**THE EFFECT OF VITAMIN C ON SOME BLOOD PARAMETERS AND IRON STATUS DURING MENSTRUAL CYCLE IN WOMEN OF HOLLY AL-NAGAF PROVINCE**

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**خلاصة البحث:**

ان اخذ جرعة من فيتامين ج لها تأثير على بعض معايير الدم وحالة الحديد لدى النساء خلال الدورة الشهرية وان الهدف من هذه الدراسة هو محاولة التعرف على مدى تأثير فيتامين ج على بعض المعايير المهمة للدم وايضا مستوى الحديد في بلازما الدم لدى النساء خلال الدورة الشهرية محاولين التعرف عن مدى امكانية استخدام هذا الفيتامين في تعويض النقص الحاصل في الحديد في النساء خلال الدورة الشهرية. حيث هذه الدراسة أجريت على خمسين إمراة تم اختيارهن بصورة عشوائية من الأقارب والأصدقاء والجيران لفترة استمرت ستة أشهر ,اثنان وعشرون من النساء غير متزوجات والبقية متزوجات تتراوح أعمارهن من (20 – 45 ) سنة (ذوات دورة شهرية منتظمة ) وقد فهمن الغرض من هذه الدراسة وقد خضعن إلى فحص الدم الكامل وذلك باستخدام جهاز تحليل الدم الاوتوماتيكي "سيسمكس" لتحديد معايير الدم لهن والتي تتضمن حساب العدد التفريقي لكريات الدم الحمر, تركيز الهيموغلوبين, معدل حجم كرية الدم الحمراء, معدل هيموغلوبين كريه الدم الحمراء, معدل تركيز الهيموغلوبين لكرية الدم الحمراء وكذلك حساب تركيز الحديد, قابلية الارتباط الكلية للحديد و فرتين في المصل ومع تناول جرعة الفيتامين ج ولفترة (29±1) يوم حيث هذه الفحوصات أجريت بعد تحديد اليوم 24 من الدورة الشهرية الاولى (اربعة ايام قبل الدورة) واليوم الرابع اثناء حدوث الدورة الشهرية حيث خضعت كل امرأة في هذين اليومين وقبل تناول الجرعة الأولى من فيتامين ج إلى الفحوصات المشار إليها سابقا وذلك بعد سحب (5 مل) من الدم من كل امراة وفي اليوم الرابع من الدورة الشهرية بدأت كل امرأة بتناول الفيتامين ج عن طريق الفم بجرعة ( 500 ملغ) يوميا مقسمة على جرعتين واستمرت حتى اليوم الرابع من الدورة الشهرية اللاحقة (29±1 يوم) وفي نفس اليومين (24, 4) للدورة الشهرية اللاحقة أعيدت الفحوصات المشار إليها سابقا مع التوقف عن اخذ الجرعة من فيتامين ج في اليوم الرابع من الدورة الشهرية اللاحقة.

 نتائج هذه الدراسة أظهرت: أن للفيتامين ج تأثير على بعض معايير الدم حيث كانت الزيادة معنوية (P<0.05) قبل وبعد الدورة الشهرية مقارنة بفترة ما قبل اخذ جرعة الفيتامين ج بالإضافة إلى الزيادة المعنوية في هذه المعايير بعد اخذ جرعة الفيتامين (بعد الدورة الشهرية مقارنة بفترة قبل الدورة قبل اخذ جرعة الفيتامين) للنساء المتزوجات وغير المتزوجات. كذلك لوحظ تأثير الفيتامين ج على تركيز الحديد والفرتين في الدم حيث كانت الزيادة معنوية (P<0.05) قبل وبعد الدورة الشهرية بعد اخذ جرعة الفيتامين مقارنة بفترة ما قبل اخذ جرعة الفيتامين كذلك حصول تحسن ملحوظ في هذين التركيزين بعد اخذ جرعة الفيتامين مقارنة بفترة ما قبل الدورة قبل اخذ جرعة الفيتامين, أما تأثير الفيتامين ج على مستوى قابلية الارتباط الكلية للحديد فقد تبين إن هناك نقصان معنوي في مستواه قبل وبعد الدورة الشهرية بعد اخذ جرعة الفيتامين وكذلك نقصان في هذا المستوى بعد الدورة الشهرية بعد اخذ جرعة الفيتامين مقارنة بفترة ما قبل الدورة الشهرية قبل اخذ جرعة من الفيتامين.

**Abstract**

 The supplementation of Vitamin C has an effect on some parameters of blood and iron status in women during menstrual cycle. The aim of this study is designed to know more about the role of this vitamin during menstruation on some parameters of blood and iron status trying to solve deficient of Iron in woman through monstrous cycle by treatment with this vitamin.

 This study was achieved on fifty women selected randomly from relatives, friends and nigherboring in a period of six month: twenty two of them were unmarried; another twenty eight were married. Their age ranges (20-45) years (with regular menstruation). They understood the aim of this study and they were subjected to complete blood test by using Hematological Auto analyzer apparatus "Sysmex" for estimation of their parameters of blood which are include red blood cells count (RBCs), hemoglobin concentration (Hb), mean cell volume (MCV), mean cell hemoglobin (MCH) and mean cell hemoglobin concentration (MCHC), the measurement of their serum concentration of iron, the total iron binding capacity and ferritin in serum that are associated with administration of vitamin C in a period that continues for about (29±1day). So this examination would take place after determined the day 24th of a regular menstrual cycle (four days before menses) and the day 4th of menses. At these two days and before vitamin C administration, (5 ml) of blood was taken from each examined woman for complete blood test and for measurement serum concentrations of iron status as mentioned above. Each woman had (500mg) vitamin C orally on the bases of twice daily after meal. Her administration of vitamin C begins in the day 4th of first cycle and continues for (29±1day) for the day 4th of the next cycle.

 At the same two days (4th, 24th) of the next cycle, the above procedures were repeated and vitamin C administration was stopped in the day 4th of menses of the next cycle.

 The results of the present study is indicated that the Vitamin C has an effect on the level of some parameters of blood and there is significantly increase (P<0.05) before and after menses compared with the period of before administration of Vitamin C, also the same thing on serum concentration of iron and ferritin (P<0.05). While the effect of Vitamin C on the concentration of total iron binding capacity; there is significantly decrease (P<0.05) before and after menses before administration of Vitamin C, also decrease in its level after menses after supply of Vitamin C.

**INTRODUCTION**

 Vitamin C (L-ascorbic acid) was an organic compound needed in small quantities for normal metabolism; the daily requirements of vitamin C vary depending on such factors as, body mass, rate of growth and pregnancy (Arthur and John, 2006). The average intake of vitamin C was about (95 mg) for women, (107 mg) for men while pregnant and smoke tobacco were require slightly more (Frei *et al*., 2012). The orders chiropterans, anthropoids and human were lack the ability to synthesis ascorbate internally from glucose due to they lack L-gulonolactone oxidase, the enzyme that responsible for convert dehydroascorbic acid (DHA) to ascorbate and the main sources of vitamin C are fruits and vegetables (Padayatty *et al*., 2003 and Carl *et al*., 2008). Glut1+Glut3 were glucose transport and transfer only DHA form while SVCT1and SVCT2 imported it across plasma membrane for absorption rapidly from intestinal cell by a process of facilitated diffusion (Savini *et al*., 2008). Ascorbic acid was important for the synthesis of collagen (which is important component of blood vessels, tendon, ligaments and bone), carnitine (small molecule that is essential for the transport of fat into mitochondria) and nor epinephrine; also it was act as enzyme cofactor by maintaining metal ions in their reduced form (Erdman *et al*., 2012). Vitamin C was non-enzymatic antioxidant in [plasma](http://lpi.oregonstate.edu/mic/glossary#plasma) and tissues protected [proteins](http://lpi.oregonstate.edu/mic/glossary#protein), [lipids](http://lpi.oregonstate.edu/mic/glossary#lipid), [carbohydrates](http://lpi.oregonstate.edu/mic/glossary#carbohydrate), and [nucleic acids](http://lpi.oregonstate.edu/mic/glossary#nucleic-acid) from damage by [free radicals](http://lpi.oregonstate.edu/mic/glossary#free-radical) and [reactive oxygen species](http://lpi.oregonstate.edu/mic/glossary#reactive-oxygen-species) (ROS) that are generated during normal [metabolism](http://lpi.oregonstate.edu/mic/glossary#metabolism), by active immune cells and cigarette smoke, also help to regenerate [vitamin E](http://lpi.oregonstate.edu/mic/vitamins/vitamin-E) and glutathione from its [oxidized](http://lpi.oregonstate.edu/mic/glossary#oxidation) form (Combs, 2012 and Carr *et al*., 2013 ).

 Severe vitamin C deficiency has been known as scurvy; Symptoms of scurvy include [subcutaneous](http://lpi.oregonstate.edu/mic/glossary#subcutaneous) bleeding, poor wound closure, bruising easily, hair and tooth loss, weakening of blood vessels, connective tissue and bone (Lykkesfeldt and Poulsen, 2010). Vitamin C has been helpful in treating preeclampsia in pregnant women, [periodontal disease](http://health.howstuffworks.com/diseases-and-conditions-channel.htm), autoimmune disease, hypertension, lead toxicity, cataract, cancer, diabetic, hair loss and asthma (Hutchinson *et al*., 2012 and Harrison *et al*., 2014). There was close relationship between iron absorption and vitamin C; since the large percent of iron in body found in hemoglobin 67%, little quantity of iron found myoglobin 3.5%, enzymes required for biochemical reaction 2.5% and 27% storage as ferritin and hemosiderin; actually 80% of heme synthesis occurs in bone marrow and 20% in liver (Miret *et al*., 2003). The healthy adults were absorbed iron about (10%) from plant food and (15%to 35%) from red meat. Dietary iron is absorbed in the duodenum in form of ferrous (Fe+2), normally the man and woman were need 8.7 mg/day and 14.8 mg/day of iron respectively while 500 mg contained in ferritin complex in bone marrow that used to compensate the amount of iron lost during the menstrual cycle (Severyn *et al*., 2009). The Normal serum ferritin levels were 300 µg/L in men and postmenopausal women while about 200 µg/L in premenopausal women; ferritin was released from damaged hepatocytes; thus levels were elevated in inflammatory disorders, alcohol excess, malignancy, renal failure and metabolic syndrome (Koperdanova and Cullis, 2015). The World Health Organization (WHO) was considered the iron deficiency anemia (IDA) was the number one nutritional disorder in the world and 80% of the world population may be iron deficient and 30% may have IDA (Anderson *et al*., 2009). Ferritin was served to store iron in a non-toxic form (Apo ferritin was bind with the free ferrous iron and stores it in the ferric state) and then transport it to areas where it is required (for synthesis of Hb) so that the high plasma level of iron was a major trigger for the production of ferritin (Chifman *et al*., 2014). When the ferritin level was low (<50 ng/mL), there was a risk for lack of iron, which could lead to [IDA](http://en.wikipedia.org/wiki/Anemia). Low ferritin might indicate in the deficiency of vitamin C (Kell and Pretorius, 2014). From the menarche, the needed of female for iron is about (30-90%) greater than of male, but in the 15% of women considered highly blood loss; the average blood loss during menses was about (35 ml with 10-80 ml) which is considered normal. Because of blood loss, women were more suspectable to iron deficiency anemia than men (Harvey *et al*., 2005). The absorption of non heme iron from plants sources was low due to the limited amount of foods that stimulate the absorption of non-heme iron or consumes large amount of beverages such as tea and coffee which are in phytates and tannins, which has been reported to inhibit iron absorption (Sam man *et al*., 2001). Ascorbic acid was either increased iron mobilization from many tissues (reticuloendothelial system) that stores it in form of ferritin and might improve the iron utilization in synthesis of HB ( Teucher *et a*l., 2004) or the ascorbate was considered as well-known iron-solubilizing and iron-reducing effect due to it was enhanced the activity of duodenal ferric reductace enzyme, which converted (Fe+3) to (Fe+2) to increase the absorption of non- heme iron, so that ascorbate deficiency was the contributing factor for iron deficiency anemia (Short and Domagalski, 2013).

**MATERIAL AND METHOD**

1. **Study population:**

This study was involved the clinical trial design and carried out throughout the period which extended for about six months. The initial total number of women obtained for this study was 56, but this number was reduced to 50 healthy women because 6 they became pregnant. However, these women mostly were selected randomly from relatives and friends (unmarried and married women) with regular menstrual cycle and were understood the objective of this study in order to ensure successful results. This study was achieved on fifty women, twenty two were unmarried and the remaining were married, their age range from (20-45) years and their Body Mass Index (BMI) range from (19-34 kg/m2).

1. **Data collection:**

 For this study self-report questionnaire was developed and face to face interviews were used to collect Information about Name, Age, Address, Telephone, smoking state, marital status (married or unmarried)), medical or surgical history, degree of ingested fruit (rich in vitamin C) if her consuming daily or every other day or once weakly, degree of ingested red meat if her consuming daily or weekly, socioeconomic status (if she has a job or household). Also we had available information about menstrual cycle (duration, severity and the date of first day of menses to determine the day 24th of the first cycle (four days before menses) and the day 4th through menses fall down that were determined by response to the questions.

**Exclusion criteria:**

1. The women who had gastrointestinal disturbance.
2. The women with unregularly menstrual cycle.
3. The women that administered some drugs like Aspirin, estrogen- containing contraceptive and anticoagulant.
4. The pregnant women.
5. The women who had inflammation, liver disorder, malignancy, iron over load and renal disease or predispose to kidney stone.
6. Weight and height measurement apparatus

 The weight of each woman is used by manual balance and height of them is measured by using tap measure. The aim of these measurements is to calculate their Body Mass Index (BMI) according to the following equation: BMI= Weight (kg)/ Height (m2), (Eknoyan and Garabed, 2008).

1. Vitamin C supplementation, hematological examination and iron status measurement:

 Firstly determined the day 24th of the first regular cycle (four days before menses) and day 4th of menses before supplementation of vitamin C for each woman, the blood sample was withdrawn from each examined woman about (5ml) in each date (day 24th before menses and day 4th through menses) This amount was divided into two parts:

 Part one (1ml): was put in EDTA tube to estimate some parameters of blood which involved (red blood cells count (RBCs), hemoglobin concentration (Hb), mean cell volume (MCV), mean cell hemoglobin (MCH) and mean cell hemoglobin concentration (MCHC) by using Auto analyzer hematological apparatus.

Part two (4ml): for measurement the concentration of Iron, Total Iron Binding Capacity (TIBC) and ferritin in serum as quantitative determined by using Iron, TIBC and ferritin Enzyme Immunoassay Test Kit using ELIZA apparatus.

*- Each woman starts in the day 4th of first menses* to supplement the first dose of vitamin C 500 mg (one tablet), which is divided into two pieces taken twice daily, ingested orally after a meal. It was manufactured by (REMEDICA PHARMACUTICAL INDUSTRY CO.) which is located in Limas sol – Cyprus

*-After first cycle (29±1day) of supplementation of vitamin C,* The hematological examination which we explained above were repeated in the same date; (day 24thof next cycle and day 4th through next cycle)

 A statically analysis was performed by using (paired t-test) to differentiate the means before and after menses at level of significant α=0.05, utilizing (SPSS: ver.18 for window) and (Excel) programs. All values were expressed as Means ± SD, P- value of less than 0.05 was considered statically significant.

Results:

The result of the present study viewed that no significantly differences in age (years) and body mass index (BMI) of married and unmarried women as in table (1):

 Table (1): Anthropometric data for married and unmarried women

|  |  |  |  |
| --- | --- | --- | --- |
| AnthropometricData (mean±SD) | Unmarried N=22 | Married N=28 | P- value |
| Age (years) | 27.18±5.3 |  33.89±3.2 | NS |
| BMI(kg/m2) | 28.18±4.2 | 32.64±6.3 | NS |

The effect of vitamin C on Red Blood Corpuscular (RBCs) counts (X106/mm3) in married and unmarried women

The result showed that a significantly increase (P<0.05) in RBCs count after administration of vitamin C (before and after menses) as compared with RBCs count before administration of vitamin C, also before the administration of vitamin C showed a significantly decrease (P<0.05) after menses as compared with before menses and this count of RBCs will be improved (increased significantly) after the administration of vitamin C as compared with before administration (before menses) as viewed in (Table 2)

Table (2): the effect of vitamin C on RBCs count in married and unmarried women (Mean±SD)

|  |  |  |
| --- | --- | --- |
| Administration ofvitamin C (500 mg) |  RBCs count  (X 106/µL) |  P-value |
| 4 days before Menses | 4 days after Menses  |  |
| Before administration (B) | 4.2 ±0.412 | 3.8 ±0.356@ | P<0.05 |
| After administration (A) | 4.97±0.397\* | 4.54±0.378\*@ | P<0.05 |

\*: significant increase (P<0.05) in RBCs count after administration of vitamin C as compared with before

 Administration of vitamin C.

@: significant differences (P<0.05) in RBCs count after menses (before and after administration of vitamin C as compared with before menses before administration of vitamin C

The effect of vitamin C on the level of Hb (g/dl) in blood in married and unmarried women

 The statically analysis for the level of Hb showed a significantly increase (P<0.05) in this parameter after administration of vitamin C (before and after menses) as compared with Hb level before administration of this vitamin while before administration of vitamin C the result indicated that a significantly decrease (P<0.05) in Hb level after menses as compared with before menses and this level will be improved (increased significant) after administration of vitamin C (12.06±0.98) as compared with before administration (before menses) as viewed in (Table 3).

Table (3): the effect of vitamin C on the level of Hemoglobin in married and unmarried women

|  |  |  |
| --- | --- | --- |
| Administration of vitamin C (500mg) | The level of Hb in blood(g/dl) | P- value |
| 4days before menses | 4days after menses |  |
| Before administration (B) | 11.8 ±1 | 11.04±1.01@ | P<0.05 |
| After administration (A) | 12.95±0.89\* | 12.06±0.98\*@ | P<0.05 |

 \*: significant increase (P<0.05) in Hb level after administration of vitamin C as compared with before

 Administration of vitamin C.

 @: significant differences (P<0.05) in Hb level after menses (before and after administration of vitamin

 C) as compared with before menses before administration of vitamin C

The effect of vitamin C administration on serum iron concentration in married and UN married women

The effect of vitamin C on serum iron concentration was showed in table (4) a significantly increase (P<0.05) after the administration of vitamin C (before and after menses) as compared with before administration of this vitamin But before the administration of vitamin C showed a significantly decrease (P<0.05) in the level of serum iron after menses as compared with before menses and its concentration will be improved (increased significantly) after administration of vitamin C as compared with before administration (before menses).

Table (4): the effect of vitamin C on serum iron concentration (µg/dl)

|  |  |  |
| --- | --- | --- |
| AdministrationVitamin C(500mg) | Serum iron concentration(µg/dl) | P-value |
| 4 days before menses | 4 days after menses |  |
| Beforeadministration(B) | 98.47±31.3 | 90.9±35.16@ | P<0.05 |
| Afteradministration(A) | 131±31.5\* |  112±29.6\*@ | P<0.05 |

\*: significant increase (P<0.05) in the serum iron concentration after administration of vitamin C as

 compared with before Administration of vitamin C.

 @: significant decrease (P<0.05) in the serum iron concentration after menses (before and after

 administration of vitamin C) as compared with before menses before administration of vitamin C

The effect of vitamin C on the values of Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH) and Mean Corpuscular Hemoglobin concentration (MCHC) in married and unmarried women

the result showed a significant decrease (P<0.05) in these values after menses as compared with before menses (before administration of vitamin C) and these parameters will be improved (increased significantly) after administration of vitamin C as compared with before administration (before and after menses) as viewed in (Table 5)

Table (5): the effect of vitamin C on MCV, MCH and MCHC in married and un married women

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Administrationof vitamin C(500mg) | Mean corpuscleVolume(Fl)MCV | Mean cellHemoglobin(pg)MCH | Mean cellhemoglobin concentration(g/dl)MCHC | P- value |
| 4 Days before menses | 4 days after menses | 4 days before menses | 4 days after menses | 4 days before menses | 4daysaftermenses |  |
| Beforeadministration(B) | 85.9±5.7 | 84.7±6.2@ | 27.5±2.5 | 26.±2@ | 31.5±1.7 | 30.1±1@ | P<0.05 |
| Afteradministration(A) | 88.1±5.2\* | 87.6±5\*@ | 28.9±2.2\* | 27 ±2.2\*@ | 33..5±1..5\* | 31.9±1\*@ | P<0.05 |

\*: significant increase (P<0.05) in MCV, MCH and MCHC after administration of vitamin C as compared with before administration of vitamin C.

@: significant differences (P<0.05) in MCV, MCH and MCHC after menses (before and after administration of vitamin C as compared with before menses before administration of vitamin C.

The effect of vitamin C on serum Total iron binding capacity (TIBC) and feritin concentration in married and unmarried women

Table (7) showed a significantly increase (P<0.05) in serum ferritin and a significantly decreased in serum TIBC after the administration of vitamin C (before and after menses) as compared with before administration of this vitamin. But before administration of vitamin C indicate a significant decrease (P<0.05) in serum ferritin and increased in serum TIBC after menses as compared with before menses and the level of Ferritin will be improved (increased significantly) after administration of vitamin C as compared with before administration (before menses)

Table (6): the effect of vitamin C on serum (TIBC) and feritin Concentration in serum in married and unmarried women

|  |  |  |  |
| --- | --- | --- | --- |
| Administrationof vitamin C(500mg) | Serum TIBC(mg/dl) | Serum feritin(ng/dl) | P- value |
| Beforeadministration(B) | 4 days before menses | 4 days after menses | 4 days before menses | 4 days after menses |  |
| 337.9±51.4 | 342±58.5\* | 25.3±19.1 | 23.1±24.04@ | P<0.05 |
| Afteradministration(A) | 330±60.2@ | 334±69.3@ | 31.7±23.18\* | 27.7±24.7\*@ | P<0.05 |

\*: significant increase (P<0.05) in the serum ferritin concentration after administration of vitamin C as compared with before administration of vitamin C and in serum TIBC after menses before administration of vitamin C as compared with after administration of vitamin C.

@: significant differences (P<0.05) in the serum ferritin and TIBC concentrations after menses (before and after administration of vitamin C) as compared with before menses before administration of vitamin C

**DISCUSSION**

The effect of administrations of vitamin C for married and unmarried women was showed a significantly increase in the count of RBCs (before and after menses) as shown in table (2). Also the decrease in this parameter is due to blood loss through menstruation (before the administration of vitamin C) but this count could be improved and significantly increase (P<0.05) after the administration of this vitamin may be related to *Firstly,* vitamin C was considered as an antioxidant agent against oxidation stress which could increase hemolysis of RBCs therefore, it might protect erythrocyte from damage and this can lead to an increase in RBCs count and this is consistent with researcher's opinion (Baillie *et al*., 2009). *Secondly,* vitamin C might play an important role in improving iron absorption from the small intestine especially non heme iron (in plants) and this may help in the increased synthesis of RBCs in the bone marrow and this reliable with many researches (Anderson *et al*., (2009) and Short and Domagalski, 2013 ). While the significantly decrease (P<0.05) in RBCs count might be related with the loss of blood through menses about (35ml per day) and the length of menses vary between 3-8 days and this leads to more loss of iron which is needed for erythropoiesis in bone marrow, and this agreed with the researcher's results (Goodman *et al*., 2007). Table (3) was showed a significantly increase (P<0.05) in the level of Hb after supplementation of vitamin C (before and after menses) and this might be related to *Firstly,* vitamin C was acted a reducing agent for reducing ferric ion (Fe+3) which is reduced to ferrous (Fe+2) during conversion to its oxidized form this is constant to many research's foundations (McGregor and Biesalski, (2006) and Stephen, *et al*., 2009). *Secondly*, the (Fe+2) was considered the soluble form of iron. In turn, its absorption in the duodenum by enterocyte and the iron played an important role in the biosynthesis of Hb; Since vitamin C was increased the bioavailability of iron in the presence or absence of inhibiting substances therefore, it may lead to an increase of Hb level (Severyn *et al*., 2009). The statically analysis of present study was showed that there was a significantly increase (P<0.05) in the levels of MCV, MCH and MCHC after the administration of vitamin C (before and after menses). Also, the decreased in these parameters during menses before administration of this vitamin could be improved (significantly increase) after the administration of vitamin C as showed in table (5) and this might be ascribed to the effect of vitamin C on improving of the iron absorption (from animal and plant foods) which was considered a critical component for hemoglobin synthesis and this might lead to an increase in the amount of Hb inside RBC and an increase in MCV which certified by other results (Fleming and Bacon, (2005) and Finkelstein *et al*., 2011). while the significant decrease in these parameters during menses was due to the blood loss which is considered the importance cause for iron deficiency and lead to a decrease in the production of RBCs, lower Hb contents and this may cause lower MCV, MCH and MCHC and this reliable with some researcher's results (Sid ell *et al*., 2006). The Table (6) shows that there was a significantly increase (P<0.05) in serum ferritin and a significantly decrease in serum TIBC after the administration of vitamin C (before and after menses) and this was attributed to the fact that vitamin C could redistribute iron from reticuloendothelial system to the liver (parenchyma cells) and store it as ferritin and could double the amount of iron stored. Also, since iron is loosely bound to transferrin in cells throughout the body, So that when iron absorption (serum level) was increased, the liver would decrease the production of transferrin and the transferrin binding capacity for iron which gradually decrease because of the blood became transferred the iron into the liver and bone marrow to store it as ferritin and lead to lowering TIBC and this agreed with what believed many researchers (Hoffman *et al*., (1996) and Camaschella, 2005). While the significantly increase in (TIBC) during menses might be due to the fact that TIBC was increased the ability of protein transferrin to bind with iron in the blood and carry it to the bone marrow for erythropoiesis and leads to the serum iron and its' body stores are low (Yee *et al*., 2008) or it may due to the fact that the liver produces more transferrin to presumably maximize the use of the little iron that is available during menstruation and this agrees with (Yamanishi *et* *al*., 2003).

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