

# The Effect of a Date Consumption-Based Nutritional Program on Iron Deficiency Anemia in Primary School Girls Aged 8 to 10 Years Old in Zahedan (Iran)

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**Aim:** Iron deficiency anemia (IDA) is one of the most common nutritional problems in students. The best and most cost-effective ways to prevent IDA are changes in people's dietary habits and their nutrition education. The purpose of this study was to determine the effect of nutritional program based on dates consumption on IDA in primary schoolgirls.

**Materials and methods:** This was a semi-experimental study. The study population consisted of primary school girl students of Zahedan, Iran, during the academic year of 2018–2019. The sampling method was a combination of stratified sampling and multi-stage cluster sampling. Then, 31 female primary school children with IDA were fed with dates for 2 months. Before the intervention and after 2 months of date consumption, hemoglobin, hematocrit, and ferritin blood parameters were measured. Both paired *t*-test and chi-square test were used to analyze the data using SPSS version 21.

**Results:** The results were meaningful. The hemoglobin levels at the beginning and the end of the study were  $11.19 \pm 0.38$  and  $12.05 \pm 0.81$  g/dL, respectively ( $P = 0.001$ ), the hematocrit levels were  $34.24 \pm 0.41\%$  and  $37.17 \pm 2.36\%$ , respectively,  $P = 0.001$ , and the ferritin levels were  $47.07 \pm 21.89$   $\mu\text{g/dL}$  and  $53.98 \pm 19.77$   $\mu\text{g/dL}$ , respectively,  $P = 0.001$ .

**Conclusion:** The consumption of date fruit increased hemoglobin, hematocrit, and serum ferritin levels in primary school girl students with IDA; therefore, it is recommended to give dates to school girls.

**Keywords:** iron deficiency anemia, IDA, dates, girls' schools, nutrition

## Introduction

Iron deficiency anemia (IDA) is one of the most common forms of anemia in childhood, but it can be prevented as it has a favorable response to treatment. IDA is considered as a major public health problem worldwide, especially in developing countries.<sup>1</sup> More than half of the school-age children are at risk of IDA.<sup>2</sup> The highest prevalence of IDA is in preschool and school-age children.<sup>3</sup> The prevalence rate of IDA in the Iranian children was 23%,<sup>4</sup> and the prevalence rate of IDA in the Zahedan children was between 20% and 23.6%.<sup>5–7</sup> The prevalence of IDA in tropical regions of the world is higher due to the higher prevalence of parasitic infections, lower meat consumption and higher poverty rates.<sup>8</sup> Symptoms are usually intrusive and hidden, and their severity is associated with a shortage of food. These children are pale with poor muscle development and are at risk for

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infection and fainting. The children with IDA have hairy skin, hair losses, weakness, pagophagia, anxiety, depression, poor appetite, pruritus, and edema due to an unknown mechanism that increases the plasma protein leakage. Also, they have growth retardation, loss of albumin, gamma globulin and koilonychia (nail-spoon like).<sup>9</sup> IDA causes loss of concentration at work, decreasing learning ability and reduction of the physical working efficiency. Educational dropout and learning disabilities in the early years of schooling may be due to insufficient iron stores, and many mental and behavioral problems in children have been attributed to IDA.<sup>10</sup> The World Health Organization (WHO) recommends a combination of four basic strategies including iron supplementation, appropriate nutrition education, the enrichment of foods with iron compounds, and the control of parasitic and infectious diseases to prevent and control anemia and iron deficiency anemia.<sup>11</sup> Lack of knowledge in both nutritional needs and nutritional values of different foods is a major contributor to the prevalence of malnutrition among primary school children and vulnerable groups. Schools as a broad base serve a large population of children and play an important role in the transfer of health information to individuals, families, and society.<sup>12</sup> Nutrition education applied should be easily adapted to socio-economic status, dietary habits and locally available traditional food resources.<sup>13</sup> Considering the role of nutrition disorder in the prevalence of IDA,<sup>14</sup> strategies for nutritional improvement are safe ways to control and prevent micronutrient deficiencies, especially iron.<sup>15</sup> Therefore, if IDA is diagnosed early, it can be treated or prevented by modifying the nutritional status and the administration of iron supplements.<sup>16</sup>

Considering the prevalence of IDA and the effect of nutritional education on the prevention and control of it, the use of date fruit can contribute to controlling IDA. Dates (*Phoenix dactylifera*) are one among the fruits used in the human diet that possess a high nutritional value.<sup>17</sup> There are 314 calories in 100 g of date. Ten minerals are reported, the major being selenium, copper, potassium, and magnesium. The consumption of 100 g of dates can provide over 15% of the recommended daily allowance from these minerals.<sup>18</sup> In addition, the amount of iron in dates is about 0.3 mg to 10.4 mg per 100 g. Therefore, eating a few dates daily will provide your body's daily iron. Also, dates contain vitamin C and fiber, which increase iron absorption.<sup>19</sup> Yossef et al (2015) found that the use of dates in the treatment of IDA of children is beneficial and the iron content in 100 g of black dates is reported

to be 166.5 mg.<sup>20</sup> Dates have also been shown to contain other properties that are useful in treatment or prevention of events such as fatigue, reinforcement of kidney, chronic cough, rheumatoid arthritis and back pain, diarrhea, kidney stone, and peptic ulcers.<sup>19,21</sup> Dates contain anticancer properties that may also help prevent the disease.<sup>22</sup> Dates also serve as a good source of natural antioxidants.<sup>23</sup> Dates can improve hemoglobin (Hgb) levels via increasing erythrocyte production.<sup>24</sup> It seems that the prevalence of IDA is high in female students of Zahedan City, Iran,<sup>7</sup> and the abundance of dates in this area.<sup>25</sup> Therefore, this study was designed to determine the effect of consumption of date fruit on IDA among primary school girl students.<sup>26</sup>

## Methods and Materials

This was a semi-experimental study. The study population consisted of the primary school girl students of Zahedan, Iran, during the academic year of 2018–2019. The sampling method was a combination of stratified sampling and multi-stage cluster sampling such that strata were state schools and education districts 1 and 2. The multi-stage cluster sampling was used within each stratum, in which cluster headers were schools, grades, and the classrooms, respectively. After obtaining the code of ethics (443) from the Zahedan University of Medical Sciences and conducting the necessary correspondence and coordination with education districts 1 and 2, four primary girl schools were selected out of all state schools or girls in districts 1 and 2 of Zahedan. A total of 1500 questionnaires were distributed to 8–10-year-old primary school girl students for inclusion criteria. The study inclusion criteria were as follows: 1) no history of chronic condition, terminal illness, allergies, parasites, thalassemia, renal disease, gastrointestinal disease, and bone marrow disease; 2) no surgery in the past 3 months; and 3) those who had not yet started their menstruation. Only 100 subjects met the inclusion criteria, and informed consent was obtained from the subject's parents to participate in the study. Three cubic centimeters of venous blood was taken from children's hands with a 5-cc syringe. Of which 1.5 cc of venous blood was collected in a tube containing ethylenediamine tetraacetic acid to measure the levels of hematocrit (Hct) and Hgb and analyzed by Sysmex Cell Counter. The remaining 1.5 cc was collected in a polyethylene tube to measure serum ferritin levels. After centrifugation, when the serum is obtained, ferritin levels were determined by ELFA method, using Widaf machine (BioMerieux S.A, France).

In this study, according to the WHO, IDA was defined as a Hgb level lower than 11.5 g/dL, Hct lower

than 34%, and ferritin 12 µg/L or less in 5–11-year-old children.<sup>27</sup> Finally, 31 students with IDA were included in the study. Students consumed seven dates (approximately 100 g) for 2 months under the supervision of the researcher. At the same time, the researcher met the participants and their parents for three 60-min sessions to talk about the nutritional value of dates to control the IDA and their properties. The researcher gave those pamphlets that contained information on effective food products in preventing and controlling IDA. The complete blood count (CBC) and ferritin test were performed again immediately following the intervention. Statistical analysis was performed using SPSS Version 21. Data were expressed as mean ± standard deviation (SD) to compare the IDA differences before and after the intervention. The paired *t*-test was used to compare the IDA differences before and after the intervention. The chi-square test was used to compare qualitative variables before and after the intervention.

## Materials

The dates used in this study were Mazafati dates, which primarily grow in Saravan and Iranshahr in Sistan and Baluchestan Province, Iran. Mazafati and Rabbi are the dates that have economic value. *P. dactylifera* is considered as a multi-purpose tree by the native people of Saravan. Rural houses are constructed by leaves and

trunks of the date palm. Moreover, leaves of this species are used for handicrafts. Date fruits are aphrodisiac and also used as medicine for cough, blood purgation, anemia, laxative, and cancer. Decoction of seeds is applied for kidney problems and grinded seeds are used as fodder for animals. *P. dactylifera* is respected as a “life” tree among the Baluch tribes and has been used as food, animal feed, medicine, building material, fencing, different household articles, decoration, and handicrafts.<sup>25</sup>

## Results

The Kolmogorov–Smirnov test results indicated that the obtained data were normally distributed. The demographic data that showed that the majority of participants (80.6%) were Baluch. Fathers had a high school diploma or less education but no academic education. Also, only 3.2% of the mothers attained higher levels of education beyond the high school diploma. Unemployed fathers were 19.3% and the mothers were housewives (96.9%) (Table 1).

Mean Hgb levels in subjects were  $11.19 \pm 0.38$  g/dL before the intervention and  $12.05 \pm 0.81$  g/dL after the intervention, and the result obtained was statistically significant ( $p = 0.0001$ ). The mean Hct levels in subjects were  $34.24 \pm 0.41\%$  before the intervention and  $37.17 \pm 2.36\%$  after the intervention, and the result obtained was statistically significant ( $p = 0.001$ ). The mean ferritin levels in subjects were  $47.07 \pm 21.89$  µg/L before the intervention and

**Table 1** Frequency Distribution of Demographic Indicators

		Frequency	Percentage
Ethnicity	Baluch	25	80.6
	Fars	6	19.4
Fathers' education level	Illiterate	12	38.7
	Under the high school diploma	11	35.5
	The high school diploma	8	25.8
	Beyond the high school diploma	0	0
Mothers' education level	Illiterate	18	58.1
	Under the high school diploma	8	25.8
	The high school diploma	4	12.9
	Beyond the high school diploma	1	3.2
Fathers' occupation	Unemployed	6	19.3
	Employee	3	9.7
	Self-employed	11	35.5
	Worker	11	35.5
Mothers' occupation	Housekeeper	30	96.8
	Employee	0	0
	Employed	1	3.2

53.98 ± 19.77 µg/L after the intervention, and the result obtained was statistically significant (p = 0.001) (Table 2).

## Discussion

As the results showed Hgb, Hct, and ferritin levels increased after the date consumption in the female primary school students. All the participants who had IDA at the beginning of the study demonstrated an increase in the blood indices, which can be said that this is due to the presence of iron in the dates and its role in the production of RBCs.<sup>19,24</sup> Yossef et al also found that the use of dates for 2 months by children aged 9 to 11 in the orphanage has increased the levels of Hgb and Ferritin.<sup>20</sup> Abdul Rahman et al also reported that Hgb levels improved in pregnant Egyptian women after consuming 100 g of dates daily for 7 weeks.<sup>28</sup>

Hernandez et al (2006) and Sazawal et al (2010) also achieved similar results.<sup>29,30</sup> Changes in various indices and a significant association between Hgb and ferritin changes appear to be somewhat normal, as the increase in Hgb levels may be due to an increase in the amount of ferritin and/or with the increase in iron storages. The amount of Hgb also increases gradually, and it can be predicted that the storage of iron will improve with the proper nutrition.

Sari et al, in their study, demonstrated that Hgb levels increased in anemic girls who consumed iron supplementation and dates sap. Increased Hgb levels in girls who consumed dates sap were higher than those in who consumed iron supplements,<sup>31</sup> which is the result of this study and the result of the Rahmadani's study that the effect of dates on Hgb in pregnant women<sup>32</sup> emphasizes the effect of dates on Hgb increasing in consistent with our results. Priya et al, in their study, showed that the Hgb levels increased in the age group of 18–55years who consumed dates with milk,<sup>33</sup> but in the Priya et al's study, the age group was different, and fasting people consumed dates with milk for 20 days. In

this study, although milk contains phosphate and it is an inappropriate material in iron absorption,<sup>16</sup> but its mixture with dates has been shown to increase Hgb in the present study, which needs to be studied more accurately. A research has ruled out this result that the mixture dates such as amla has improved the Hgb level.<sup>34</sup>

Akilaroon, Devi, and Jyothipriya (2019) have conducted a research titled “Comparative study on Hgb levels on amla with honey and dates”. Sample size of 50 divided into two groups, one group took amla and honey and another group took only dates. The raise in Hgb levels was measured after 20–25 days. The findings demonstrated that both dates and amla with honey have a drastic increase in the level of Hgb.<sup>34</sup>

Sheikh et al referred to the various properties of fruits from the Holy Quran and science. One of these fruits was dates; its ingredients are vitamins A, B, and D, as well as pentos, glucose, oxalose, ramenose, and uranic acid. The emphasis on the usefulness of dates on health has been mentioned in the Holy Quran.<sup>35</sup>

Regilda et al found that foods rich in corn, chickpea, and cow's lungs are effective in controlling IDA, and it has increased the Hgb levels significantly in primary school children.<sup>36</sup> Also, Anita found that the date extract increases the level of Hgb, which indicates that the dates are rich in iron, and the presence of proteins, carbohydrates, lipids, and elements such as Zn, Fe, Ca, and the presence of abundant amounts of vitamin A is helping in the synthesis of Hgb.<sup>37</sup> This suggests that nutritional correction plays a pivotal role in controlling anemia. Given the many properties of dates and its various ingredients, it is suggested that this inexpensive, healthy, and affordable fruit is taken into account in the elementary school diet program.

## Limitations

### Parents' Lack of Cooperation

Due to the aggressive intervention, their children and their parents were initially afraid of entering the study. Researchers educated and spoke about anemia, its complications and the safety of the above tests for the child and that the experiments were conducted by an experienced person. The samples were taken with the full consent of the parents and the child itself.

### Guicac Test

This test was not conducted due to the lack of identical conditions for stool exam (S/E), and there was an absence of a history of parasitic disease based on the data collection form.

**Table 2** Comparison of Means and Standard Deviations (SD) of Variables Before and After Intervention

Variable	n	Before the Intervention Mean ± SD	After the Intervention Mean ± SD	The Paired t-test Results
Hgb (g/dL)	31	11.19 ± 0.38	12.05 ± 50.81	t = 7.58 P = 0.001
Hct (%)	31	34.24 ± 0.41	31.17 ± 2.36	t = 6.19 P = 0.001
Ferritin (µg/L)	31	47.07 ± 21.89	53.98 ± 19.77	t = 2.58 P = 0.001

## Conclusion

The results of this study showed that the consumption of date fruit increased Hgt, Hct, and serum ferritin levels in all age groups. Moreover, dietary modification can play an important role in preventing and controlling IDA which may be cost-effective. Dietary modification and diet correction should be in accordance with the conditions of the given area and considering the habits and traditions of each region. In Sistan & Baluchestan, considering the planted area of date in this province and the importance and value of it in this area; therefore, dates can be used to treat or prevent IDA in different age groups. Also, considering many of the demonstrated properties of this fruit as mentioned repeatedly in the Quran, it is therefore recommended that the date is supposed to be the fruit of heaven that can be used to treat other diseases. Finally, the researchers recommend the authorities and managers of Education Districts to give 5–7 dates daily in schools to prevent IDA and other mineral deficiencies in Sistan & Baluchestan Province, especially at Zahedan girl's schools, because we concluded that seven dates for 2 months improved blood factors such as Hgb, Hct, and ferritin in this research.

## Ethical Considerations

The authors confirm that this study was conducted in accordance with the Declaration of Helsinki.

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## Disclosure

The authors declare that they have no conflicts of interest in this work.

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