

Alterations In Hematological Indices In Antenatal And Postnatal Mothers Within Kerkuk Province, Iraq

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ABSTRACT

Objective: The purpose of this study is to examine changes in hemoglobin, packed cell volume, white blood cells, and platelet counts in Iraqi women from Kirkuk Province during the prenatal and postnatal phases. **Methods:** During the course of a year, 600 women attended Azadi Hospital in Kirkuk, including 300 pregnant women in the third trimester and 300 postpartum women. An automated analyzer was used to collect and analyze blood samples, and the outcomes were contrasted with those of a control group of 60 university students who were not pregnant. **Results** Hematological parameters showed notable alterations. During pregnancy, hemoglobin and packed cell volume dropped, but after delivery, they rose ($p < 0.022$). During pregnancy, the white blood cell count was significantly greater ($p < 0.001$), and it continued to rise after delivery. There was no discernible change in the platelet count. Instead of clinical situations, these deviations were ascribed to normal physiological processes. **Novelty:** This study contributes to better health monitoring and risk assessment for maternal care by shedding light on the typical hematological alterations that occur in Iraqi women throughout pregnancy and the postpartum phase.

INTRODUCTION

A pregnancy can be influenced by some factors, e.g. culture, behavior, environment, socioeconomic status, as well as access to medical care; meanwhile, the values of hematological indices would, consequently, reflect the health status of the gestation and its expected outcome. Complete Blood Counting (CBC), one of the most important basic tests, is routinely carried out at both hospitals and private clinics to monitor the overall health of a pregnant woman and thereby detect any complications i.e., anemia and blood diseases, infections etc. The CBC test implies important information i.e. hemoglobin percentages (Hb%), number and types of white cells (WBC), erythrocytes (RBC), platelets (PLT) differential counting etc. Peripheral blood cell analysis could also help physicians diagnose the cause of symptoms i.e. weakness, fatigue, and bruising that are common in pregnant women as they represents symptoms of anemia syndrome e.g. infection and other disorders [1]. The CBC test, particularly at early stages of pregnancy, is performed to determine any health abnormalities that a pregnant mother may have developed that would have an impact on baby's health [2]. This test keeps track of the RBC which transport oxygen (O_2) throughout the body as the iron supplements would suggest whether or not the blood iron levels are dropped. The CBC also provides information on a number of other hematological parameters, however, in pregnancy the most useful are

Hb%, RBC, WBC and blood platelets (PLT); meanwhile, most laboratories would provide pregnancy adjusted reference ranges to enable easier interpretation by the physicians. The WBCs, produced by bone marrow, represent almost [1%](#) of a person's blood, whose counts increase during pregnancy fight against pathogens e.g. viruses, parasites, and bacteria. After an infection, the memory cells remember the antigens to combat in the event of next exposure where the WBCs respond immediately to produce antibodies and prevent another illness [3]. All gynecologist, advise pregnant woman, particularly, at late weeks of gestation, to have a CBC test done, examined by general physical for confirmation, in case any signs of fatigue, weakness, fever, inflammation, bruising or bleeding. Prior to all laboratory testing, pregnant mothers are advised to have enough information about the importance of the test, implications of both positive or negative result, the risk of disease transmission to the fetus and how the results would be delivered, e.g. a high or very low hemoglobin levels is associated with increased fetal risk [4]. Although the first antenatal screen usually occurs early in pregnancy, the mothers would still be advised, at any later stage to receive a first antenatal screen. Hence, a general checkup on health condition is achieved by the physicians help the pregnant co-op with her changeable condition. For extra assurance, the Iraqi pregnant women may refer to more than one physician during pregnancy. Centrally controlled health data base, to keep track, unfortunately is still absent in Iraq which deems so necessary for regular checkup.

A comparison of CBC survey may be needed for both the pregnant admitting hospital and non-pregnant women for routine purposes as a part of follow up health condition and medical interference if necessary. Accordingly, physicians or gynecologist would recommend appropriate treatment according to the outcome of the CBC.

RESEARCH METHOD

Data of 300 pregnant and another 300 postnatal women (ages ranged 15-40 years old) had admitted Azadi hospital, for normal delivery (without cesarean operation), involved in this research, have been compared with other 60 healthy non-pregnant control women, represented the final year university students (ages ranged 22 ± 2 years old). To avoid biased interpretation, no pregnant women above 40 years old are included in this research. In all cases at least 3 mL of the peripheral blood samples were collected intravenously using standard procedure by professional nurses, kept in EDTA containers and immediately analyzed using automated blood analyzer (Shenzhen Mindray Bio-Medical Electronics Co. Ltd. China) at the Hospital. All data are kept confidentially according to the relevant code of conduct.

RESULTS AND DISCUSSION

The mean age of control healthy women that represented final year university students, was almost 22 ± 4 years old were compared with pregnant women (24.6-26.1 years old). The hemoglobin percentages (Hb%) in prenatal women measured

(11.83gm/dL $\pm$ 1.04) with significantly ($p\leq 0.001$) dropped down in comparison with their counterpart, the control (13.43gm/dL $\pm$ 2.15). In postnatal women the Hb% had significantly ($p\leq 0.022$) raised back to 12.4gm/dL $\pm$ 1.6. However, the counts of white blood cells (WBC) was significantly ($p\leq 0.001$) elevated to (11.69 $\times 10^6$ /dL) in prenatal than in comparison with control (7.42 $\times 10^6$ /dL). The count of WBC had further risen back, postnatally to (15.82 $\pm 4.7 \times 10^6$ /dL). Simultaneously, the count of PCV% had significantly ($p\leq 0.037$) insignificantly dropped down in prenatal women (34.11 ± 7.76) in comparison with their counterparts the control (37.11 ± 3.33), respectively; however, it insignificantly rose postnatally, to 36.67 ± 3.8 (Fig. 1 & Table-1). On the other hand, the percentage of blood platelets (PLT) had insignificantly declined; however, it had slightly risen postnatally, in comparison with prenatally (with an insignificant difference).

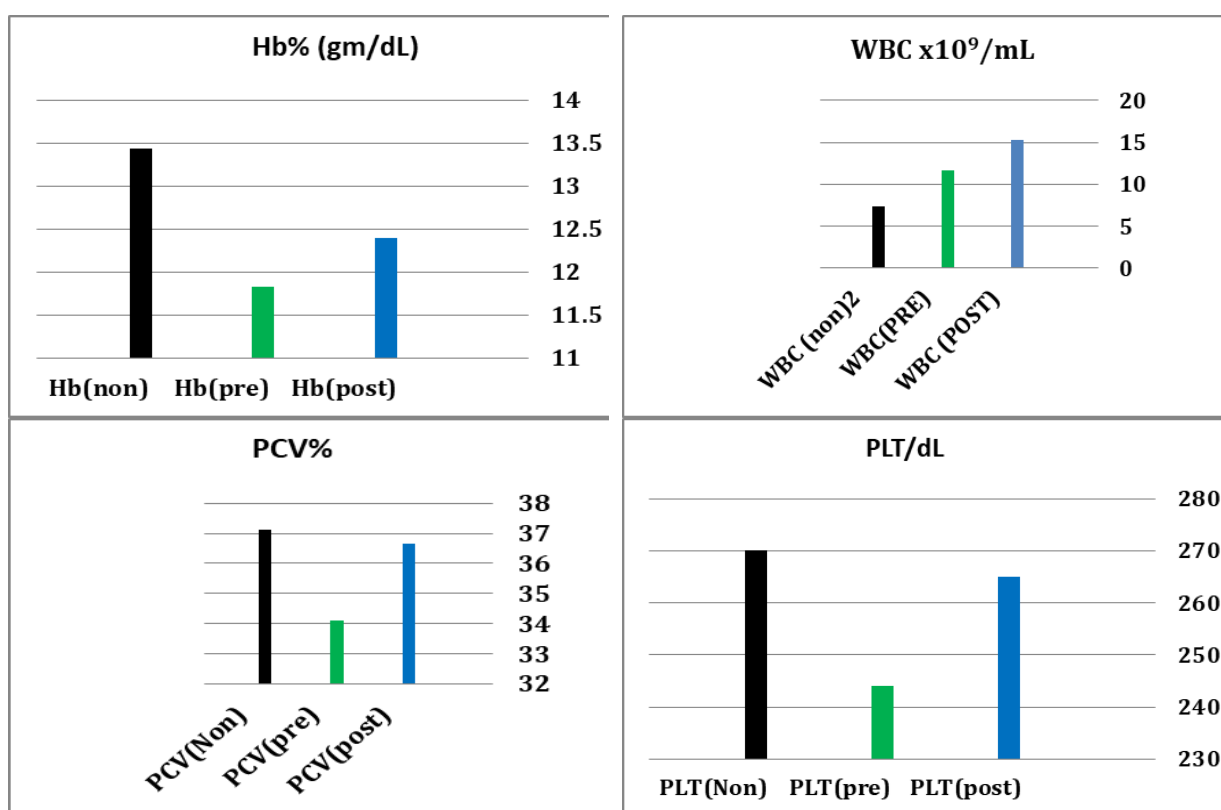


Figure 1. The Arithmetic Mean Values Of Some Blood Parameters In Control (Non-Pregnant), Prenatal And Postnatal Women

Table 1. Blood Indices In Pregnant Women Before Birth Compared With Control Women; ($P\leq$), Value Of Probability Test; (NS), Insignificant Differences

Parameters/Units	Ages (Years)	Hb% (gm/dL)	WBC (10^9 /mL)	PCV (%)	PLT ($\times 10^9$ /mL)
Non-pregnant (n=300)	22.63 $\pm$ 2.4	13.43 $\pm$ 2.15	7.42 $\pm$ 2.14	37.11 $\pm$ 3.33	270 $\pm$ 73
Pregnant (prenatal) (n=300)	26.08 $\pm$ 5.5	11.83 $\pm$ 1.04	11.69 $\pm$ 2.11	34.11 $\pm$ 7.76	244 $\pm$ 71
Probability-test ($p\leq$)	0.01	0.001	0.004	0.037	0.06

Postnatal (n=160)	24.63±4.1	12.4±1.6	15.82±4.7	36.67±3.8	265±89
Probability test (p<)	NS	0.022	0.001	NS	NS

Many blood parameters are influenced by some factors e.g. pregnancy health, seasonal variation, sex, lactation and nutritional status [5]. These factors are considered as normal variations that would increase the levels of diagnostic precision when blood components are compared between individuals [6]. Although, blood groupings are also found to vary between different nations worldwide; however, an international counting of blood parameters for normal individuals are documented for general reference i.e. comparison purposes [7]. Normal international level of hemoglobin documented ranges between 12-16 gm/dL for women at childbearing age. Its minimum normal value is documented 11 gm/dL in the 1st and 3rd trimester of the pregnancy and 10.5 gm/dL in the 2nd trimester. The physiological drop in Hb% concentration from the 1st to the 3rd trimester of pregnancy is often quoted 5 gm/dL; however, other studies have suggested varying levels of drop e.g. (8-13 gm/dL) [1]. The fall in Hb% is not an abnormal phenomenon as all pregnant women undergo such alteration. In pregnancy, both total RBC number and plasma volume increase, but the Hb% levels drop according to the higher increment in plasma volume. This condition provides placental perfusion with reduced blood viscosity [8]. These signs and symptoms are consequent of anemia, infection or leukemia, polycythemia etc [1]. The total amount of iron in the body of an adult woman averages 2.3 gm equal to the weight of a dime [9]. In a typical pregnancy, maternal iron requirements ranges between 300-350mg for the fetus and the placenta, 500mg for the expansion of the maternal RBC mass, and 250 mg associated with blood loss during labor and delivery [10]. In a normal pregnancy, physiological changes may occur in almost all organs and systems to accommodate the demands of fetoplacental unit [11]. The physiological changes in hemoglobin concentration (Hb%) and platelet count during pregnancy, accordingly, are a well-known phenomenon [12]. The outcome of regular CBC tests would insure monitor the health condition of both mother and her child that would guarantee early diagnose any relevant disorder by the physicians; which consequently, help the latter to prescribe the most righteous medication useful for the patients.

Measuring hemoglobin and hematocrit is so common during pregnancy for normal health checkup where normal level of Hb% would be around 12-16 gm/dL) for women of childbearing age. Its minimum normal value is found to be 11 gm/dL in 1st and 3rd trimester of the pregnancy and 10.5 gm/dL in the 2nd trimester. In the present research, the hemoglobin and hematocrit (RBC) indices showed general decline in the pregnant women. Although, dripping these two blood indices is very normal at late month of gestation but it could indicate that the pregnant woman is anemic, iron deficient, which may hinders the development of the fetus [13]. Consequently, prescription of any medication, radiation or drugs may harm or have a negative impact on both, the mother

and baby, due to body's response mechanism [4]. Screening for high and low blood values before surgery (cesarean section) insures the adequate health of the pregnant woman for the surgery, not anemic or suffering from hemophilia. Gestational age should also be taken into account when assessing hemoglobin, as levels drop down during pregnancy due to hemo-dilution caused by increased plasma volume [13]. International lower limit for hemoglobin is usually 11.5 gm/dL, but for pregnant women the lower limit is usually reported as 10.0 gm/dL [14]. Our results are similar to another study carried out in Nigeria where Hb% significantly decreased due to the tendency of pregnant women to undergo iron deficiency as well as need for more RBC to support baby's demand for extra oxygen and get rid of more CO₂ [15][16]. In our research hemoglobin percentages had declined below normal denoting anemia which is the most frequent hematological concern during pregnancy, characterized by both decreased in hemoglobin mean cell volume (MCV) and mean cell hemoglobin (MCH) levels [13]. When iron deficiency is suspected, a measurement of serum ferritin should be used as an extra factor to confirm the diagnosis [17]. White blood cells (WBCs), make up almost [1%](#) of a person's blood would fight against viruses, parasites, and bacteria meanwhile the bone marrow produces more WBCs when battling an infection. After an infection, the well trained memory cells, would remember the antigens to fight in the event of a second exposure as the WBCs respond immediately to produce antibodies and prevent another illness [18].

In a Nigerian study the total number of WBC was found insignificantly altered from the normal range [17]. In the present study, the account of WBC significantly increased ($p \leq 0.004$) from 7.42×10^9 to $11.69 \times 10^9/L$ at the 3rd trimester in the pregnant woman. This is considered as a normal phenomenon which could mostly be due to an increase in number of neutrophils in the blood to fight bacteria that may attack the pregnant women [19]. The WBC count may increase throughout gestational period and immediately then after, which may not need any treatment unless there is an underlying infection [20]. On the other hand, elevation of WBC, particularly the lymphocytes, during pregnancy may also be referred to the body building up immunity of the fetus [21]. Elevation in WBC levels during pregnancy in the present research, generally, deems a reactive response to the pregnancy and do not usually suggest a clinical problem. Almost all mothers were healthy with no pathogenic infection detected to attribute it the increase of WBC to but perhaps rather to the activation of immune system to fight any unexpected pathogen may attack the mothers. The latter confirms the credibility of our research as unbiased results.

Unfortunately, neither manual differential counting via blood smear nor via system automated carried out to tackle the frequency of neutrophils. However, the frequent elevation of the total WBC during pregnancy could be attributed to an increase in number of neutrophils that may, not usually be associated with inflammation or infection [22]. The total WBC count can also be misleading in pregnant women and should also be interpreted with care, e.g. elevation in neutrophils with a low lymphocyte count may

produce a total white cell count that falls within the reference range. Hence, the absolute deferential WBC counting deems more useful than the total white cell count that indicate activation of immune cells inside the blood to confront any pathogenic condition postnatally.

Alterations in number of platelets (PLT) frequently are detectable during all pregnancies as a consequence of hemodilution as the body produces more plasma during pregnancy that drop the total number of PLT per volume of blood, which can become more pronounced as the pregnancy progresses from the second to third trimester [23]. During normotensive healthy pregnancies, a decrease in platelet count occurs e.g. between 4.4% and 11.6% developing gestational thrombocytopenia [24]. Further decrease in the platelet count -rather than increase- is most obvious in women with low levels of it prior pregnancy. A platelet level of $150 \times 10^9/L$ or less is considered an abnormally low and should be discussed with a hematologist to avoid further complication incur on both mother and her baby. Due to a slightly increased risk of blood clotting, it will be advisable to discuss results with a hematologist, when platelet levels are higher than $600 \times 10^9/L$ [25]. In such cases, platelets will soon be destroyed in filtrating process, at a higher rate at pregnancy as the spleen would increase in size due to increased blood volume at pregnancy. In the present research the PLT had slightly decreased in comparison with normal cases could be interpreted as a common phenomenon in all pregnant women. The latter interpretation is confirmed by an obvious increase in PLT, back to normal, postnatally.

CONCLUSION

Fundamental Finding : According to this study, in healthy Iraqi women, there are notable changes in hematological indices such as hemoglobin, packed cell volume, and white blood cell count during the prenatal and postnatal phases. The majority of these parameters revert to their prepartum values after giving birth. Pregnancy-related physiological adjustments that are not harmful are the main cause of these alterations.

Implication : These results emphasize how crucial it is to include routine hematological monitoring during pregnancy in order to guarantee early identification of any abnormalities that might point to underlying issues. They also offer a foundation for enhancing risk assessment and maternal health management techniques. **Limitation :**

The absence of long-term postnatal follow-up beyond the initial recovery period, which would have offered more thorough insights into the entire recovery process, is a limitation of this study. Furthermore, the study sample was restricted to women who were patients at one hospital in Kirkuk Province, which can have an impact on how broadly the findings can be applied. **Future Research :** In order to evaluate the long-term recovery of hematological indices, future research should take into account a larger population, including women from various geographic locations and socioeconomic backgrounds, and prolong the postpartum monitoring period. A more comprehensive

understanding of maternal health during and after pregnancy may also be possible by investigating the possible impact of lifestyle and nutritional factors on these variances.

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