Research Article
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Association between hemoglobin status with vitamin c intake

Abstract

Background: Diets across the world are commonly deficient in several micronutrients, especially iron. And iron deficiency disorders are a major public health problem in many developing countries. It is important to understand the factors that contribute to maintain optimal iron status. The current study was conducted to view the effect of vitamin C intake, which is known to increase iron absorption, on iron status as represented in hemoglobin status.

Objective: The objectives of the study were

a. To investigate the association between hemoglobin status and Vitamin C intake among the BS students of RLAK College of Home Economics.

b. To assess the vitamin C intake in the students

Limitations

a. Time was a limiting factor.

b. It was a small scale study hence didn't involve a large sample.

Methodology: The study was carried out on 150 respondents (all adolescent girls) of age groups 19 to 25years. The data was collected via questionnaires. The questionnaire was filled by the help of generic food photograph atlas. Standardized recipes were used to calculate the Vitamin C intake in the food consumed. The data collected was entered in SPSS and analyzed by Independent Sample T test and Measure of Central Tendency i.e. mean.

Result: There was no significant association between hemoglobin status and vitamin C intake with p value=0.394 (i.e.; $p > 0.05$). Mean vitamin C intake of the selected sample was higher i.e. 122.09mg/day which is above RDA (75mg/day). The result also revealed that mean consumption of vitamin C rich foods is slightly higher in subjects with normal hemoglobin status as compared to those with below normal hemoglobin level.

Conclusion: It has been concluded that there is no significant association between hemoglobin status and vitamin C intake. But the vitamin C rich food consumption is high in subjects with normal hemoglobin than those with below normal.

Keywords: iron, vitamin c, haemoglobin, factors

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Abbreviations: TIBC, total iron-binding capacity; UIBC, unsaturated iron binding capacity; TfR, transferring receptor

Introduction

Diets across the world are commonly deficient in several micronutrients, especially iron. In developing countries, severe iron deficiency is considered to contribute directly to cognitive impairment, decreased work productivity, and death.[1,2] In industrialized countries, iron depletion increases the risk of anemia in certain populations (e.g., pregnant women, female blood donors, and women using intrauterine devices). It is therefore, important to understand the factors contributing to maintain optimal iron status.

Dietary iron absorption is strongly affected by iron status, by the form of iron consumed, and by other constituents in the diet.[3–5] Nonheme iron is poorly absorbed compared with heme iron, and many nutritional factors are known to influence its absorption positively (vitamin C and meat) or negatively (phytates, fibers, polyphenols, and calcium).[6] Ascorbic acid has been shown by many authors to be a strong promoter of nonheme iron absorption and is implicated in iron status.[7]

The purpose of this study was to find the association between iron status and vitamin c intake among the teen-aged students of RLAK college of Home Economics Karachi.

Methodology

The current study examined the association between hemoglobin statuses with vitamin C intake of the adolescent girls of RLAK College of Home Economics.

Subject and sampling

Population: The total population of B.S programme in RLAK College is 500. The population consisted of girls of 19-25years.

Convenient Sample: The sample was convenient because it was collected from my college. The students had their hemoglobin checked as the requisition of their assignments.

Size of Sample: Total sample size is 150. I collected data from 25 students

Data collection

Procedure: The data was collected from BS students of RLAK College of home economics. The data collector filed the questionnaires to the students in college. Students were explained how to fill the questionnaires and were asked to fill their academic records after rechecking their mark sheets for accuracy. The questionnaires were then collected. A signed consent form was obtained from each of the participant before the commencement of the study.

Types Of Data Collected: The questionnaire included 4 types of data

a. General information

b. Deficiency symptoms

c. Food frequency table

d. Academic records

The current study used hemoglobin level from general information and food frequency table to assess the vitamin C intake.[8]

Tools for data collection

The tool for data collection was questionnaire which include 1 day 24 hour recall and food photograph atlas.

Questionnaire: Girls were asked questions related to iron deficiency anemia symptoms and hemoglobin levels, number of family members and age, which helped to analyze their health status more precisely.

Food photograph atlas: Rubina Hakeem (RH) published generic FPA photographs were used to assist data collection.

Data entry

The data was entered in SPSS, Version 13 (Statistical Packages for the Social Sciences). Each data collector participated equally in the data entry. After the entry of data by all the collectors, it was pooled in a single file and cleaned. Each student extracted the data for their specific study.

Nutrient analysis

About 96 food items were listed in the food frequency table. The pictures selected by the respondents from the GFP Atlas showed the volume of food consumed. Standardized recipes were used to calculate the nutrient content of Vitamin C.[9]

Statistical analysis

The level $P \leq 0.05$ was considered as the cut-off value for significance. Data were presented using descriptive statistics in the form of frequencies and percentages for quantitative variables. Independent Sample T Test was used to find association between mean intake of Vitamin C and hemoglobin status of the subjects.

Presentation of results

The characteristics of the subjects are presented in tables. The association of vitamin C intake and hemoglobin status is presented in chart. Intakes are presented as mean in tables.

Results and discussion

General characteristics of the subjects

This study of 150 respondents included all reproductive girls of age 19-25years. The sample consists of subjects with below normal and normal hemoglobin status while none of the respondent had above normal hemoglobin status. Table 1 indicates the general characteristics of respondents i.e. age, hemoglobin status, and weight status.

Table 1 General Characteristics of the respondents

General characteristics	Percentages (%)
Age of the respondent:	
19 – 21yrs	85.30%
22 – 25yrs	14.70%
Total:	**100%**
Hemoglobin Status:	
Below Normal (<12g/dl)	40%
Normal (12-15.5g/dl)	60%
Total:	**100%**
Weight Status:	
Underweight (BMI < 18kg/m^2)	26.66%
Normal (BMI 18-24.5kg/m^2)	54%
Overweight (BMI 25-30kg/m^2)	14.67%
Obese (BMI > 30kg/m^2)	4.67%
Total:	**100%**

The study included the subjects lie on the last stage of adolescence (19-21yrs) mostly. This study indicated that students with normal hemoglobin status are greater than with below normal. According to Berkson, for an unbiased evaluation, it is essential to use highly selected groups of normal and anemic groups of subjects which are discrete with regard to their distributions by hemoglobin level may give suggestive evidence of anemia.

Furthermore this study indicated that underweight students are greater than overweight while majority of the students possess normal weight status. Studies have shown that BMI is an anthropological measure that is currently used by health and medical professions as a marker of obesity.

Average consumption of vitamin C (mg/d) in subjects

The subjects were evaluated for their average consumption of Vitamin C which was computed through Measure of Central Tendency i.e. Mean.

According to the 2001-2002 National Health and Nutrition Examination Survey (NHANES), mean intakes of vitamin C were 83.6mg/day for adult females, meeting the currently established RDA for most non-smoking adults.[9] In the present study the mean consumption of Vitamin C was found to be 122.09mg/day which is greater than the RDA i.e. 75mg/day.[10]

Association between Vitamin C intake (mg/d) and hemoglobin status

The association between Vitamin C intake and hemoglobin status was found by using independent sample t test. Results were presented

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as means and are presented in Figure 1. The result was statistically insignificant because the p value obtained was higher (0.394) than the standard cutoff for the significance level (0.05).

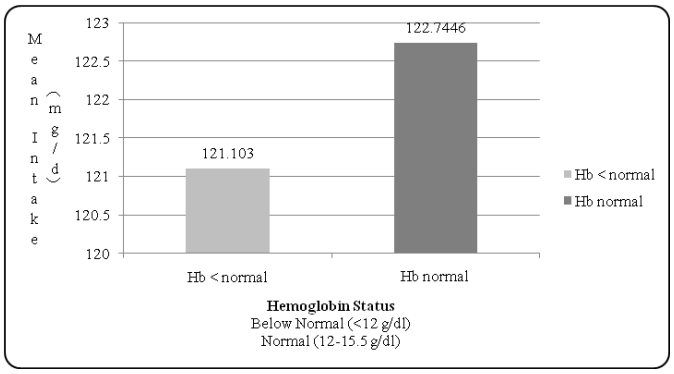

Figure 1 Association between Hb status and Vit C intake (mg/d).

p = 0.394.

Values of Vitamin C are presented as means.

The result revealed that there is no association between hemoglobin status and Vitamin C intake. However, past studies show positive association between Vitamin C and hemoglobin status. In one study in which increasing amounts of ascorbic acid ranging from 25 to 1000mg were added to a liquid formula meal containing 4.1mg nonheme iron, iron absorption increased progressively from 0.8% to 7.1%[11] thus improving hemoglobin status.

In contrast with the striking effect of ascorbic acid on iron absorption as revealed by past researches, the improvement in iron status when the diet is supplemented with vitamin C has been minimal. In one study, the addition of 2000mg vitamin C/day to the diet for ≤2y did not alter iron stores significantly as measured by serum ferritin concentrations. In another study, 100mg ascorbic acid given 3 times daily with meals to menstruating women for 9month had no significant effect on iron status. Similarly, 25 healthy women aged 20-45y with low iron stores as defined by a serum ferritin concentration <20µg/L were given 500mg ascorbic acid 3times daily with meals for 10 wk. There was no significant alteration in biochemical indexes of iron status in these women, even in those consuming a diet low in bioavailable iron.[11]

Average intake of vitamin C rich fruits and vegetables

The subjects were assessed for their intake of vitamin C rich fruits and vegetables. In fruits, citrus fruits, and in vegetables, tomatoes were the mostly consumed food. Mango is also a rich source of Vitamin C, but it was missed in the questionnaire. Table 2 & 3 represents the results of the average intake of vitamin C rich fruits and vegetables.[12]

Table 2 Mean Intake of Vitamin C Rich Fruits

Fruits	Mean intake (g/d)
Papaya	5.96
Watermelon	16.9
Berries	4.16
citrus	22.58

Values expressed as means

Table 3 Mean Intake of Vitamin C Rich Vegetables

Vegetables	Mean intake (g/d)
Tomatoes	38.23
Cauliflower/Cabbage	8.72
Green beans	3.71

Values expressed as means

The mean intake of fruits and vegetables is lower in Pakistan might be due to changing lifestyle which include more meat and processed food products while lowering intake of fruits, vegetables and whole grain products.

Association between hemoglobin status and mean intake of vitamin C rich fruits and vegetables

The association between hemoglobin status and mean intake of vitamin C rich fruits and vegetables was found by using custom tables by their means. Figure 2 shows the association between the two.

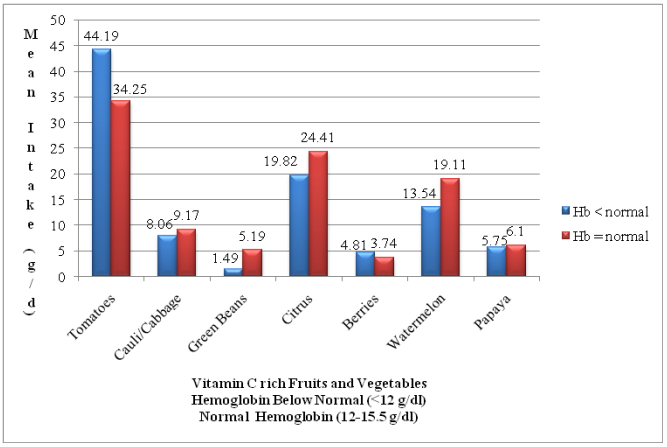

Figure 2 Association between Hb Status and mean intake of Vit C rich Fruits and Vegetables.

These results indicate that the overall intake of fruits and vegetables is slightly higher in subjects with normal hemoglobin compared with those having hemoglobin status below normal. However, there is no significant difference between the two as shown by Figure 2.

The result also shows that the consumption of tomatoes and berries is higher in subjects with hemoglobin status below normal as compared to subjects having normal hemoglobin.

A few authors found that consumption of fruits or vegetables enhances iron absorption or status, whereas other authors found no relation. These inconsistent results might be due to other components of fruits and vegetables that may have either an enhancing or inhibiting effect on iron absorption. In particular, an inhibiting effect of fiber on nonheme iron absorption has been suggested by several authors, but studies on the effect of fiber from fruits and vegetables are lacking.[12]

Conclusion

The present study shows no association between hemoglobin status and vitamin C intake (i.e. p> 0.05) however, the mean intake of Vitamin C is higher and above RDA. The reason might be that a diet consisting of varied fruits and vegetables with different levels of

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vitamin C and fiber, the effects of these components counteract each other, leading to an unchanged hemoglobin concentration. Further work is needed to more closely identify the complex enhancing and inhibiting effects of different fruit and vegetable components (vitamin C, fibers, phytates, polyphenols, and others) on iron status.[10]

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Conflict of interest

The author declares no conflict of interest.

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