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CONSUMPTION OF BEETROOT JUICE ALTERS SOME HEMATOLOGICAL PARAMETERS IN 12 HEALTHY WOMEN

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ABSTRACT

The highest prevalence of iron deficiency anemia is among a population that have inadequate access to iron enriched foods during stages of high iron demand. In particular women of reproductive age as a result of pregnancy or due to iron lost in menstrual blood. Beetroot (*Beta vulgaris*) has been used traditionally in Libya for treatment of anemia since long time. A dietary intake of iron is needed to replace the basal iron losses from the body daily. We examined the effects of beetroot juice consumption on Hemoglobin and Ferritin in 12 healthy female subjects, mean age (31.8±6.6 years). Blood samples were obtained from the participants prior to (zero time) and on day 11 and on day 16 of daily consumption of 200 ml of beetroot juice. The blood samples of each participant were also analyzed for Complete Blood count and compared to the zero-time sample. We found that Hemoglobin and Ferritin levels are markedly increased. In addition, we noted some changes in RBC, WBC, and platelet count. The results showed significant ($P < 0.05$) with Ferritin and Hemoglobin.

KEYWORDS: Anemia, Beetroot Juice, Hemoglobin, Female, Ferritin.

INTRODUCTION

The Beetroot is the taproot portion of the beet plant (*Beta vulgaris L*) of the family (*Amaranthaceous - Chenopodiaceous*). Other than as a food, beetroot have used as a medicinal plant.[1] Beetroot is a rich source of folate (37% of the Daily Value) and a good source of iron (16% of the Daily Value), with other nutrients having insignificant content.[2] Therefor we can expect that beetroot consumption may modulate some hematological parameters because body regularly gets iron from the foods. Moreover, its become well known that other non-meat foods such as spinach and other dark green leafy vegetables are highly recommended to prevent anemia due to their higher content of iron and folate.[3] Iron absorption from foods can be best optimized by the inclusion of ascorbic acid-containing vegetables. Cooking, industrial processing, and storage degrade ascorbic acid and remove its enhancing effect on iron absorption.[4] The highest prevalence of anemia is in preschool-age children, and in women.[5] The most common form of anemia in women is iron deficiency anemia, which is usually due to chronic blood loss caused by excessive menstruation. In hematology, iron deficiency anemia describes the condition in which the number of RBCs in the blood is low, or if these cells have less than the normal amount of hemoglobin. Its caused by a deficiency of iron which is an essential constituent of hemoglobin. Diagnosis of anemia in women is based on a hemoglobin of less than 12 to 13 g/dl.[6] Further testing such as blood smear test is then required to determine the cause. Body iron is distributed in active metabolic and storage pools with proteins. Ferritin store iron in an insoluble form and are present primarily in the liver, spleen, and bone marrow.[7,8] Under steady state conditions, serum ferritin concentrations correlate well with total body iron stores.[9] hence, serum ferritin is used as a diagnostic test for iron deficiency anemia. The range for ferritin is usually between 18–115 ng/ml for females.[10] If the ferritin level is low, there is a risk for lack of iron, which could lead to anemia.[11,12] In addition, routine blood tests which generally include a Complete Blood Count (CBC), a low hematocrit value and blood smear are also important for diagnosis of anemia.[13]

MATERIALS AND METHODS

Beetroot juice preparation

Two medium-sized beets were washed thoroughly using a soft scrub brush and peeled. The beets are then sliced into the mixer and half of medium sized lemon is pressed in 200ml of water and the content in the mixer is mixed on high speed for 2 min until homogenous beetroot juice is produced. Beetroot contain high amount of nitrate which can lead to Nitrosamine formation (carcinogenic substance) in the body this can reliably be prevented by adding ascorbic acid.[14]

Patient sampling

A total of 12 healthy active women with mean age 31.6±2 were recruited for the current study in Tripoli –

Libya. All the participants in this study had regular menstrual cycles. We started the study just after the end of their menstrual cycles. Our results in this small sample size of this study n=12) can support the previous studies on beetroot effects on blood contents and CBC. Each participant consumed 200 ml of the freshly prepared juice after 2 hour of lunch for fifteen days. They are instructed to avoid some foods that are known to affect CBC such as liver, red meat, excessive coffee or tea, and avoiding taking medications throughout the period of experiment.

Blood collection and analyses

Participants rested in the lab for 5min prior to blood sample being obtained. Participants were in a seated position when 5 ml blood was drawn from the forearm vein. A portion (1-2 ml) of the blood collected was used to determine the parameters of the CBC measured by an automatic hematology analyzer (Mindray™ 3030; Orphee Medical SA, Geneva, Switzerland) according to the manufacturer instruction.[15]

Ferritin Test

The Architect Ferritin assay is used for the quantitative determination of ferritin in human serum. [16] This assay is a Chemiluminescent Microparticle Immunoassay (CMIA), we followed the instructions of the manufacturer supplied with the assay kit.

Statistical Analysis

The data was represented as mean ± SD The data was analyzed statistically using *paired student t test* by Sigma Plot 2 Programm.[17] The Paired Sample t-test was used for comparison between zero-time sample and other time point samples for each hematological parameter. (* indicates a statistically significant difference where P<0.05, ** indicates a statistically significant difference where P<0.001. (ns) means no significant difference is observed.

RESULTS

We have classified the women who included in this study into two groups according to their age**.** Table 1 shows that hemoglobin level at zero time, which indicating the hemoglobin level before start to drink beetroot juice regularly, is increased by (0.1) after 10 days of consuming beetroot juice (from 11.88 g/dl to 11.98 g/dl) and the hemoglobin level is decreased by (0.02) after 15 days in age group from 15 to 35 years, whereas, in the age group 36 to 55 years the hemoglobin level is increased by 0.53 after 10 days of consuming beetroots and the hemoglobin level is increased by (0.48) after 15 days.

Table 1. The relationship between the mean of hemoglobin in g/dl and the age of the females involved in this study.

Age (years)	Zero time Hemoglobin (g/dl)	10 days Hemoglobin (g/dl)	15 days Hemoglobin (g/dl)
15-35	11.88±1.0	11.98±0.9 ^{ns}	11.86±1.1 ^{ns}
36-55	11.55±1.7	12.08±1.1	12.03±1.2

Table 2 shows that in the females of the first group (15 to 35 years old) the mean of ferritin level at zero time is increased by 0.13 after 10 days of consuming beetroot juice and it is increased markedly by 26.73 after 15 days of regular consumption of the juice. In the second age group (36 to 55 years) the mean of ferritin level at zero time is increased by 10.69 after 15 days of consuming the juice.

Table 2: The relationship between the mean of ferritin in ng/ml and the age of the females involved in this study.

Age (years)	Zero time Ferritin (ng/ml)	10 days Ferritin (ng/ml)	15 day Ferritin (ng/ml)
15-35	10.35±7.1	10.48±11.6^{ns}	37.08±43.1**
36-55	10.78±9.7	11.15±5.3^{ns}	21.47±20.3**

Table 3 shows that the mean of RBC count (10^{12}/l) after drinking beetroot juice regularly for 10 days is increased by 0.01 in females of the first age group (15-35 years) and in the same age group the mean of RBC level is decreased by 0.31 after 15 days of the regular daily consumption of the juice. In age group from 36 to 55 years the mean of RBC level at zero time is decreased by 0.35 after 10 days and it is decreased by 0.45 after 15 days of the regular daily consumption of the juice.

Table 3. The relationship between the mean of RBC count (10^{12}/l) and the age of the females involved in this study.

Age (years)	Zero time mean of RBC (×10^{12}/l)	10 days mean of RBC (×10^{12}/l)	15 days mean of RBC (×10^{12}/l)
15-35	4.26±0.4	4.27±0.2 ^{ns}	3.95±0.1^{ns}
36-55	4.38±0.4	4.03±0.1 ^{ns}	3.93±0.6*

Table 4 shows that in the age group of 15-35 years the platelets (PLT) level at zero time is decreased by 4.83 after 10 days and it is decreased by 23.23 after 15 days of regular daily consumption of the juice. While, in the age group of 36 to 55 years the PLT level at zero time is increased by 11 after 10 days and stay at this level also after 15 days of regular daily consumption of the juice.

Table 4: The relationship between the mean of Platelets count (10^9 /l) and the age (years).

Age (years)	Zero time Mean of Platelets count ($\times10^9$ /l)	10 days Mean of Platelets count ($\times10^9$ /l)	15 days Mean of Platelets count ($\times10^9$ /l)
15-35	293.83±66.6	289±79.0 ^{ns}	270.6±49.2 ^{ns}
36-55	305±74.1	316±89.5 ^{ns}	316±60.5 ^{ns}

Table 5 shows that the mean of WBC level in females aged from 15-35 years is increased by 1.75 after 10 days and it is increased by 1.88 after15 days of regular daily consumption of the juice. Whereas, in the age group from 36 to 55 years the mean of WBC level at zero time is increased by 0.09 after 10 days and it is increased by 0.51 after 15 days of consuming beetroots with lemon juice and the WBCs level.

Table 5: The relationship between the mean of WBC count (10^9 /l) and the age (years).

Age (years)	Zero time Mean of WBC count (10^9 /l)	10 days Mean of WBC count (10^9 /l)	15 days Mean of WBC count (10^9 /l)
15-35	5.33±0.7	7.08±1.6*	7.21±1.2*
36-55	5.97±0.8	6.06±1.4 ^{ns}	6.48±*0.4

DISCUSSION

We showed here that hemoglobin level is increased by beetroot juice intake (**Table 1**). This finding is consistent with the results obtained by other studies.[18,19,20] Serum ferritin is the most convenient laboratory test to estimate iron stores. Thus, our result in Table 2 indicates that intake of beetroot juice lead to increase in iron stores in the body. This finding is consistent to that found by Lotfi et al 2018.[21] In contrast to our finding, longer time of use of beetroot has been found to result in increasing the RBC count.[22,23] Also, it has been found that beetroot intake increases the blood count and improves blood circulation and the oxygen-carrying capacity of RBCs.[18,24] In addition, it has been shown that the red pigment betalain of beetroot increases the number of RBCs and increases hemoglobin.[25] Our finding (Table 3) that consumption of beetroot juice for 15 days resulted in little decrease of RBC count in both age groups of the intended females may be due to the shorter period of study in comparison to the mentioned studies. However, it has been found that consumption of beet roots juice for few days resulted in similar change in platelet count (Table 4) to that found in this study.[26]

CONCLUSION

We have shown in this study that beetroot juice consumption has marked effects on the level of some hematological parameters in healthy women, it can be used to prevent and improve anemia among women.

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