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# EFFICACY AND SAFETY OF VITAMIN-C FOR IRON ANEMIA PATIENTS

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**Abstract:**

***Introduction:*** *Despite the increasing use of targeted therapies in cancer patients, chemotherapy remains a mainstay of cancer treatment.*

***Objectives:*** *The main objective of the study is to analyse the efficacy and safety of Vitamin-C for iron anemia patients.*

***Material and methods:*** *This cross sectional study was conducted in Health department Punjab during 2019 to 2020. The data was collected from those patients who were suffering from iron deficiency anemia. Patients were treated for 3 months and assessed with a complete blood count every 2 weeks for 2 months; iron metabolism was measured at week 8.*

***Results:*** *The data was collected from 100 female patients. The only factors which emerged as statistically significant from the adjusted logistic regression analysis model were insufficient intakes of iron (OR = 7.39; 95% CI: 1.45-37.57) and vitamin C (OR = 6.14; 95% CI: 1.34-28.27), frequent (≥2 times per week) tea consumption (OR = 0.01; 95% CI: 0.01-0.08), infrequent (≤2 times per week) red meat consumption (OR = 3.71; 95% CI: 1.01-13.61), and the possession of a personal history of IDA (OR = 6.00; 95% CI: 1.45-24.76).*

***Conclusion:*** *It is concluded that taking oral iron alone was equivalent to taking oral iron supplemented with vitamin C in improving hemoglobin level and iron stores. Our results suggest that vitamin C is not essential for patients with IDA.*

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## INTRODUCTION:

Despite the increasing use of targeted therapies in cancer patients, chemotherapy remains a mainstay of cancer treatment. Consequently, anemia remains a common, expected complication in patients receiving chemotherapy [1]. In addition to the myelosuppressive effects of chemotherapy, other cancer-associated conditions that contribute to the decreased production of red blood cells (RBCs) and lead to anemia include: renal disease associated with erythropoietin deficiency, tumor involvement within the bone marrow, possible vitamin deficiencies, and, perhaps most importantly, functional iron deficiency (FID) [2].

Normal iron metabolism, erythropoiesis, and pathogenesis of functional iron deficiency. In the normal (noninflamed) state, dietary iron (or an oral iron supplement) is ingested. Iron is absorbed by enterocytes in the proximal small intestine via the divalent metal transporter 1 and transported to blood vessels via ferroportin, then to the bone marrow via transferrin. In the bone marrow, iron is taken up by macrophages where it is stored as ferritin until needed for erythropoiesis. At that time, stored iron is transferred via ferroportin to red blood cell (RBC) precursors for hemoglobin synthesis. Erythropoietin (EPO) is the physiologic regulator of RBC production [3].

ron deficiency can be divided into 3 stages: prelatent iron deficiency, latent iron deficiency (also called iron-deficient erythropoiesis), and iron deficiency anemia (IDA). At the first stage, iron intake lower than the required amount causes progressive depletion of iron storage primarily in the liver and muscle cells [4]. Patients at this stage generally have no symptoms, and the diagnosis of iron deficiency is made when levels of serum ferritin (the storage form of iron) decrease below 20 ng/mL (to convert to micrograms per liter, multiply by 1.0). Sustained iron storage depletion leads to the second stage of iron deficiency, iron-deficient erythropoiesis, in which iron deficiencies progress and begin to affect erythropoiesis. Despite an increased transferrin level, serum iron level decreases along with transferrin saturation [5]. Erythropoiesis impairment appears when the serum iron level decreases to less than 50.3 µg/dL (to convert to micromoles per liter, multiply by 0.179) and transferrin saturation is less than 16%.[4] Hemoglobin level is still within the normal range until the development of the IDA stage. Iron storage levels deplete to the point that they can no longer support the hemoglobin production and generate enough red blood cells (RBCs). Iron deficiency impairs RBC synthesis and hemoglobin production, leading to anemia [6].

**Objectives**

The main objective of the study is to analyse the efficacy and safety of Vitamin-C for iron anemia patients.

## MATERIAL AND METHODS:

This cross sectional study was conducted in Health department Punjab during 2019 to 2020. The data was collected from those patients who were suffering from iron deficiency anemia. Patients were treated for 3 months and assessed with a complete blood count every 2 weeks for 2 months; iron metabolism was measured at week 8. The primary outcome was the change in hemoglobin level from baseline to the 2-week follow-up. The secondary outcomes included the change in the reticulocyte percentage after 2 weeks of treatment, the increase in hemoglobin after 4 weeks of treatment, the increase in serum ferritin after 8 weeks of treatment, and adverse events. Exploratory outcomes included MCV, MCH, and MCHC levels every 2 weeks at all-time points and serum iron level, transferring saturation, and TIBC at 8 weeks.

The data was collected and analysed using SPSS version 19. All the values were expressed in mean and standard deviation.

## RESULTS:

The data was collected from 100 female patients. The only factors which emerged as statistically significant from the adjusted logistic regression analysis model were insufficient intakes of iron (OR = 7.39; 95% CI: 1.45-37.57) and vitamin C (OR = 6.14; 95% CI: 1.34-28.27), frequent (≥2 times per week) tea consumption (OR = 0.01; 95% CI: 0.01-0.08), infrequent (≤2 times per week) red meat consumption (OR = 3.71; 95% CI: 1.01-13.61), and the possession of a personal history of IDA (OR = 6.00; 95% CI: 1.45-24.76).

**Table 01:** Multivariate logistic regression analysis of the factors associated with iron deficiency anemia among the study sample of female

| **Variables** | **Adjusted OR (95% CI)** |
|---|---|
| Intake of iron | |
| < Recommended intake | 7.39 (1.45-37.57) |
| ≥ Recommended intake | 1 (Ref.) |
| Intake of vitamin C | |
| < Recommended intake | 6.14 (1.34-28.27) |
| ≥ Recommended intake | 1 (Ref.) |
| Frequency of tea consumption | |
| ≤2 times a week | 0.01 (0.01-0.08) |
| ≥3 times a week | 1 (Ref.) |
| Frequency of red meat consumption | |
| ≤2 times a week | 3.71 (1.01-13.61) |
| ≥3 times a week | 1 (Ref.) |
| Blood clotting during menstruation | |
| Yes | 1.66 (0.42-6.47) |
| No | 1 (Ref.) |
| Past personal history of iron deficiency anemia | |
| Yes | 6.00 (1.45-24.76) |
| No | 1 (Ref.) |
| Past family history of iron deficiency anemia | |
| Yes | 1.04 (0.26-4.17) |
| No | 1 (Ref.) |

**Table 2: Mean of Hb in anemic and non-anemic patients.**

| **Hb (g/dl)** | **N** | **Mean** | **Std. Deviation** |
|---|---|---|---|
| | | | |
| Non anemic | 20 | 14.1 | 1.3 |
| Anemic | 30 | 8.7 | 1.5 |
| T-test p value = 0.000 | | | |

**Table 3: Mean of RBCs in anemic and non-anemic patients.**

| **T-test** | | | |
|---|---|---|---|
| **RBCs $10^{12}$/L** | **N** | **Mean** | **Std. Deviation** |
| Non anemic | 20 | 4.8 | 0.5 |
| Anemic | 30 | 3.1 | 0.4 |
| T-test p value = 0.000 | | | |

**Table 04:** Changes in Red Blood Cell Parameters

| **Variable** | **Mean (SD)** | | **Between-group difference (95% CI)** |
|---|---|---|---|
| | **Vitamin C plus iron** | **Iron only** | |
| Change in hemoglobin level, g/dL | 4.20 (1.47) | 4.07 (1.48) | 0.13 (−0.14 to 0.41) |
| Change in reticulocyte percentages | 0.16 (0.82) | 0.02 (0.81) | 0.14 (−0.01 to 0.29) |
| Change in mean corpuscular volume, $\mu m^3$ | 12.80 (5.89) | 11.49 (5.84) | 1.31 (0.21 to 2.41) |

## DISCUSSION:

This demographic group (ie, women of childbearing age) is at a heightened risk of deficiency in comparison with the general population due to their greater nutritional needs for the maintenance of their metabolic stores and because of their potentially high nutritional demands due to menstrual blood loss, pregnancy, and/or lactation [7].

The study observed an overall IDA prevalence of 12.5%, a significantly lower rate than that found by a prior study among a sample of female Saudi university students, which reported a prevalence of IDA of 64% (defined as hemoglobin <12 g/dL). In developing countries, the overall prevalence of anemia has been estimated at 43%, but in highly developed countries, it has been reported at a far lower level of 9%.To take an example, research in an Indian setting reported a prevalence of 44.0% among female university students, and widespread IDA has also been found among female students in other developing countries such as Bangladesh, where 63.3% of a female student sample was found to have IDA [8]. In contrast, in Australia, a developed country, only a 3% prevalence of IDA was found by a study using a sample of female university students [9].

Oral iron provides an inexpensive and effective means of restoring iron balance in patients with IDA. Vitamin C is the only dietary constituent other than animal tissue that has been shown to promote the absorption of nonheme iron in humans. Thus, some clinicians, who believe that vitamin C can improve the efficacy of oral iron and speed up the treatment of anemia, recommend taking vitamin C supplements combined with oral iron tablets [10]. However, the absolute dose of vitamin C did not appear to be associated with iron absorption with a complete diet, and the improvement in iron status was not noticeable, which was consistent with our findings that oral iron alone provides efficacy equivalent to that of oral iron with vitamin C. The changes in hemoglobin level were similar between the 2 groups at weeks 2, 4, 6, and 8. The mean difference in hemoglobin level change was within the equivalence margin of ±1 g/dL, which is the threshold for clinically significant change recommended by hematologists. Notably, the changes in MCV from baseline to all time points were slightly greater in the vitamin C plus iron group. MCV is a measure of the mean size of RBCs, and patients with IDA typically have lower than normal values. The RBC parameters MCH, MCV, and MCHC are more sensitive and helpful to monitor the response to a treatment [11].

## CONCLUSION:

It is concluded that taking oral iron alone was equivalent to taking oral iron supplemented with vitamin C in improving hemoglobin level and iron stores. Our results suggest that vitamin C is not essential for patients with IDA.

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