**Original Research Article**

# Hematological Changes in Pregnancy-induced Hypertension pregnant women in the third trimester in Gadarif State, Eastern Sudan

## Usama A Elsharief[1]*, Tasneem H Abd Elrahman[2]*, Samia O Massaad[1]*, Rabie A Babiker[1], Bashir M Barry[3], Smah A Osman[4], Gamal K. Adam[1]

[1]Faculty of Medicine and Health Sciences, Gadarif University, Gadarif, Sudan.
[2]Ministry of Health, Gadarif State, Sudan.
[3]Department of Gynecology and Obstetrics, Ministry of Health, Gadarif State, Sudan.
[4]Department of Pathology, Ministry of Health, Kassala, Sudan.
* The first three authors equally contributed to this work

## Abstract

**Background:** Pregnancy-induced Hypertension (PIH) is most important complications for maternal and perinatal morbidity and mortality. The objective of this study was to compare the changes of hematological parameters in pregnancy induced hypertension and normotensive pregnant women in the third trimester in Gadarif State.

**Methods:** A case control hospital based study was conducted in Gadarif Obstetrics and Gyncology Hospital in the period 1st march to 1st June 2017. A total 200 subjects were studied out of them 100 patients was case and 100 healthy pregnant women was control. 2.5 milliliter of venous blood was taken in EDTA anticoagulant container. Automated hematological analyzer (sysmex KX 21N) was used to measure complete blood count. Structured questionnaires were used to collect data from the participants.

**Results:** The present study showed that the mean of platelet count in the women with pregnancy induced hypertension was (212.19±67.04x109/l)versus (259.6±83.09x109/l) in normotensive pregnant women (P-value.032). RBCs in PIH pregnant women was (4.43±0.77x1012/l) versus (4.40±0.64x1012/l) in normotensive pregnant women (P-value.06) and WBCs in women with PIH was (7.64±1.9x109/l) versus (7.8±1.75x109/l) in normotensive pregnant women (P-value .19).

**Conclusion:** The study concludes that platelet count was significant lower in pregnancy induced hypertension pregnant women than normotensive. No significant different in Red Blood Cells count, Hemoglobin, White Blood Cells count.

**Keywords:** Pregnancy-induced hypertension, Platelets, hematological analyzer, Gadarif state, Sudan

# 1. Introduction

Pregnancy-induced hypertension (PIH) defined as the development of new hypertension in a pregnant woman after 20 weeks' gestation, in which the systolic blood pressure (SBP) >140 mmHg and diastolic blood pressure (DBP) >90 mmHg (Williams, 2014; Kintiraki et al, 2015). PIH is the most common disorder of pregnancy and leading cause of high maternal and neonate morbidity and mortality (Mohapatra et al, 2015). Around 5-7% of pregnant women develop pregnancy induced hypertension disorders (Mohapatra et al, 2015), a majority of cases are in developing countries (Duley, 2009). PIH may cause several critical problems in pregnancy such as premature delivery, intrauterine growth retardation, abruptio placentae and fetal death (Obed and Patience, 2006; Anand and Anand, 2012). PIH has been divided into four categories Pregnancy induced gestational hypertension, preeclampsia, eclampsia and Chronic hypertension (Jhajharia and Verma, 2019).Pre-eclampsia and eclampsia associated with maternal and newborn morbidity and mortality (WHO, 2013).Although eclampsia is the rarest form of pregnancy-induced hypertension, but is the most severe one, caused by pre-eclampsia which is mainly considered as a vascular disorder (Fisher, 2015). In the early stage of pregnancy the invasion of extra villous trophoblast into the maternal uterus is important to establish pregnancy. Failure of trophoblast invasion result in a failure of transformation of the uterine spiral arteries. Failure of trophoblast invasion and spiral artery transformation is important in the development of pre-eclampsia (Fisher, 2015). Trophoblasts are the first cells that differentiate from the fertilized egg; they form the outer membrane of the placenta, and are responsible for the nutrients and oxygen exchange between the mother and the fetus (Gathiram and Moodley, 2016). The trophoblast invasion and vascular growth can regulate by decidual natural killer (NK) cells, An abnormal expression of NK cell surface antigens and a failure in the regulation of NK cell cytotoxicity or angiogenic factors may be some of the causes of pre-eclampsia and resulting in a high-flow and high-pressure state (Hanna et al, 2006; Fukui et al, 2012; Tessier et al, 2015).

Pre-eclampsia has also been associated with thrombocytopenia (Yan, 2016).

Pregnancy is divided into three trimesters, the first trimester is from week (1 - 12) includes conception, which followed by the fertilized egg traveling down the fallopian tube and implanted in the uterus, where it begins to form the fetus and placenta .The second trimester is from week (13 – 28). The third trimester is from week (13 – 38) (Mohamed, 2015).There is anatomical, physiological, biochemical, and endocrine changes that affect multiple organs and systems during Pregnancy (Costantine 2014). These changes are important for woman to adapt the pregnancy state and to aid fetal growth and survival. The hematologic system supply fetal hematopoiesis by vitamins and minerals (iron, vitamin B12, folic acid), this may result in maternal anemia (Kraemer and Zimmermann, 2007). The most significant hematological changes are physiologic anemia, neutrophilia, mild thrombocytopenia, increased procoagulant factors, and diminished fibrinolysis (Paidas et al, 2011).

Pregnancy outcome is influenced by many factors, culture, environment, socioeconomic status and access to medical care. The hematological profile of pregnant women also has an impact on pregnancy and its outcome (Ayokunle, 2011).

Hematologic parameters may vary in different populations (Karita et al, 2009), several studies have shown that the hematological profiles in pregnant women with Hypertensive disorders of pregnancy (HDP) differ from those in normotensive pregnant women. Baskaet al (2015) was studied 50 PIH pregnant women and 50 normal pregnant women reported that haematocrit value of PIH pregnant women is significantly higher compared to that of the normal pregnant women (P<0.05). There is a strong association of increased haematocrit and PIH.

Monteiro (2014) study done in singleton mothers.75 subjects with PIH and 62 normotensives pregnant women. He showed that, among the measured blood parameters, platelet

count was lower in PIH compared to control, but there was no different in other parameters.

In Nigeria, Onuigwe, (2015) was investigated the platelet count in seventy pregnant women with pregnancy induced hypertension and thirty (30) healthy pregnant women (control). He observed a significantly lower platelet count among pregnant women with PIH compared to controls. There seems a significant relationship between low platelet count and PIH.

In Sudan, study conducted by Ahmed (2015) in 100 PIH pregnant women and 75 normal pregnant women, who reported that WBCs significantly increase in PIH women, while platelets count significantly decrease this may predispose these women to thrombocytopenia when compare with normotensive women.

Pregnancy Induced Hypertension affects hematological values of pregnant women. Understanding of hematological changes accompanied by normal pregnancy may enable to put a new strategy for control of pregnancy complication. There is no study on hematological changes during pregnancy in Gadarif state, therefore the present study was compare hematological values between pregnant women with Pregnancy Induced Hypertension and normotensive pregnant women in Gadarif State, Eastern Sudan.

## 2. Materials and Methods

This was a case control hospital based study conducted at Gadarif Obstetrics and Gyncology Hospital during the period between 1stmarch to 1st June 2017. A total of 200 subjects were studied (ages ranged 18-45 years old),100 patients (case group) and 100 healthy pregnant women (control group) to determine complete blood count of pregnant women and pregnant with induce hypertension disorders at third trimester. 2.5 ml venous blood sample was collected from each participant into Ethylene Diamin Tetra Acetic Acid (EDTA) container to perform complete blood count. Structured questionnaires were used to collect data from the participant. Sample were analyzed by using automated hematological analyzer (sysmex KX 21N) Japan.

### 2.1 Ethical clearance

Ethical clearance was obtained from the ethical committee of Gadarif University Faculty of Medicine. Informed consent was taken from each participant before collecting the sample.

### 2.2 Data analysis

Data were analyzed by using SPSS computer program, Version 20.0. One way AOVA and t-independent test were used. P-value significant level was set at $< 0.05$.

## 3. Results

A total of 30 Down syndrome patients diagnosed with CHD were collected in the study period. There were 19 females (63.3%) and 11 males (36.7 %), the mean ages of the patients were 4.4 years (the ages 16 years. 2 Children with down syndrome were born to young mothers (7%), 25 and 29 years of age. Mean maternal age at delivery was 36 years. Most mothers were multiparas 26 (86.7%) and 4 (13.3) were Primiparity. 2 patients had Family history of cardiac diseases.
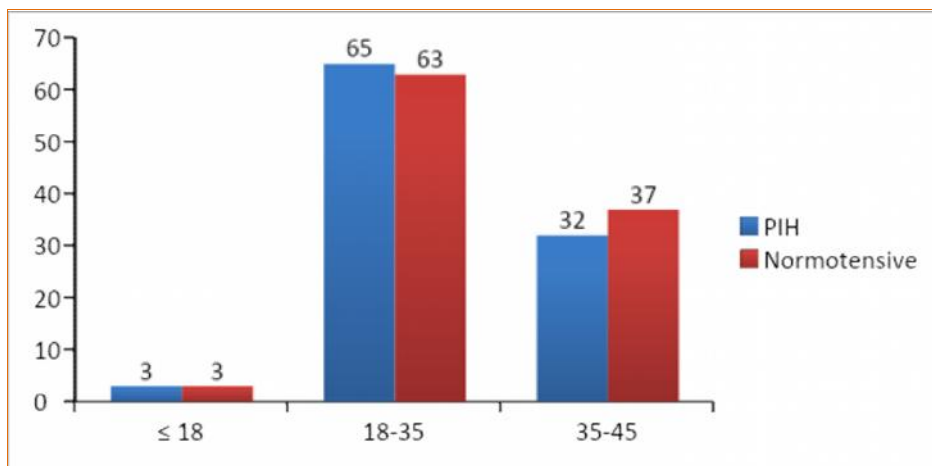
Figure 1: show age frequency of PIH and Normotensive group.

Hematological parameters data in control and study subjects is presented as mean ± Standard deviation (SD).

The mean of red blood cell (RBCs) count in the women with pregnancy induce hypertension was ($4.1333\pm0.49 \times 10^{12}$/l) versus ($4.4\pm.85 \times 10^{12}$/l) in the women with normotensive pregnancy (Table 1).

Table 1: show the mean of RBCs count in the PIH pregnant women and normotensive pregnant women

| Parameters | PIH pregnant women<br>Mean+ Std .D | normotensive pregnant women<br>Mean+ Std .D | p-P.value |
|---|---|---|---|
| RBCs | | | |
| 18 | 4.13±0.49 | 4.4±.85 | |
| 18- 35 | 4.43±0.77 | 4.28±0.64 | .06 |
| 35-45 | 4. 40±0.85 | 4.2±.65 | |

The mean of hemoglobin (HB) in the women with pregnancy induce hypertension was (10.5±.45) versus (11.1±9.2) in women with normotensive pregnancy. There was no significant difference (Table 2).

Table 2: show the mean of HB count in the PIH pregnant women and normotensive pregnant women

| Parameters | PIH pregnant women<br>Mean+ Std .D | normotensive pregnant women<br>Mean+ Std .D | p.value |
|---|---|---|---|
| HB | | | |
| 18 | 10.5±.45 | 11.1±9.2 | |
| 18- 35 | 10.7±1.6 | 10.6±1.5 | .76 |
| 35-45 | 10.4±1.2 | 10.5±1.4 | |

The mean of hematocrit (Hct) in the women with pregnancy induce hypertension was (34.3±2.49%) versus (33±2.94%) in normotensive women there was no significant difference (Table 3).

Table 3: show the mean of HCT count in the PIH pregnant women and normotensive pregnant women

| Parameters | PIH pregnant women Mean+ Std .D | normotensive pregnant women Mean+ Std .D | p.value |
|---|---|---|---|
| HCT | | | |
| 18 | 34.3±2.49 | 33±2.94 | |
| 18- 35 | 35.11±3.33 | 34.7±5.9 | .86 |
| 35-45 | 34.68±3.2 | 34.07±9.95 | |

The mean of white blood cell (WBCs) in women with pregnancy induce hypertension was ($7.9\pm1.2$ x$10^9$/l) versus ($7.6\pm1.1$x$10^9$/l) in the women with normotensive pregnancy there was no significant difference (Table 4).

Table 4: show the mean of WBCs count in the PIH pregnant women and normotensive pregnant women

| Parameters | PIH pregnant women Mean+ Std .D | normotensive pregnant women Mean+ Std .D | p.value |
|---|---|---|---|
| WBCs | | | |
| 18 | 7.9±1.2 | 7.6±1.1 | |
| 18- 35 | 7.64±1.9 | 7.8±1.75 | .19 |
| 35-45 | 7.9±1.6 | 7.17±1.5 | |

The mean of Platelet (PLTs) in the women with pregnancy induce hypertension was ($218.66\pm20.50$X$10^9$/l) versus ($371.33\pm$ 44.46X $10^9$/l) in the women with normotensive pregnancy. There was significant decrease in pregnancy induce hypertension women (Table 5).

Table 5: show the mean of PLTs count in the PIH pregnant women and normotensive pregnant women

| Parameters | PIH pregnant women Mean+ Std .D | Normotensive pregnant women Mean+ Std .D | p-value |
|---|---|---|---|
| PLTs | | | |
| 18 | 218.66±20.50 | 371.33±44.46 | |
| 18- 35 | 212.19±67.04 | 259.6±83.09 | .032 |
| 35-45 | 230.3±47.3 | 270.35±81.4 | |

## 4. Discussion

The marriage at young ages have health implications for both mothers and children, the present study revealed that PIH was common in age group18-34 with frequency of 65 (65%) there was no significant effect in hematological values between different age groups. This is in line with study carried out by Vinodhini and Lavanya (2014) in 50 pregnancy induce hypertension and 50 normotensive pregnant women reported that the mean age of pregnancy induce hypertension pregnant women was 24-29 years and there was no statistically significant correlation between age and thrombocytopenia and the majority of the women were primigravidas and presented with thrombocytopenia and disagreed with Onuigwe et al (2015) reported that teenage pregnancy is significantly associated with low platelet count among patients with PIH.

In the present study, the platelet count in the women with PIH is significantly lower (p<.032) from that in the women with normotinsive pregnancy. This finding agreed with the previous study conducted in Sudan by Ahmed (2015) in 120 pregnancy induced hypertension pregnant women and 75 normotinsive pregnant women, who reported that there was decreased in platelet count in PIH women compared to normotensive women. Also Praveen et al (2017) from Indi are ported that the platelet count in 120 PIH women were lower when compared with 50 control. Goran G-Babic (2011) from Serbia studied in 38pregnany induced hypertension pregnant women and 51 normal pregnant women and reported that there was decreased in platelet count and increased activation and aggregation of platelet in PIH pregnant women. The current study is inconsistent with that reported by Makuyana et al, (2002) observed no significant difference in platelets count and other hematological parameters in 38 pre-eclamptic women compared to 72 normal pregnant women.

## 5. Conclusion and Recommendations

The study concluded that platelet count was significantly decreased during 3rd trimester of pregnancy, soon of the hematological parameters measured; platelet count may be a suitable marker in monitoring pregnant women with PIH. No significant different in Red Blood Cells count, Hemoglobin, White Blood Cells count. The study recommends that routine and regular monitoring of platelet count is included in the routine antenatal check-up among pregnant with PIH.

## Conflict of interests

The authors declare that, they do not have any conflict of interest regarding this study.

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