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Hematological and Immunological Parameters Associated with Vitamin D Deficiency in Pregnant Women

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ABSTRACT

The aim of the study is to follow up a number of biochemical, immunological and physiological changes associated with vitamin D deficiency in pregnant women. 50 samples were collected from pregnant women, 50 from control group and 50 from non-pregnant women. A number of laboratory tests were carried out on the withdrawn blood samples. These tests examined the ELISA to measure vitamin D concentration. The concentration of vitamin D in the pregnant women group, control group and the non-pregnant women group (26.31,43.97,50.9) were found to be Nano mole / L respectively, indicating a decrease in vitamin D concentration in pregnant women compared to the control group. The results of the present study showed a significant decrease in the volume of the red blood cells in the three studied groups at the probability level P <0.05 where the average ratio of the volume of the red blood cells in the group of pregnant women and control group and the group of non-pregnant women was (40.0, 39.7,37.3) % respectively. The results of the comparison between the two groups showed no significant differences in the size of the size of the red blood cells in the three studied groups at the probability level P <0.05. The results of the statistical analysis showed significant differences in the blood platelet counts in the three studied groups at the P <0.05 level. The mean number of the blood platelet counts in the pregnant women group, control group and the non-pregnant women group were (222, 237,208) X1000/mm^3 respectively. Comparison between the two groups showed no significant differences in the number of thrombocytes in the three studied groups at the probability level P <0.05.The results of the statistical analysis showed a significant increase in the number of white blood cells in the blood of pregnant women and non-pregnant women at the probability level P <0.05 compared to the control group and the average number of white blood cells in the pregnant women group, control group and the group of non-pregnant women (35.0, 9.08, 10.6) cell/mm^3 respectively. A significant decrease in the IgE concentrations in the three studied groups at the level of probability P <0.05 and the average IgE concentration in pregnant women's blood and control and non-pregnant women (82.20,90.6, 79.8) U / L respectively, where no significant differences between the three studied groups at the probability level P <0.05. In the case of CRP, the results of the effective C test in the serum of the three studied groups showed that all samples had a negative result. As for the results of the blood components, there was a significant decrease in the concentration of hemoglobin in the blood of pregnant women and non-pregnant women compared to control group at the level of probability P <0.05 where the concentration of hemoglobin in the group of pregnant women and control group and the group of non-pregnant women (11.6,12.8,8.4) mm / 1hour, respectively, where the results of the comparison between the two averages showed significant differences between the group of non-pregnant women and the control group and the absence of the significant differences between group of the women's control group t pregnant at the level of probability P <0.05. The results showed a significant difference between the non-pregnant women group and the control group at P <0.05.

Introduction:

Vitamin D is known to play a role in calcium balance in the body and its deficiency causes rickets in children and osteoporosis in adults, vitamin D regulates for many physiological events in the human body and sunlight can be considered the largest source of vitamin D, UVB, which activates Keratinocytes in the skin, increasing the consumption of the 7-dehydrocholesterol compound, forther production of Cholesterol, which is the main source of vitamin D in the body.

Vitamin D values are associated with a reduction in the risk of vitamin D deficiency and osteoporosis as the natural value of vitamin D is 30 to 50 ng / ml and the value of less than 20 ng / ml (50 nmol / L) is a reference to vitamin D deficiency[(1)]. Most cases cause vitamin D deficiency when people do not get enough exposure to the sun and do not eat foods rich with vitamin D and the main cause of vitamin D deficiency is not exposure to sunlight and the exposure of half an hour to the sunlight in the middle of the day during the summer enough to equip about 50.000 A universal unit of vitamin D in people with white skin[(2)].

Vitamin D deficiency is a global problem and is known as a major factor affecting various immune functions as well as bone and muscular development. Recent studies have reported that most of the common causes of non-specific symptoms can result from vitamin D deficiency, although some researchers have confirmed this and the most important studies to prove that vitamin D deficiency can lead to common symptoms are unknown causes such as headaches and fatigue[(3)]. This deficiency is often associated with various disorders such as diabetes, infectious diseases[(4)] heart disease, cancer, blood vessels, rheumatism and muscle weakness[(5)].

Studies conducted so far in different countries reported that vitamin D deficiency is prevalent during pregnancy, and that pregnant women are more likely to lack vitamin D than any other human group. Vitamin D deficiency during pregnancy is accompanied by several harmful outcomes for mothers and newborns, including height the risk of gestational diabetes, preeclampsia, cesarean delivery, postpartum depression, premature birth, low birth weight during the birth, this lead to and Osteomalacia and muscle dysfunction in the mother, this deficiency may also affect during gestational on calcium balance and low blood calcium, and a baby rick results to Vitamin D deficiency during Pregnancy[(6),(7),(8)].

Due to the prevalence of vitamin D deficiency in Iraqi pregnant women and the importance of following up the physiological and immunological changes associated with vitamin D deficiency in pregnant women, this study aimed to investigate the changes in a sample of pregnant and non-pregnant women (Married) who suffers from vitamin D deficiency and their comparison with a third sample of normal women at the vitamin level. This was done by studying the cellular blood components including (Hb, PLT, PCV, WBC) and immunological studies included (IgE, CRP).

Methods :

Sampling Collection:

100 Women were diagnosed with vitamin D deficiency and 50 women are normal during the period from October 2017 to January 2018. Women ranged in age from 19 to 78 years old and were divided into three groups of pregnant women, consisting of 50 pregnant women aged 19 to 35 years.

Control group :

Including 50 non-pregnant and healthy women. The group of women who suffer from vitamin D deficiency and take the treatment 50 cases who had taken vitamin D supplements.

Determination of vitamin D concentration in serum: Determination Vitamin D3 concentration in serum samples was estimated using Mini vidas using a standard curve.

Complete blood picture tests (CBP):

Total count of white blood cells: Total Leucocytes count The total number of white blood cells was calculated using blood cell counter the Hemocytometer Chamber and the dilution solution (Turkes Fluid) according to[(9)].

Determination of Hemoglobin concentration:

Hemoglobin Estimation of Cyanomethemoglubin was used to estimate the concentration of hemoglobin in the blood sample according to the method established by[(10)]. Several tests were used by the Spanish company Linear.

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Measuring the Packed cell volume: P.C.V Measurement

The Heparin-free capillary tubes were used, a separate haematocrit and reader were used to measure and quantify the size of the chorionic red blood cells[9]. Total blood platelet count: The ammonium oxalate method was used according to[11].

Immunological Examinations for Serum:

Determination of acute phase protein concentration Estimation concentration of C-reactive protein and Determination of concentration of IgE concentration of estimation by Minivids .

Statistical Analysis:

The statistical analysis program SPSS was used with version 23, with Mean TSE and Mean TSE. Morality was tested at the probability level of P<0.05 using t-test.

Results and Discussion:

Concentration of vitamin D:

The statistical analysis of data showed significant differences in the concentration of vitamin D in the three studied groups at the probability level P <0.05. The average vitamin D concentration in the pregnant women group, control group and non-pregnant women group was 5.09,43.97,26.31 ng / Indicates a decrease in the concentration of vitamin D in pregnant women compared to the control group and Figure (1) showed a significant decrease in the probability level P <0.05 between the arithmetic averages of the three groups

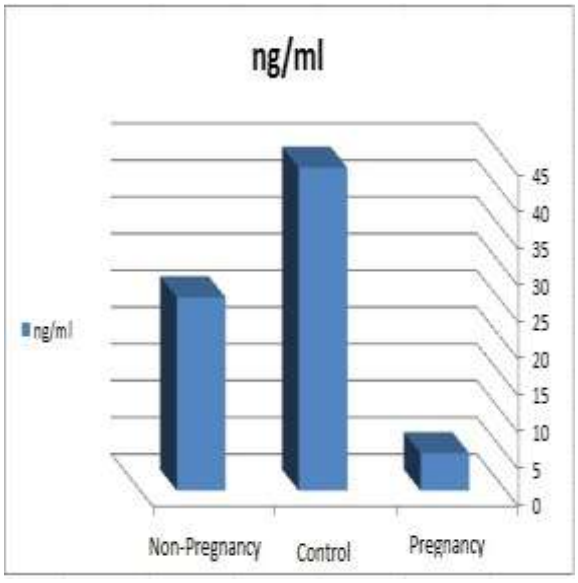

Figure (1): Average concentration of vitamin D in the three studied groups

The results of the current study showed a decrease in the concentration of vitamin D in pregnant women compared with the two groups under study and this result is consistent with many recent studies as the lack of vitamin D is one of the problems that spread in many countries and the group of pregnant women are the most vulnerable to this shortage By up to 40% of total vitamin deficiencies in women in general. The importance of studying and monitoring vitamin D deficiency in pregnant women is reflected in an overlap between vitamin deficiencies in the pregnant mother and the occurrence of many diseases in children born, such as bone disease, auto immune disease and diabetes (D.M.) .

The risk factors that cause vitamin D deficiency are those that are largely related to exposure to the sunlight. The main source of vitamin D is closely related to exposure to sunlight, which clearly stimulates the production of vitamin D in the body (endogenous)." The underlying cause of vitamin D deficiency is low production Of vitamin D in the human body[12].

Note that current study agrees with a study[13],who observed a decrease in the concentration of vitamin D in pregnant women by 62.2% in their study of a sample of pregnant women in Ankara, Turkey, and concluded that the causes of the deficiency is mainly due to insufficient exposure to sunlight because of the nature of the atmosphere in Turkey It was also noted that the results of Vitamin D deficiency in pregnant women were reflected in the level of vitamin in newborn babies and the mother and child should be compensated with vitamin D from external sources.

The results are consistent with those of[14] who observed a significant decrease in vitamin D concentration among women in Turkey for a sample of 87 pregnant women. This decrease was explained by the nature of the diet, which is the external source of vitamin D supply the body has basic requirements for building bones and controlling many metabolic events. Obesity and malnutrition are factors that cause vitamin D deficiency because cholesterol is the primary source of vitamin D building. When obesity occurs, it causes fat metabolism, thus reducing vitamin results, and malnutrition reduces vitamin D levels.

The results of this current study with Study[15], which included a study of 160 cases of vitamin D deficiency in pregnant women in Athens within one year, reached a level of vitamin D below 8ng / ml. This

deficiency was explained by the fact that pregnant women did not take vitamin D in the first months of pregnancy because of their lack of awareness and health education to avoid vitamin D deficiency.

The results of this current study are consistent with a study conducted on two groups of women in India for a group of teenage girls and a group of pregnant women. The prevalence of vitamin D deficiency in the two groups was shown to be affected by the four seasons. The concentration of vitamin D in summer was lower than the winter confirms that the use of sunscreen powders and dark skin color significantly reduce vitamin D production in the skin and thus reduce its concentration in pregnant women. Vitamin D deficiency is a major problem especially for pregnant women because vitamin D is essential in the balance of calcium and phosphorus as well as bone growth and control of many metabolic pathways[17] Vitamin deficiency in pregnant women should be treated with vitamin A during pregnancy for the purpose of maintaining the health of the fetus as well as the role of vitamin D in reducing the incidence of heart disease and ovarian cystitis and many other diseases.

Hemoglobin Concentration:

The results of the statistical analysis showed a significant decrease in the concentration of hemoglobin in the blood of pregnant and non-pregnant women compared to the control group at the probability level P <0.05. The average concentration of hemoglobin in the group of pregnant women, control group and non-pregnant women group was 8.4,12.8,11.6 g/dl respectively, Figure 2 showed the average concentration of hemoglobin in the three studied groups. The results showed a significant difference between the non-pregnant women group and the control group and no significant differences between the control group and the pregnant women group at the probability level P <0.05 .

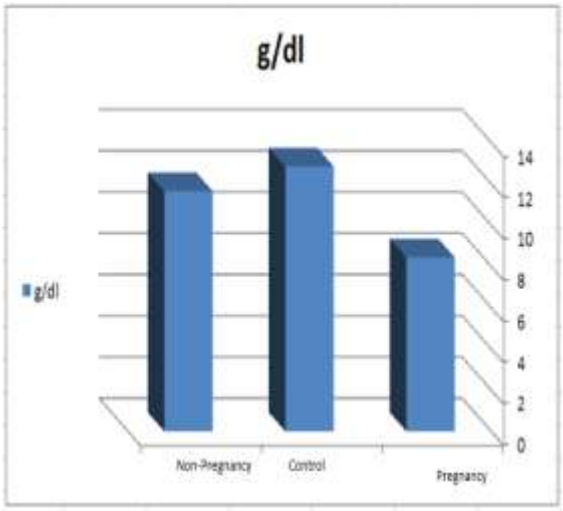

Figure (2): Mean concentration of hemoglobin in the three studied groups

Percentage of Packed Cell Volume (PCV):

The results of the present study showed a significant decrease in the volume of PCV in the two studied groups of vitamin D deficiency compaire with control group at the probability level P <0.05. The average size of PCV in the group of pregnant women, control group and non-pregnant women was 37.3,39.7, 40.0 % respectively the figure (3) showed the average comparison of the PCV in the three studied groups that there was no significant difference in the volume of compressed red blood cells in the three studied groups at the probability level P <0.05.

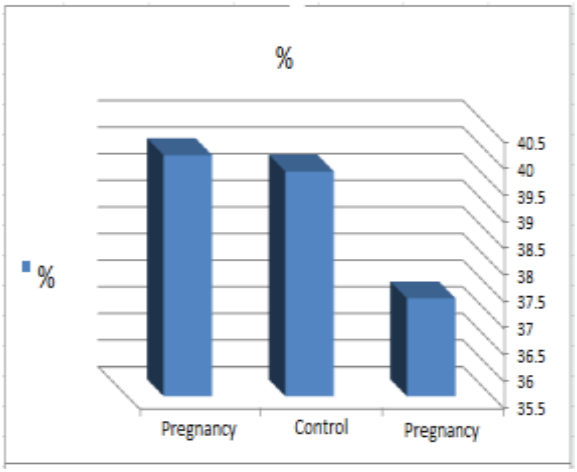

Figure (3): Average volume PCV in the three studied groups

Platelets:

The results showes non significant differences in platelet counts in the three studied groups at the P <0.05 level. The mean number of platelets in the group of pregnant women, control group and non-pregnant women was 208,237,222 X1000/mm3 respectively. Figure (4). The results of the comparison between the

two groups showed no significant differences in the number of thrombocytes in the three studied groups at the probability level P <0.05.

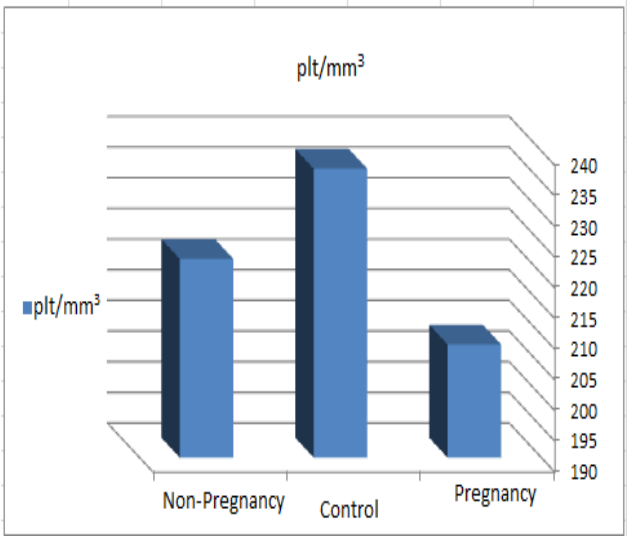

Figure (4): The average number of platelets in the three studied groups

White Blood Cells:

A significant defferences in the number of white blood cells in the blood of pregnant women and non-pregnant women at the probability level P <0.05 compared to control group. The average number of white blood cells in the pregnant women group, control group and non-pregnant women group (10.6. , 9.08, 3.5) x1000/mm^3 respectively, Figure (5) .The results showed a significant difference between the non-pregnant women group and the control group at P <0.05

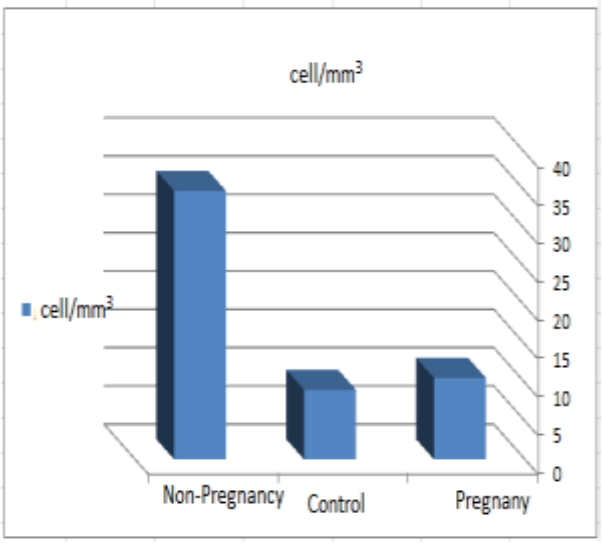

Figure (5): Mean number of white blood cells in the three studied groups

The results of our current study showed a decrease in the level of hemoglobin in the blood of pregnant women compared to the other studied groups, as well as a decrease in the proportion of blood corpuscles compressed PCV in the groups studied while the number of red blood cells/.knmj,k0.320011.

Remained within the normal values of the three groups. Anemia is a disease caused by iron deficiency in the mother's body due to increased fetal need for iron to form blood. Hemoclobin is also responsible for the transfer and exchange of gases in the blood. Vitamin D plays an important role in the formation of red blood cells through its effect on the Erothropoitein hormone in the kidney thus stimulates the production of blood cells from the bone marrow[18]

Many studies agree that vitamin D directly affects the formation of red blood cells (Erythropoiesis) and that a deficiency of vitamin D leads to a decrease in the concentration of hemoglobin and the incidence of anemia[20] the results of current study agree with what it was found[19] It was noted that vitamin D deficiency was associated with hypocholesterolemia and an increase in the number of blood vessels. It was explained why vitamin D plays a major role in influencing the formation of different blood cells.

The results of our current study are consistent with a study[22], finding a significant decrease in the concentration of hemoglobin in pregnant women. This result was explained by the relationship between vitamin D and the development of anemia during pregnancy. The suggested mechanism of effect is that vitamin D regulates expression and production of (Erythropoitein) for the production of erythrocyte progenitor (Erythropoitein). By activating its recipients on the Erthroid progenitor cells as well as contributing to the maturity and composition of the proliferative) Erythroid burst forming, which is stimulated with Erythropoitein hormone to produce red blood cells. The lack of vitamin D results in a decrease in the production of Calcitriol (the compound α-25-hihydroxy-vitamin D3) in bone marrow thus reducing the formation of red blood cells process (Erythropoiesis) [23]

The relationship between vitamin D deficiency and the occurrence of many cardiovascular diseases is attributed to the effect of vitamin D on the production of platelets, as well as vitamin D affects the (Blood Volume) and thus increase the activation of blood platelets and increase their numbers. The results of our current study with[25]. It was noted that the number of

thrombocytopenia was within the normal limits of pregnant women despite the occurrence of vitamin D deficiency. This can be explained by an inverse relationship between platelet size and platelet counts (Mean Platelet Volume MPV) . The life span of the thrombocytopenia decreases and the average platelet size usually increases during pregnancy. Vitamin D is classified as Preprohormone because the main source of vitamin is made inside the body and 10% of it is taken through food, so we find that vitamin D has a wide spectrum of effect on the physiology of the body and that vitamin D deficiency leads to the emergence of many diseases, especially in the pregnant mother[26].

The results of our current study indicate an increase in the number of total white blood cells in pregnant and non-pregnant women compared to control group. White blood cells are one of the components of the immune system in the body and perform a number of important functions such as protecting the body from pathogens and has a large role in allergic reactions and heparin secretion Which prevents blood clotting and secreting from basophile cells. As vitamin D plays a major role in metabolizing minerals, building bones and stimulating immune defenses. It is believed that there is a correlation between the concentration of vitamin D and the number of white blood cells. In study it was observed that low concentration of vitamin D leads to an increase in white blood cells[27] as this result indicates the role of vitamin D in maintaining the stability of the components of the immune system and shows a relationship between the components of the immune system, such as Cytokines and C-reactive protein CRP) and concentration of vitamin D and the presence of vitamin D high concentrations lead to reduce the incidence of inflammation[28] . The results of current study are consistent with the study of[29]. It was noted that the low concentration of vitamin D is associated with the increase in the number of white blood cells and that the relationship between vitamin D and the numbers of white blood cells is an important indicator to follow the condition of the immune system, especially that the pregnant need to strengthen its immune system to maintain health and life of the fetus, so it is necessary to strengthen the mother with vitamin D during pregnancy to ensure that they have good concentrations that help to strengthen immunity in the body and thus the body of the fetus[30] .

Concentration of IgE:

The results of the statistical analysis showed a significant decrease in IgE concentration in the three studied groups at P <0.05. The mean IgE concentration in pregnant women's blood and control and non-pregnant women (79.8,90.6,82.20) U / L, respectively, Figure (6) Mean IgE concentration in the blood of the three studied groups. The results of the comparison between the two mean differences were significant between the three studied groups of the probability level P <0.05 .

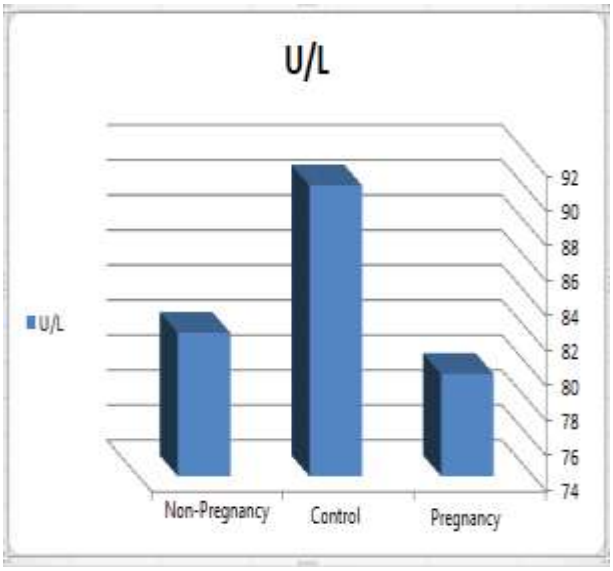

Figure (6): Mean concentration of IgE in the three studied groups

The results of current study indicate that there is a significant decrease in the IgE concentration in pregnant women. IgE is the antibody that causes allergic diseases. This is consistent with many research studies that show a close relationship between vitamin D and IgE and allergen factors. The results of our current study are consistent with the study of vitamin D, which observed a relationship between vitamin D and the incidence of multiple infections in pregnant women..

The continuation to get vitamin D by the mother during pregnancy leads to increased immunization of the child born against various allergic diseases[31]. IgE antibodies that are produced by the immune system (Antibodies) are called allergy antibodies (Allergy).

The results of current study are consistent with what they found[32] as they reported a decrease in the concentration of IgE antibodies during pregnancy. Studies indicate that IgE increases at the beginning of pregnancy during the first months, which may cause the

appearance of allergy symptoms in pregnant women, the decline begins gradually as pregnancy progresses, vitamin D is very important in the immune reactions Immunomodulator) as well as many important functions in enhancing the side Immune system and prevent the emergence of cancerous diseases and work on the development of embryonic stages correctly without the existence of congenital malformations[33]. The study indicated that vitamin D deficiency is associated with (Asthma), resulting in an increase in the concentration of IgE in the blood[34].

Concentration of C-reactive Protein:

The results of the C-reactive protein test in the serum of the three studied groups showed that all the samples had normal value of C-Reactive protein test. The results of current study show that vitamin D deficiency does not affect the concentration of active C protein. The effectiveness of vitamin D is known to have two functional types, namely metabolism calcium and non-metabolism calcium. Calcium consisted of controlling the concentration of calcium and phosphorus in the blood through kidney function, the small intestine and the (parathyroid gland). While non-Calcaemics include control of the design of cellular differentiation, the formation of blood cells in the bone marrow, immune regulation, and formation of immunity. Vitamin D on the immune system is clear and precise as the lack of vitamin D leads to the many diseases like asthma and autoimmune diseases[35].

The results of current study agree with a study[24], noting that the relationship between vitamin D deficiency and the level of active protein C is a positive and within normal range. This is confirmed by a study[36]. Vitamin D deficiency is associated with Asthma disease and the level of active C protein within normal limits is found in the study of 7[3]. The effective C protein is one of the essential components of innate immunity, one of the immune manifestations of the signs of inflammation in the body.

The results of current study correlates with what was found in[37] as there was no association between vitamin D deficiency and an active of protein C stimulation. Vitamin D affects the stimulation of T & B lymphocytes and regulates the immune system[12]. C-reactive protein is one of the acute phase proteins (Acut-Phase), which acts as an early indicator of inflammation, a protein made in the liver and increased in the case of inflammation[38]. The level of active C protein in the blood of pregnant women is affected by the tissue response to insulin. A slight decrease in insulin sensitivity occurs during pregnancy, so the level of C protein is affected by a number of factors during pregnancy, the most important of which is the effective C protein test[39]. The mother's preparation of a good quantity of vitamin D during pregnancy leads to a decrease in the value of CRP and works to protect both maternal and child health[40].The effective C protein is one of the factors that stimulate phagocytosis by stimulating the movement of white cells (leucocytes), Some research and studies have suggested that active C protein can play a major role in repairing and rebuilding tissue after damage has occurred[41]

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