Establishment of Estradiol Secretion Pattern in the Three Trimesters of Pregnancy in Port Harcourt, Rivers State, Nigeria

EZEIRUAKU F.C.

Department of Medical Laboratory Science, Faculty of Basic Medical Sciences, College of Health Sciences, Niger Delta University, Bayelsa State.

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Abstract

Accurate assessment of blood estradiol level during pregnancy is vital for maternal and fetal health. It's quite common for blood estrogen levels in women to fluctuate widely throughout the menstrual circle, in pregnancy and menopause. The study established serum estradiol secretion pattern in different stages of pregnancy in Port Harcourt Rivers State, Nigeria. This was done using a total of 465 pregnant women, 186 of them in their first trimester, 153 in the second trimester and 126 in the third trimester of pregnancy. Also 201 non pregnant women in their luteal phase were used as a control group. Enzyme linked immunosorbent Assay (ELISA) was the method used for the estimation of estradiol concentration in serum. The result showed a mean ± SD estradiol concentration of 531.06 ± 378.57 pg/ml during the first trimester, 1245.42 ± 389.33 pg/ml in the second trimester and 2783.83 ± 1186.09 pg/ml in the third trimester. While the non pregnant control group had a mean value of 127.48 ± 81.06 pg/ml.

Analysis of the results obtained gave reference intervals of 152.49 - 989.63, 856.09 - 1634.75 and 1597.74 - 3969.92 (pg/ml) in the first, second, and third trimester respectively. A reference interval of 46.42 - 208.54 (pg/ml) was obtained for the non pregnant control group at luteal phase. This study showed that the concentration of serum estradiol increases steadily with progression of pregnancy, with a positive correlation coefficient of r=0.455 and for the first time, established the trimester specific reference intervals for serum estradiol in an apparently healthy pregnant women in the city of Port Harcourt and its environs of Rivers State, Nigeria.

Keywords: Estradiol, Trimester, Pregnancy, Menstrual cycle, Menopause, Luteal phase.

INTRODUCTION

Estradiol (E₂ or 17B-estradiol) is the primary estrogen, (AL-Atawi et al.,2004), the most potent (Davis et al., 2005) and the major female reproductive hormone (Bell et al.,1995). It's produced primarily by developing follicles in the ovaries, the corpus luteum and the placenta (Borawski and Bluth, 2011). Thus it is the predominant estrogen during reproductive years, both in terms of absolute serum levels as well as in terms of estrogenic activity (Gruber and Farag, 2011).

In plasma, estradiol is largely bound to sex hormone-binding globulin, also to albumin. Only a fraction of 2.21% (±0.04%) is free and biologically active, the percentage remaining constant throughout the menstrual cycle (Nussey and Whitehead, 2001).

Pregnancy is the period from conception to birth. It begins with the fertilization of an ovum (egg) and its implantation. The egg develops into the placenta and the embryo, which grows to form the fetus (Borawski and Bluth, 2011). Pregnancy typically lasts 37 to 42 weeks, with the average being 40 weeks. This is calculated from the first day of the last period and often broken down into three stages called trimester (Karian, 2010).

There is no single normal estrogen level that women can expect to experience. Normal levels of serum estrogen will frequently fluctuate based on a woman’s age and whether or not the woman is lactating, pregnant
or menstruating. But maintaining estrogen levels in a certain range is of vital importance. During menstruation, normal levels will settle around 50pg/ml, while during ovulation, it rises as high as 200pg/ml, but quickly falls there after (Abbassi-Ghanavati et al., 2005).

The role of estrogen in pregnancy include making things grow, increasing blood flow and causing skin to be more sensitive (Ananya, 2014). During this period, estrogen levels can be up to 100 x higher. These levels fluctuate throughout pregnancy to help stimulate lactation, post partum and to increase the necessary blood flow to the uterus. This falls after birth.

In women, serum estradiol is measured in a clinical laboratory and reflects primarily the activity of the ovaries. As such, they are useful in the detection of baseline estrogen in women with amenorrhea or menstrual dysfunction, and to detect the state of hypoestrogenicity and menopause (Carreau et al., 2003). Individual laboratory results have always been interpreted using the ranges provided by the laboratory that performed the test. This study, because of the inconsistency in the different laboratory ranges, and the problems associated with estrogen dysfunction in pregnancy, we establish the reference ranges in Port Harcourt, Rivers State of Nigeria using apparently healthy pregnant and non pregnant women from the population.

MATERIALS AND METHODS

Study Area

The study was carried out using samples from pregnant and non pregnant women in the city of Port Harcourt and its environs in Rivers State, south of Nigeria. The city of Port Harcourt is located In the latitude 4°47'21"N and longitude 6°59'55"E with a population of about 1,382,592 with 48.1% females, (Nigeria census, 2006). It’s a cosmopolitan, being home to many non indigenes apart from the ethnic Ikwere, Okirika and the kalabar amongst others with a mean temperature of about 26.4°C.

Study Population

A total of 666 study subjects were used for this study. This is made up of 465 apparently healthy pregnant women and 201 non pregnant women. Out of the 465 pregnant women, 186 were in their first trimester, 153 in the second trimester and 126 in the third trimester. (Lumsden and Mullen, 1978) (Horn and Pesce, 2003). The non pregnant (control) subjects were in their luteal phase of normal menstrual cycle. The age of both pregnant and control volunteers were between 18 and 40 years. All the participants were subjected to questionnaire that contained the following information: Maternal education and occupation, personal history like age, height, and weight, Dietary history, duration of menses, last time of menses and day of ovulation.

Sample Collection

Five millilitres (5mls) of blood samples were collected from a prominent vein in the cubital fossa of the arm of the study subjects during the first (4-13 weeks), second (14-26 weeks) and third (>27 weeks) trimesters of gestation as well as during the luteal phase of the control group using a disposable plastic syringe (Lewis and Noriyuki, 2008). This was discharged into a commercially prepared plain bottle container. This was allowed to clot at room temperature for 30 minutes, followed by centrifugation at 2000 rpm for 5minutes.

The serum was separated and stored frozen at -20°C and analysed within 7days of sample collection. Proper consent was gotten from the subjects and the management of the hospitals for this study.

Methodology

The estradiol serum level from the subjects were analysed using the Enzyme Linked Immunosorbent Assay (ELISA) (Peter et al., 2001). (Feit et al., 1983). The Estradiol (E2) Enzyme immune assay (EIA) is based on the principle of competitive binding between E2 in the serum specimen and E- HRP conjugate for a constant amount of rabbit-anti-Estradiol (Leguin, 2005). The estradiol kits were procured from BioCheck Incoporated, Foster City, CA.

Data Analysis

Data collected were entered into IBM compatible computer. Data analysis was done using established statistical package for social science (SPSS). The mean, standard deviation (SD), coefficient of variations were computed and the results were expressed as mean ±SD. Student’s t-test was used to compare the differences between the means. Correlation were done using Pearson’s correlation coefficient and statistical difference were set at (P<0.05) 95% confidence level.

RESULTS

The result obtained from the study of the estradiol secretion pattern of 465 pregnant subjects (at different stages) and that of 201 non pregnant women were as tabulated below in table 1, 2 and figure 1.
Table 1. The mean and standard deviation of serum estradiol level in the different stages of pregnancy in Port Harcourt, Rivers State, Nigeria

<table>
<thead>
<tr>
<th>STUDY GROUP</th>
<th>NO. OF SUBJECTS</th>
<th>MEAN <em>±</em> S.D (PG/ML)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTROL</td>
<td>201</td>
<td>127.48 <em>±</em> 81.06</td>
</tr>
<tr>
<td>1** TRIMESTER</td>
<td>186</td>
<td>531.06 <em>±</em> 378.57*</td>
</tr>
<tr>
<td>2** TRIMESTER</td>
<td>153</td>
<td>1245.42 <em>±</em> 389.33*</td>
</tr>
<tr>
<td>3** TRIMESTER</td>
<td>126</td>
<td>2783.83 <em>±</em> 1186.09*</td>
</tr>
<tr>
<td>TOTAL</td>
<td>666</td>
<td></td>
</tr>
</tbody>
</table>

* Statistical analysis of the result showed a significant different between the groups at 95% confidence level (P<0.05)

Table 2. Showed the reference range of estradiol values for the different groups (1st trimester, 2nd trimester, 3rd trimester) studied.

<table>
<thead>
<tr>
<th>STUDY GROUP</th>
<th>REFERENCE RANGE (pg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>46.42 <em>-</em> 208.54</td>
</tr>
<tr>
<td>1st trimester</td>
<td>152.49 <em>-</em> 989.63</td>
</tr>
<tr>
<td>2nd trimester</td>
<td>856.09 <em>-</em> 1634.75</td>
</tr>
<tr>
<td>3rd trimester</td>
<td>1597.74 <em>-</em> 3969.92</td>
</tr>
</tbody>
</table>

DISCUSSION

Estradiol hormone are used to help determine the timing of a woman’s ovulation and most often ordered to monitor the health status of the developing baby and placenta during pregnancy.

This is in addition to other investigative functions of the hormone that includes menstrual abnormalities, vaginal bleeding, infertility, monitor follicle development, evaluate ovarian failure, detect tumours/cancers and monitor hormone replacement therapy etc (Nichols, 2014).
A test result by itself is of little value unless it is reported with the appropriate information for its interpretation. Typically, this information is provided in the form of reference values, intervals or medical decision limits. This study established the reference range of serum estradiol and pattern of secretion in the different stages of pregnancy in Rivers state of Nigeria. From the study, estradiol secretion increases steadily throughout pregnancy in normal healthy subjects.

The result showed that, there is a correlation (r=0.455) or positive association of secreted serum estradiol with age of the pregnancy and there is significant difference (p> 0.05) in the level of the hormone secreted at different stages. Monitoring fetal development helps reduce the risk of miscarriages and other fetal developmental dysfunction. This is more important when it’s an assisted reproduction. The monitoring process varies slightly from one type of assisted conception to another. With different types, the process might be looking at different hormones that includes estradiol. The essence is to ascertain that there is an adequate, but not excessive response to the hormone. Estradiol is a hormone that stimulates the lining of the uterus, causing the lining to grow and to make itself ready for embryo arrival. It’s arguably the most informative in relation to the other hormones. Estradiol is tied to pregnancy because of its method of production. Knowledge of the level of the hormone, particularly at the early stage is important since estradiol, promotes placenta growth, which is crucial for proper development of the baby. The study also adds to the common pool of information which increases our knowledge and understanding of human production.

ACKNOWLEDGMENTS

This is acknowledging the sponsorship in part of this study by De-integrated medical diagnostic and research centre Port Harcourt, Nigeria.

REFERENCES


How to cite this article: EZEIRUAKU FC (2015). Establishment of Estradiol Secretion Pattern in the Three Trimesters of Pregnancy in Port Harcourt, Rivers State, Nigeria. Int. Inv. J. Biochem. Bioinform. 3(2):14-17