

# Ocular changes in pregnant Nigerian women

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## Abstract

**Objective:** Pregnancy results in a lot of hormonal changes in the body and the eyes are no exception. These ocular changes could be physiologic, pathologic or a modification of a pre-existing condition. The aim of this study was to determine physiologic ocular changes that are associated with pregnancy in healthy Nigerian women.

**Materials and Methods:** A total of 100 women were followed longitudinally through out the course of their pregnancy and 6 weeks postpartum. The women were recruited at 8 weeks of pregnancy at the anti-natal clinic in the Department of Obstetrics and Gynecology, University of Benin Teaching Hospital, Nigeria. The women were aged between 20 and 35 years. Tests carried out included visual acuity, ophthalmoscopy, retinoscopy, and tonometry. The tests were carried out in each of the three trimesters of pregnancy and 6 weeks postpartum.

**Results:** There was a fall in intraocular pressure across the trimesters and this was very significant ( $P < 0.0001$ ). Postpartum, the intraocular pressure began to rise. The difference between the third trimester and post-partum values was also statistically significant ( $P < 0.0001$ ). The difference in visual acuity through out the pregnancy was not significant ( $P = 0.8477$ ). Although, there was a fall in refractive error across the different trimesters, it was not statistically significant ( $P = 0.3$ ). There was also no difference in the third trimester and the 6 weeks postpartum values of both visual acuity and refractive error.

**Conclusion:** Ocular changes associated with pregnancy are transient and most tend to resolve postpartum, with values returning to near pre-pregnant state.

**Key words:** Acuity, ocular, pregnancy, pressure, refraction

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## Introduction

Differences in ocular physiopathology exist between males and females. These differences can be observed in the lacrimal and other eye-associated glands, the ocular surface, the crystalline lens, and the retinobulbar complexes. Literature on the subject revealed that because of sex steroid hormone (estrogen, progesterone, and androgen) actions, various physiological conditions such as age, menstrual cycle, pregnancy, and menopause, where the hormone milieu changes, affect vision.<sup>[1]</sup>

Pregnancy results in a lot of hormonal changes in the body and the eyes are no exception. These ocular changes could be physiologic, pathologic, or it could be a modification of a

pre-existing condition, the most common being proliferative diabetic retinopathy.<sup>[2, 3]</sup>

Most of the physiologic changes that occur as a result of pregnancy are usually marked in the third trimester. This is because at this period, hormonal activity is at its peak. However, these changes are transient because several weeks postpartum, all hormonal activities return to their pre-pregnant state.<sup>[4]</sup>

No study has been done on ocular changes among pregnant Nigerian women; a few have been done on Caucasian women.

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Such studies have shown that because of hormonal influences, pregnancy brings about changes in refractive status, cornea sensitivity, visual acuity, and intraocular pressure.<sup>[5-10]</sup>

Reports of ocular changes during pregnancy have been mostly presented anecdotally or in small case series. While most of the described changes are transient in nature, others extend beyond delivery and may lead to permanent visual impairment.<sup>[11-13]</sup> Therefore, it is important to be aware of physiologic changes as well as of the potential effects on preexisting disease and complications in order to counsel and advice women who currently are, or are planning to become pregnant.

## Materials and Methods

This study was a longitudinal one. One hundred and seventeen pregnant women in their first trimester of pregnancy were followed throughout the course of pregnancy. These women were recruited in the 8th and 10th week of pregnancy.

The 117 pregnant women were recruited at the antenatal clinic of the Department of Obstetrics and Gynecology, University of Benin Teaching Hospital, Nigeria. The pregnant women were between the ages of 20 to 35 years. While some were primigravidae, others were multigravidae. Examinations were conducted in the three trimesters of pregnancy and 6 weeks post-partum. However, 17 of the women were lost to follow-up, either because they did not attend the postnatal appointments or bring their babies for immunization exercises. Also, some of the women attended the University of Benin Teaching Hospital (UBTH) only for the expert antenatal care, and never actually intended to deliver there. Post-partum, only 100 women were part of the study.

Ethical approval was obtained from the University of Benin Teaching Hospital ethics committee and informed consent from the women. The study adhered to the tenets of the declaration of Helsinki. The women were free from systemic and ocular diseases which were the exclusion criteria for participation in the study.

After measuring systolic and diastolic blood pressure, a full ophthalmic examination was carried out on them. This included measurement of distant visual acuity (VA) using the Snellen's chart. Snellen's fractions were then converted to the logMar equivalent for the purpose of statistical analysis. Ophthalmoscopy was done using the monocular direct ophthalmoscope, to rule out any posterior segment diseases. The refractive status was determined with the use of a static retinoscope and finally, intraocular pressure was measured using the Kowa hand-held applanation tonometer, with 0.5% proparacaine topical anesthetic. Values analyzed were for the right eyes only. All tests were done between the hours of 8 am to

10 am on every anti-natal clinic visit, to avoid diurnal variation in intraocular pressure.

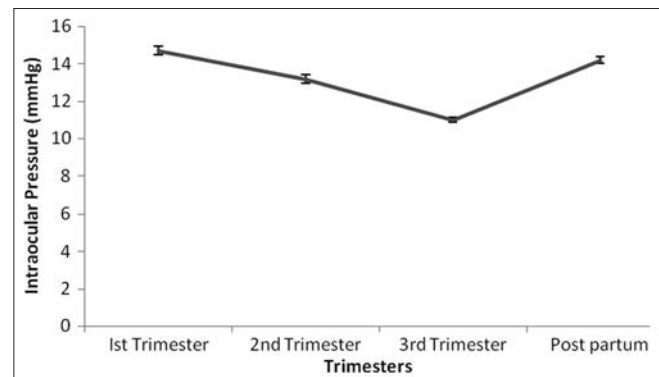
The data obtained were analyzed with GraphPad InStat statistical package (GraphPad software Inc, CA, USA). Comparison of data among the different groups was performed with one-way analysis of variance (ANOVA), while test between groups was with Student's t-test.

## Results

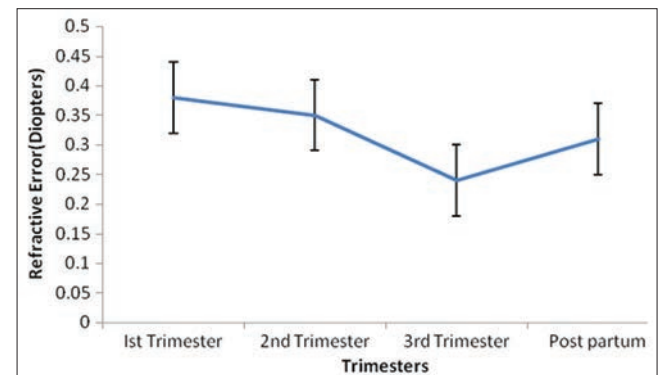
There was a fall in intraocular pressure (IOP) across the three trimesters of pregnancy and this was extremely significant  $P < 0.0001$ . The difference between the values in the third trimester and 6 weeks postpartum was also statistically significant  $P < 0.0001$ . [Table 1, Figure 1].

There was a fall in refractive error across the three trimesters of pregnancy, but this was not significant  $P = 0.3$ . Also the third trimester value did not differ significantly from the postpartum value  $P = 0.4$ . This is shown in Table 2 and Figure 2.

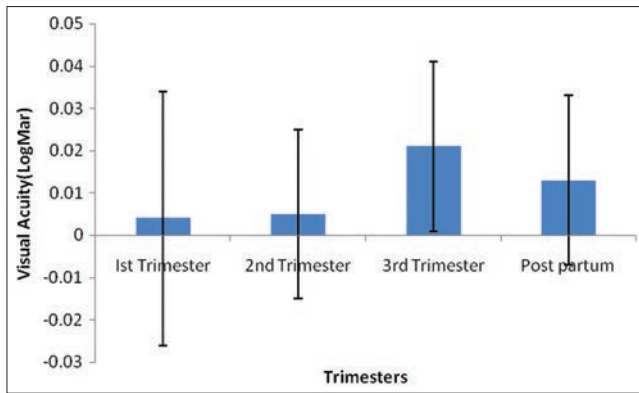
Comparison of the visual acuity across all three trimesters did not show any significant difference,  $P = 0.8477$ . Also there was no significant difference between the third trimester visual acuity and the postpartum visual acuity,  $P = 0.8092$ . This is represented in Table 3 and Figure 3.



**Figure 1:** Changes in intraocular pressure with pregnancy



**Figure 2:** Changes in refractive error in pregnancy



**Figure 3:** Changes in visual acuity in pregnancy

Statistics	First trimester	Second trimester	Third trimester	Postpartum
Mean IOP (mmHg)	14.70	13.20	11.00	14.20
SD	2.20	2.00	1.30	1.80
SEM	0.24	0.22	0.14	0.19
N	100	100	100	100

IOP = Intraocular pressure; SD = Standard deviation; SEM = Standard error of mean; N = Number of subjects

Statistics	First trimester	Second trimester	Third trimester	Postpartum
Mean R E (diopters)	0.38	0.35	0.24	0.31
SD	0.54	0.56	0.56	0.53
SEM	0.06	0.06	0.06	0.06
N	100	100	100	100

Statistics	First trimester	Second trimester	Third trimester	Postpartum
Mean V A (logMar)	0.004	0.005	0.021	0.013
SD	0.200	0.200	0.200	0.200
SEM	0.030	0.020	0.020	0.020
N	100	100	100	100

## Discussion

During pregnancy, various physiological changes take place in the body due to the hormonal effects of the placenta. These placental hormones have effects on most organ systems, including the eyes. In this study, the mean visual acuity was observed to reduce from the first trimester through to the third trimester. Postpartum, visual acuity gradually rose to pre-pregnancy state. This agrees with the study by Pizzarell <sup>[9]</sup>, who reported a worsening of myopia with pregnancy. The reduction in VA across the different trimester however, was not significant.

Although there was a change in refractive error across the different trimesters and postpartum, these changes were

not statistically significant, in agreement with studies <sup>[6,7]</sup> that had reported no significant changes in refractive error during pregnancy.

The changes in visual acuity and refractive error during pregnancy have been ascribed to increased levels of estrogen. Estrogen is a water retaining hormone.<sup>[9]</sup> Also, pregnant women usually have about twofold increase in secretion of aldosterone, reaching a peak at the end of gestation. This, along with the actions of estrogens, causes a tendency to reabsorb excess sodium from the renal tubules and to retain fluid. This causes the maternal blood volume to rise 30% above normal. This increase usually happens mainly in the latter half of pregnancy. Also, the bone marrow becomes increasingly active and produces extra red blood cells to go with the excess fluid volume.<sup>[11]</sup>

There is cornea edema due to the associated fluid retention of ocular tissues. This generally leads to decrease in sensitivity of the pregnant mother's cornea, which may cause problems for contact-lens wearers who may traumatize their corneas more than usual when fitting their lenses, resulting in chronically red, irritated eyes and relative contact-lens intolerance.<sup>[12]</sup>

This tendency of fluid-retention also affects refraction meaning current spectacles or contact-lenses may temporarily be either too weak or too strong, depending on the specific refractive error. These changes can affect the sharpness of eyesight. An increase in fluid in the eyes can increase nearsightedness temporary. Fluid retention can cause the curvature of the cornea to become steeper, causing light rays from objects to become focused in front of the retina, as it happens in myopia. This would lead to changes in visual acuity.<sup>[11-13]</sup>

The changes in intraocular pressure (IOP) during pregnancy were significant in this study. IOP was found to reduce consistently during the different trimesters, as the pregnancy advances, with the lowest pressure in the third trimester. The finding that the third trimester of pregnancy has an ocular hypotensive effect is consistent with other studies.<sup>[14-18]</sup>

The normal intra-ocular pressure may decrease slightly due to certain hormonal and circulatory changes. This could be advantageous to patients suffering from glaucoma, a condition where the raised intra-ocular pressure damages the optic nerve that transmits visual information to the brain.<sup>[19,20]</sup>

The physiological mechanism responsible for the decrease in IOP during pregnancy is not well known. A number of mechanisms have been postulated. Among them is that decreased IOP in pregnancy is due to elevated hormonal levels which cause an increase in fluid outflow conductance without altering the rate of fluid entry.<sup>[20]</sup> It is well documented that levels of progesterone and estrogen change during pregnancy.

Estrogen causes dilation of the vessels of the circulatory system leading to decreased arterial pressure and thus a reduction in aqueous humor production.<sup>[12,21-22]</sup> This could explain the reduced intraocular pressure reported in this study.

During pregnancy, the extreme quantities of estrogens cause the release of relaxin. The relaxin softens the pelvic ligaments of the mother, so that the sacroiliac joints become relatively limber and the symphysis pubis becomes elastic.<sup>[23-24]</sup> These changes make for easier passage of the fetus through the birth canal. Philips and Gore<sup>[23]</sup> suggested that this softening of ligaments in late pregnancy might extend to the ligament of the corneo-scleral envelope to produce reduced corneo-scleral rigidity and therefore cause a fall in IOP.

Ocular changes are common in pregnancy. Although these changes are transient and resolve postpartum, it can have an impact on the course of a pre-existing ocular disease, or it can be associated with the development of a new disorder, like central serous chorioretinopathy. The results of refractive eye surgery before, during, or immediately after pregnancy are unpredictable, and refractive surgery should be postponed until a stable postpartum refraction. Family physicians and obstetricians who take care of these women should have a firm understanding of the various ocular changes associated with pregnancy and the implication they may have for management.

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