levels until after eight weeks post-partum (Fleming *et al.,* 1997). The possible reasons for the decline in cortisol levels in post-partum women are placental degeneration, decrease in placental CRH, and decreased ACTH levels.

This study agrees with other work that serum cortisol level is altered during pregnancy and tends to return back to normal during the postpartum period.

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