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Physiological Changes in Hematological Parameters and Nutritional Awareness of Pregnant women in Al-bayda city.

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Abstract:

Pregnancy is characterized by a deep modification of physiological functions of the pregnant woman's body. Indeed, during the pregnancy, there is a considerable increase of the metabolic needs, as well as modifications of the hormonal balance. These phenomena provide enough justification for the hematological disorders. Low hemoglobin or anemia is one of the most commonly encountered medical disorders during pregnancy. The study was descriptive cross sectional study, conducted during the period from October 2017 to December 2017, aimed to assess the anemia status and nutritional awareness in pregnant women in Al-bayda city. Fifty pregnant women were enrolled in this study, from each woman, 2 mL of venous blood was collected for measuring the RBCs count, hemoglobin, hematocrit, and mean corpuscular volume the data were collected using questionnaire. The main result showed that significant decreased in RBCs count, hemoglobin, hematocrit, and mean corpuscular volume of pregnant women who have poor nutrition compared with pregnant women who have excellent and medium nutrition. The study concluded that the prevalence of pregnancy-related anemia was significantly higher in pregnancy women that have low economic status.

Key words: Pregnancy, Nutrition, Hematological Parameters, anemia.

Introduction:

A healthy and varied diet is important at all times in life, but particularly so during pregnancy. The maternal diet must provide sufficient energy and nutrients to meet the mother’s usual requirements, as well as the needs of the growing fetus, and enable the mother to lay down stores of nutrients required for fetal development as well as for lactation. The dietary recommendations for pregnant women are actually very similar to those for other adults, but with a few notable exceptions. The main recommendation is to follow a healthy, balanced diet based on the Balance of Good Health model. In particular, pregnant women

should try to consume plenty of iron- and folate-rich foods, and a daily supplement of vitamin D (10 µg/day) is recommended throughout pregnancy [1].

Pregnancy is an occasion when women become more aware of the importance of healthy nutrition and seek for more nutrition-related information. Compared to the period before preconception and pregnancy, pregnant women are more eager to know what they should eat and what not [2]. A poor pregnancy diet can lead to various nutritional deficiencies. Proper nutrition is a part of pregnancy that cannot be forsaken. A balanced diet full of whole grains, fruits and vegetables will help keep health throughout pregnancy [3]. Inadequate nutrition, especially early in the pregnancy, may impair fetal brain development and cause abnormalities in endocrine functioning, organ development and the energy metabolism of child [4]. Education is an important factor in health promotion.

Nutrition during pregnancy plays an important role in the well-being of the mother and fetus, and may further influence the health of the children later in life [5]. One of the complications of in proper diet and nutrition during pregnancy is anemia; it can develop in any pregnant women physiologically due to increase demand of iron and vitamin during the pregnancy [6]. Iron deficiency and iron deficiency anemia are serious public health problems throughout the life cycle in both industrialized and developing countries, with negative consequences on maternal and child mortality, cognitive and physical development of children, and physical performance and work capacity in adults. Strategies to control deficiencies include dietary diversification, food fortification, vitamins and iron supplementation. Maternal iron status has been a critical factor for pregnancy outcomes, because maternal anemia as well as iron deficiency increases the risk of adverse pregnancy outcomes such as preterm delivery and low birthweight. Iron supplementation is a common recommendation for pregnant women to prevent iron deficiency during pregnancy [7].

Women go through a variety of physiological changes during pregnancy. Changes in the blood circulatory system are particularly notable, permitting normal fetal growth. Even in normal pregnant women, the hemoglobin concentration decreases with dilution according to the increase in the volume of circulating blood. Since iron and folic acid in amounts necessary to the fetus are preferentially transported to the fetus, the mother is likely to

develop iron deficiency anemia and folic acid deficiency anemia. About 20% of pregnant women suffer anemia, and most of the cases are iron deficiency, folic acid deficiency, or both [8,9].

Anemia is one of the most commonly encountered medical disorders during pregnancy. In developing countries it is a cause of serious concern as, besides many other adverse effects on the mother and the fetus it contributes significantly high maternal mortality. According to United Nation declaration 1997, anemia is a major public health problem that needs total elimination. It is estimated that globally two billion people suffer from anemia or iron deficiency [10]. The word implies a decrease in the oxygen-carrying capacity of the blood and is best characterized by a reduction in hemoglobin concentration. Most of the anemia is due to deficiency of essential nutrients which maintain hemoglobin level, like iron, folic acid and vitamin B_{12}, proteins, amino acids, vitamins A, C, and other vitamins of B-complex group vitamins i.e., niacin and pantothenic acid [8]. Anemia during pregnancy is partly due to physiological hemodilution and insufficient availability of essential nutrients for hemoglobin (HGB) synthesis and red blood cell (RBC) production in the erythron, such as iron, folic acid and vitamin B_{12} [11]. According to World Health Organization (WHO) has estimated that prevalence of anemia in developed and developing countries in pregnant women is 14 per cent in developed and 51 per cent in developing countries. Prevalence of anemia in all the groups is higher in India as compared to other developing countries [12]. Relative anemia is normal physiological phenomenon that occurs in pregnancy due to larger increase in plasma volume (approximately 45.0% in singleton and 50.0-60.0% in twin gestation) than in red cell mass, resulting in the well-known physiological anemia of pregnancy while absolute anemia involves a true decrease in red cell mass, involving increased red cell destruction as in haemoglobinopathy, malaria, bacterial infection as in urinary tract infection, bleeding or decreased red cell production as in nutritional deficiency\ or chronic disease [13,14]. In developing countries and in retrospective studies, it has been found that the frequencies of fetal death, low-birth-weight newborns, and premature delivery are significantly higher in cases of maternal anemia [8].

During pregnancy, plasma renin activity tends to increase and atrial natriuretic peptide levels tend to reduce, though slightly. This suggests that, in pregnant state, the elevation in

plasma volume is in response to an under filled vascular system resulting from systemic vasodilatation and increase in vascular capacitance, rather than actual blood volume expansion, which would produce the opposite hormonal profile instead (i.e., low plasma renin and elevated atrial natriuretic peptide levels) [15]. Red cell mass (driven by an increase in maternal erythropoietin production) also increases, but relatively less, compared with the increase in plasma volume, the net result being a dip in hemoglobin concentration. Thus, there is dilutional anemia. The drop in hemoglobin is typically by 1–2 g/dL by the late second trimester and stabilizes thereafter in the third trimester, when there is a reduction in maternal plasma volume (owing to an increase in levels of atrial natriuretic peptide). Women who take iron supplements have less pronounced changes in hemoglobin, as they increase their red cell mass in a more proportionate manner than those not on hematinic supplements [16].

The study reported here was designed to assess the anemia status and nutritional awareness in pregnant women in Al-bayda city.

Materials and Methods:

1. **Pregnant Women Inclusion.** This study was conducted during the period from October 2017 to December 2017, in Al-bayda city. 50 pregnant women were enrolled in this study. During the period of study, there was a cross-sectional descriptive and analytical study, aimed to investigate status of anemia among pregnant women. The study was carried out at Althora Teaching Hospital in Al-bayda city included 50 females aged 16 to 42 years.

The data were collected by using questionnaire about clinical history of the pregnant woman, Age, socioeconomic status, parity, date of last menstruation, estimated date of partum, risk factors during pregnancy, pregnancy planning, clinical antecedents, surgery, personal obstetric data, height, weight of the mother, nutritional awareness, knowledge about anemia, iron supplement intake, multivitamins, adherence to iron supplementation and possible adverse effects.

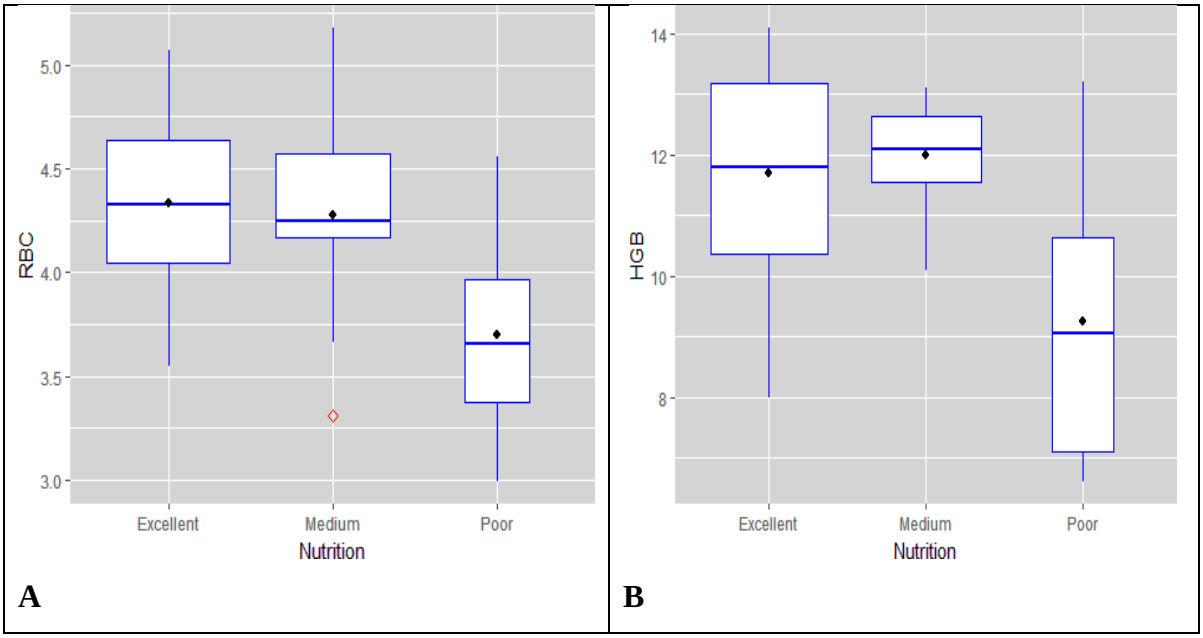
2. **Study sample.** From each woman, 2 mL of venous blood was collected in EDTA anticoagulated blood container for measuring the hemoglobin concentration. The samples were transported to the Althora teaching hospital lab for immediate analyses of HGB concentration, HCT, RBC concentration, MCV estimation using spectrophotometric method

and used (Biosystemsbts310-Germany). In the lab, Before processing, the samples in the EDTA tubes were inversed mixed 10 times to ensure that the blood was well mixed before carrying out estimation.

3. **Statistical analysis.** Data of the questionnaire and results of blood tests were analyzed using the Microsoft Office Excel (Microsoft Office Excel for windows; 2010) and software program statistical package for social sciences SPSS (version 17). With level of ($p<$ 0.05).

Results:

The study revealed that there were significant decreased in RBCs count (fig.1A), hemoglobin (HGB) (fig.1B), hematocrit (HCT) (fig.1C), and mean corpuscular volume (MCV) (fig.1D) of pregnant women who have poor nutrition compared with pregnant women who have excellent and medium nutrition.



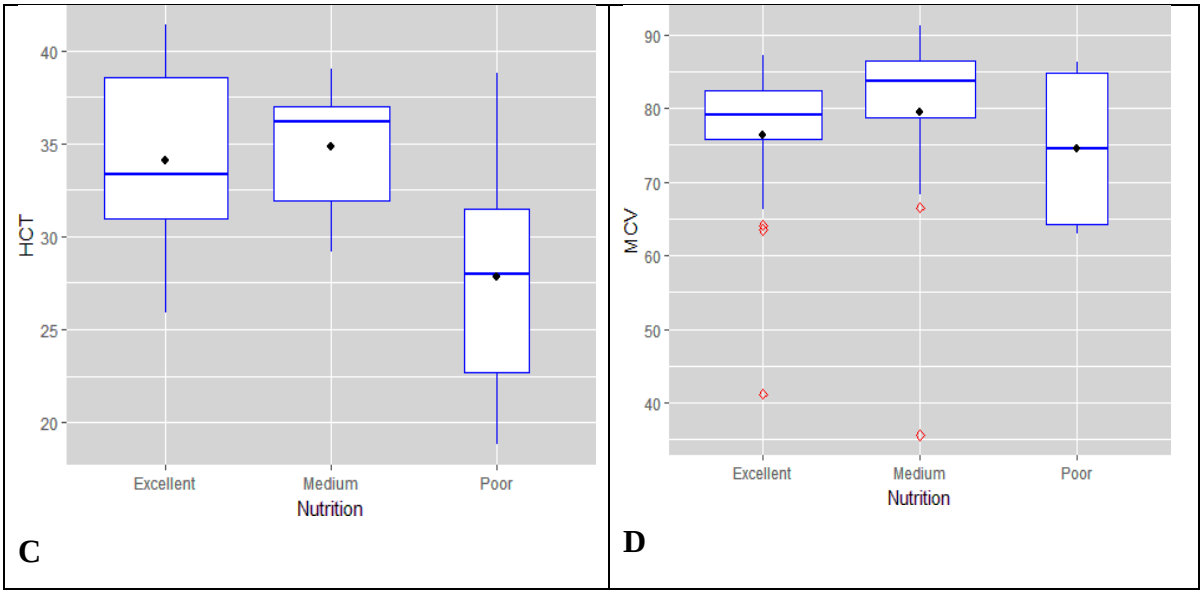


Figure 1: showing the decreasing in RBCs count (×10^12 /L) (fig.1A), hemoglobin (g/dL) (fig.1B), hematocrit (%) (fig.1C), and mean corpuscular volume (fl) (fig.1D) of pregnant women who have poor nutrition compared with pregnant women who have excellent and medium nutrition.

Discussion:

In the current study it was evident that anemia was significantly associated with nutrition status of the study subjects. The prevalence of pregnancy related anemia was higher amongst those with low economic status. It was encountered more frequently in women who have poorly nutrition. Similar observation have been reported in related studies. It is suggested that women in low economic classes and often have financial constraints [17]. Such women are likely to find it difficult to access and afford good health services. They are therefore more likely to suffer the adverse effects of poor/inadequate nutrition, acute/chronic infections with anemia as reported elsewhere. Furthermore, some cases of maternal anemia often have their origin in a woman's life before pregnancy [18].

Physiological changes in pregnancy and puerperium are principally influenced by changes in the hormonal milieu. Many hematological changes also, occurring during these periods are physiological and are of concern about anemia in pregnancy women. In pregnancy, lower hemoglobin occurs as a physiological phenomenon especially in the second trimester. Iron need is increased as a result of higher iron demand to accommodate the requirement of fetal placental unit [19]. Since anemia in pregnancy may lead to adverse

pregnancy outcomes and maternal deaths [20], iron supplementation and proper nutrition are needed to fulfill the iron deficiency in pregnancy [21]. Anemia is a lack of functioning red blood cells (RBCs) that leads to a lack of oxygen-carrying ability, causing unusual complications during life time. These RBCs are produced in the bone marrow. They have a life expectancy of about 120 days. Among other things, the body needs iron, vitamin B_{12} & folic acid for erythropoiesis. If there is a lack of one or more of these ingredients or there is an increased loss of RBCs, anemia develops [9]. Any patient with a HGB of less than 11 gm/dl to 11.5 gm/dl at the start of pregnancy will be treated as anemic. The reason is that as the pregnancy progresses, the blood is diluted and the woman will eventually become anemic. The dilution of blood in pregnancy is a natural process and starts at approximately at the eighth week of pregnancy and progresses until the 32nd to 34th week of pregnancy [22]. Moreover, during pregnancy there is disproportionate increase in plasma volume up to 50%, RBC 33% and HGB 18-20% mass. In addition there is marked demand of extra iron during pregnancy especially in the second half of pregnancy. So, physiological anemia is due to combined effect of hemodialution & negative iron balance. Criteria of Physiological Anemia include [23].

Furthermore, our study showed that, decline in RBCs count, hemoglobin (HGB), hematocrit (HCT), and mean corpuscular volume (MCV) of pregnant women who have poor nutrition compared with pregnant women who have excellent and medium nutrition. These results were in agreement with [24,25] who explained that, The progressive decline in HGB concentration may be due to an increased demand for iron as pregnancy progresses. More iron is required to meet the expansion of maternal HGB mass and the needs of fetal growth [26]. The additional progesterone and estrogen that are secreted by the placenta during pregnancy cause a release of renin from the kidneys. Renin stimulates the aldosterone-renin-angiotensin mechanism, leading to sodium retention and increased plasma volume [27]. The increase in plasma volume is relatively greater than the increase in red cell mass, which results in a fall in maternal HGB, hence the physiological anemia that occurs in pregnancy. These findings may be a reflection of iron deficiency anemia [28]. In the case of iron deficiency anemia during pregnancy, there are several possible risks to the mother, including increased fatigue, short-term memory loss, decreased attention span and decreased performance at work, increased pressure on the cardiovascular system due to insufficient

HGB and low blood oxygen saturation levels, lower resistance to infections and a reduced tolerance to significant blood loss and to surgical interventions during labor [29,30]. The presumed risks of iron deficiency for the fetus relate to the fact that low iron levels increase the risk of reduced HGB levels, and therefore oxygen, to the uterus, placenta and the fetus during development [30]. The most common cause of anemia in pregnancy is lack of iron. Less often, it is caused by folic acid deficiency. In some populations, 80% of pregnant women are anemic. Those most at risk are women from low economic groups [9].

It is now well established that maternal nutritional status at the time of conception is an important determinant of embryonic and fetal growth. The embryo is most vulnerable to the effects of poor maternal diet during the first few weeks of development, often before pregnancy has been confirmed. Cell differentiation is most rapid at this time and any abnormalities in cell division cannot be corrected at a later stage. Most organs, although very small, have already been formed 3–7 weeks after the last menstrual period and any teratogenic effects (including abnormal development) may have occurred by this time. Improving nutritional status in women prior to pregnancy has a beneficial influence on subsequent birth outcomes [1]. If all women of childbearing age were to eat a varied and adequate diet, this would help to correct any nutritional imbalances and would help to ensure that the fetus has the best nutritional environment in which to develop. Attention to the diet at this stage also sets appropriate dietary habits to be followed throughout pregnancy [2]. The Food Standards Agency (FSA) provides dietary advice for women planning a pregnancy. The general dietary recommendations are similar to the advice given to non-pregnant women in terms of following a healthy, varied and balanced diet to ensure an adequate intake of energy and nutrients. There is also an additional emphasis on consuming plenty of iron- and folate-rich foods. Women who may become pregnant are also advised to take a folic acid supplement of 400 µg per day. Maternal nutritional status at the time of conception is an important determinant of fetal growth and development, and therefore a healthy, balanced diet is important before, as well as during, pregnancy. Pregnant women are therefore advised to consume plenty of iron-rich foods during pregnancy and, in some cases, supplementation may be necessary. Lower economic status is associated with adverse pregnancy outcomes, including low birth weight and an increased risk of neonatal and post-neonatal mortality, where poor maternal diet is a major cause of low body weight globally [1].

Conclusion:

It is concluded that the prevalence of pregnancy-related anemia was significantly higher in pregnancy women that have low nutrition and economic status.

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