How to Cite:
Gujarathi, R., Arora, M., Kulkarni, M., Patwardhan, R., & Kapgate, S. (2022). Evaluating the role of dates compound in iron deficiency anemia in children. *International Journal of Health Sciences*, *6*(S4), 12663–12675. https://doi.org/10.53730/ijhs.v6nS4.12239

Evaluating the role of dates compound in iron deficiency anemia in children

Dr. Rahul Gujarathi
Professor, Department of Pediatrics, Bharati Vidyapeeth (Deemed to be University), College of Ayurved, Katraj, Pune, India
Corresponding author email: shrigujarathi@gmail.com

Dr. Manish Arora
Professor, Department of Preventive and Social Medicine, Government Ayurveda College, Ajwa Road, Vadodara, Gujarat, India
Email: docmaneesh27@gmail.com

Dr. Mrudula Kulkarni
Associate Professor, Department of Gynecology and Obstetrics, Bharati Vidyapeeth (Deemed to be University), College of Ayurved, Katraj, Pune, India
Email: drmbkulkarni@gmail.com

Dr. Ravindra Patwardhan
Professor, Department of Preventive and Social medicine, Bharati Vidyapeeth (Deemed to be University), College of Ayurved, Katraj, Pune, India
Email: patwardhanravindra@gmail.com

Dr. Sarita Kapgate
Associate Professor, Department of Toxicology and Forensic Medicine, (Bharati Vidyapeeth Deemed to be University), College of Ayurved, Katraj, Pune, India
Email: drsaritakapgate@gmail.com

***Abstract*---**Iron deficiency is by far the first cause of nutritional anemia worldwide. A large portion of iron deficiency is preventable with appropriate and timely intervention. Anemia has been a prevalent health issue in India with over 70% children. Nearly 73 million children below the age of three (79%) suffer from varying degrees of anemia. *Pāṇḍu*, in *Āyurveda*, is supposed to be the nearest co-related entity to anemia. Iron deficiency is usually the result of inadequate bioavailable dietary iron, increased iron requirement during rapid growth, and increased blood loss for any reason. If not corrected, iron deficiency leads to anemia and cognitive impairment, decreased physical capacity, and reduced immunity. The effects of anemia on children are the direst because their bodies are still developing. The management of this syndrome is supplementing elemental iron or bio-

Manuscript submitted: 9 May 2022, Manuscript revised: 18 July 2022, Accepted for publication: 27 August 2022

iron through food or as medicine. Elemental iron supplements have their own drawbacks as unwarranted effects like constipation, vomiting, metallic taste, non-acceptance and compliance, iron deposition in the tissues and sometimes iron toxicity. Bio-organic iron of natural origin (plant and animal origin) bypasses these symptoms, it is readily absorbed and readily bio-converted. The present comparative study aimed at justifying the Elemental iron supplements and bio iron i.e. iron of natural origin using Figs (*Aṅjīra*), Black Currants (*Manukā*) and Dates (*Kharjūra*) combination in the management of *Pāṇḍu* (iron deficiency anemia) in children. Patients were assessed for various symptoms of *Pāṇdū* which were graded, and on hematological and biochemical parameters. Both the drugs showed statistically significant effect in treating *Pāṇḍu* and improvement was observed persistently in all the symptoms.

***Keywords*---**iron deficiency anemia (IDA), bio-iron, dates, black currant, hemoglobin, serum iron.

Introduction

Iron deficiency is by far the first cause of nutritional anemia worldwide. A large portion of iron deficiency is preventable with appropriate and timely intervention. Anemia has been a prevalent health issue in India with over 70% children. According to the National Family Health Survey (NFHS) III, data for anemia prevalence among children under three years of age shows 79% which is five per cent more than the NFHS II survey done six years prior to the NFHS III survey, which was in 2005 – 2006. Nearly 73 million children below the age of three (79%) suffer from varying degrees of anemia. South East Asia has the largest number of anemic population, both as an absolute number and also in proportion. 66% of the children in South East Asia are supposed to be anemic. Iron deficiency anemia is characterized by fall of ±2 SD in the mean hemoglobin level specific for that age and sex in children. IDA can be understood as a blood disorder in which the blood has a reduced ability to carry oxygen due to a lower than normal number of red blood cells, or a reduction in the amount of hemoglobin. Anemia is the most common disorder of the blood, of the developing world. "Anemia" is not a diagnosis in itself. It is an objective sign of the presence of other diseases. iron deficiency is considered to be the most common cause of anemia, at least in children and females, though other conditions of nutrition such as vitamin B_{12} and folate deficiencies, parasitic infections, chronic gut inflammation leading to reduced absorption of iron, chronic diseases, endocrine disorder and various inherited disorder can also causes anemia [1, 2]. Pallor and lethargy are main symptoms at large. This is followed by refusal to feed, growth derangement and poor performance indices. It is diagnosed bio-chemically by lower levels of hemoglobin, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, low serum iron concentration, lower levels of serum ferritin and raised total iron binding capacity.

Table 1:
W.H.O. Hemoglobin Thresholds used to define ANEMIA:
[1 gm/dl:0.6206mmol/L] [3]

Age/Gender Group	Hb Threshold [gm/dl]	Hb Threshold [mmol/L]
Children (0.5–5.0 yrs)	11.0	6.8
Children (5–12 yrs)	11.5	7.1
Teens (12–15 yrs)	12.0	7.4
Women, non-pregnant (>15yrs)	12.0	7.4
Men (>15yrs)	13.0	8.1

During infancy, when growth is rapid, iron from cow's and breast milk makes it difficult to maintain body iron levels at the optimum. Breastfed infants have are at an advantage, because they can absorb iron 2-3 times more efficiently than infants that are fed cow's milk. Breastfed infants are at risk to land in to iron deficiency if regular intake of iron-fortified foods by six months of age is not started [4]. The usual dietary pattern observed in infants and toddlers with nutritional iron-deficiency anemia, is excessive consumption of cow's milk [5, 6, 7] (low iron content, blood loss from milk protein colitis). Under nutrition is also generally responsible for iron deficiency.

Iron deficiency and iron-deficiency anemia

Iron deficiency is a condition where serum iron levels fall below the threshold levels i.e. 50 mg/dL but the pathophysiology of anemia has not set off. Iron deficiency has non hematologic systemic effects. Both iron deficiency and iron-deficiency anemia are associated with impaired neurocognitive function in infancy[7]. Iron-deficiency anemia may also be associated with, possibly irreversible, cognitive defects [8]. Some studies suggest an increased risk of seizures, strokes, breath-holding spells in children, and exacerbations of restless legs syndrome [9]. Due to the potential of adverse neurodevelopmental outcomes, reducing the frequency of iron deficiency has to be an important goal, overall. Other non-hematologic consequences of iron deficiency include pica and pagophagia, the desire to ingest ice.

Diagnosis of IDA [10]

A thorough medical history is important to the diagnosis of iron-deficiency anemia. A travel history to areas in which hookworms and whipworms are endemic may also be helpful in guiding certain stool tests for parasites or their eggs [11]. In progressive iron deficiency, a sequential biochemical and hematologic events occur. Tissue iron stores deplete. The reduced serum ferritin reflects this depletion, Ferritin is an iron-storage protein, which can provide an estimate of body iron stores when inflammatory diseases are absent [12]. Later serum iron levels decrease. The iron-binding capacity of the serum (serum transferrin) increases, and the transferrin saturation falls below normal. As iron stores decrease, iron becomes unavailable to form a complex with protoporphyrin to form haem. At this point, iron deficiency progresses to iron-deficiency anaemia [13]. With lesser hemoglobin, the red blood cells (RBCs) become smaller called

microcytes, and varied in size. The changes are associated with a decrease in mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) [14]. The RBC count decreases. The reticulocyte count (percentage) is normal or moderately elevated. The peripheral blood smear reveals hypochromic, microcytic RBCs with substantial variation in cell size. A presumption of iron-deficiency anemia is most of the times done by a complete blood count (CBC) showing a microcytic anemia picture with high Reticulocyte Distribution Width (RDW), decreased RBC count (Hematocrit), normal White Blood Count (WBC) count, and a normal or elevated platelet count. Other laboratory investigations like the reduced serum ferritin, reduced serum iron, and increased total iron-binding capacity, generally, are not necessary unless severe anemia requires a faster diagnosis, other complicating clinical signs are present, or the anemia does not respond to oral iron therapy. A diagnosis of iron deficiency in the absence of anemia is challenging. Serum ferritin is a useful tool, whose value is increased by also measuring C-reactive protein to help identify false-negative results because of concomitant inflammation.

Table 2:
Laboratory studies differentiating diagnosis of microcytic anaemia[14, 15]

Study	Iron Deficiency Anemia	A or β Thalassemia	Anemia of Chronic Disease
Hemoglobin	Decreased	Decreased	Decreased
Mean Corpuscular Volume	Decreased	Decreased	Normal / Decreased
RDW	Increased	Normal / Minimally Increased	Normal / Increased
RBC	Decreased	Normal / Increased	Normal / Decreased
Serum Ferritin	Decreased	Normal	Increased
Total Iron Binding Capacity (TIBC)	Increased	Normal	Decreased
Serum Transferrin Saturation	Decreased	Normal	Decreased
Free Erythrocytic Protoporphyrin (FEP)	Increased	Normal	Increased
Soluble Transferrin Receptor	Increased	Normal	Normal
Reticulocyte Hemoglobin Concentration	Decreased	Normal	Normal / Decreased

The response of iron-deficiency anemia to adequate administration of iron is a critical diagnostic and therapeutic feature. Oral administration ferrous salts [16, 17] most often ferrous sulphate is inexpensive and effective. No evidence is available regarding the addition of any trace metal, vitamin, or other hematinic substance

leading to significant increase in the response to simple ferrous salts. Calcium and dietary fibre decrease the absorption of iron, but this can be overcome by co-administration of ascorbic acid. Tea is a significant inhibitor of iron absorption. The therapeutic dose should be calculated in terms of elemental iron. Iron in a total daily dose of 3-6 mg/kg of elemental iron in 1 or 2 doses is enough, while higher doses are used in severe cases. Parenteral iron is considered in malabsorption, where compliance is inadequate, as oral therapy is otherwise effective, less expensive and safe. Iron therapy increases the virulence of malaria and certain gram-negative bacteria. Iron overdose is mostly associated with Yersinia infection. Dietary counseling is usually necessary. Intake of cow's milk, needs be limited. Dietary iron should be increased. Iron from haem sources is more bioavailable than from non-haem sources. Iron should be continued for 2-3 months after values normalize so as to re-establish iron stores.

Pāṇḍu, a disease described in *Āyurveda*, is supposed to be the nearest co-related entity to anemia characterized by *Pāṇḍutā* (Pallor), *Akśikuṭa Śotha* (Periorbital edema), *Hṛdspanda* (Palpitation) and *Daurbalya* (Lethargy). A person who acquires *Pāṇḍu Varṇatvam* (whitish or pale complexion of the skin) or has deviation from the normal skin color to *Pāṇḍutā*, is said to be suffering from *Pāṇḍu Roga* [18, 19, 20]. *Saṅtarpaṇa* (alleviation of the disease by nourishment of the tissues) is a treatment of *Pāṇḍu* and thus it needs to be implied to patients suffering from *Pāṇḍu* [21]. The management of this syndrome is supplementing elemental iron or bio-iron through food or as medicine [20]. Elemental iron supplements have their own drawbacks and present as unwarranted effects like constipation, vomiting, metallic taste, non-acceptance and compliance, iron deposition in the tissues and sometimes iron toxicity. Bio iron i.e. iron of natural origin (plant and animal origin) prevents these unwarranted symptoms from arising, it is readily absorbed and readily bio-converted. Hence, the present comparative study of elemental iron and bio iron i.e. iron of natural origin using Figs (*Aṅjīra*), Black Currants (*Manukā*) and Dates (*Kharjūra*) combination, hence forth referred as the 'Dates Compound' was undertaken in the management of *Pāṇḍu* (iron deficiency anemia) in children.

Methodology

The present study was designed as a randomized controlled comparative trial, consisting of 160 diagnosed cases (children) of *Pāṇḍu* (Iron Deficiency Anemia), where one arm was of the trial interventional combination (Dates compound) and another arm was of the controlled drug, iron ascorbate, a commonly used iron formulation, to treat anemia. The control group was given iron ascorbate solution in a dose of 6 mg of elemental iron per kg per dose rounded to the nearest multiple of 10 mg of elemental iron, once a day early morning, empty stomach for 30 days. The trial group was asked to consume daily, a freshly prepared Dates compound paste containing Figs (*Aṅjīra*), Black Currants (*Manukā*) and Dates (*Kharjūra*), 10 grams each, soaked overnight in water, for the span of 30 days. The trial was registered with CTRI (Central Trial Registry of India) and a trial number was obtained. A physical and a biochemical examination for assessment of a complete blood count, serum iron, serum ferritin and total iron binding capacity was done before the commencement and after the end of the intervention. The pre commencement investigations were done for confirmation of diagnosis of IDA and post-trial were done to evaluate the effect of intervention.

Inclusion Criteria

The diagnosed cases of iron deficiency anemia based on low serum iron and raised total iron binding capacity, microcytic, hypochromic anemia, diagnosed on the basis of the blood indices (Hemoglobin, MCV, MCH, MCHC) from the report of complete blood count and with moderate grade of anemia (Hemoglobin varying in the range of 5-10 g %) between age group of 5 to 16 years were enrolled.

Exclusion Criteria

Diagnosed cases of anemia having origin other than iron deficiency, macrocytic and normocytic anemia, mild grade of anemia (Hemoglobin above 10 g %) and severe grade of anemia (Hemoglobin below 5 g %), with complications of anemia, with other long standing diseases and debilitating diseases were excluded from the present study.

Assessment Criteria

Patients were assessed by a visual analogue scale for subjective parameters like symptoms of *Aśraddhā* (Food aversion), *Arucī* (Anorexia), *Āsyavairasya* (Dysgeusia), *Hṛllāsa* (Nausea), *Gauravа* (Heaviness of the body), *Tandrā* (Drowsiness/Lassitude), *Aṅgamarda* (Soreness of body), *Pāṇḍūtā* (Pallor), *Kṛśtā* (Emaciation), *Agnimāndya* (Loss of appetite), *Hṛtspanda* (Palpitation), *Amlapritī* (Liking for sour foods), *Śiśiradweṣa* (Cold aversion), *Rukśatā* (Dryness), *Śramaśwāsa* (Exhaustion on slightest exertion), *Daurbalya* (Lethargy/weakness), *Karṇakśweḍa* (Tinnitus), *Śotha/Akśikūṭaśotha* (Edema/Periorbital edema), *Nidrā* (Sleep hours), *Pādaśūla/Piṇḍikodweṣṭana* (Restless Leg Syndrome), which were graded along with biochemical examination of a blood indices, serum iron, serum ferritin and total iron binding capacity was done. The modern nearest correlation to the *Āyurvedic* terminologies have been obtained from the NAMASTE PORTAL, of Central Council for Research in *Āyurveda* and *Siddha*, an autonomous body under the Ministry of AYUSH, Government of India [22].

Observation & Results

More than 300 patients were screened, together at both the sites and of those 247 patients were registered in the trial, as they fulfilled the inclusion criteria. Of these 247, 118 were enrolled in the trial group and 129 were enrolled in the controlled group of those 160 cases were completed; 80 in the each group. Among both the groups out of 160 patients 42 [26.25%] were in age group of 8-9 years, 39 patients [24.37 %] in the age group of 6-7 years, 34 patients [21.25 %] in the age group 9-10 years, 33 patients [20.62 %] in the age group 7-8 years and 12 [7.5%] in age group of 5-6 years, whereas 80 [50.0 %] patients were boys and the rest 80 [50.00 %] patients were females.

Out of 160 patients, 154 [96.25 %] patients had a history of adequate breastfeeding pattern; 04 [3.75%] patients did not receive breast-feeding. 116 [72.5 %] patients were delivered vaginally; 41 [25.63%] patients had to be extracted by a caesarean section and 03 [1.87%] patients required assistance during delivery. 142 [88.75 %] patients had completed full term of gestation; 10

[6.25%] patients were born post term and 08 [5%] patients were delivered before completion of adequate gestation.62 [38.75 %] patients had history of Bottle-feeding; 98 [61.25%] patients did not have history of Bottle-feeding.

Table 3:
Effect of Interventional Combination on Symptomatology

Parameter	Mean BT	Mean AT	X	% of improvement	'Z' value
Aśraddhā	1.95	0.625	1.325	67.95	-7.106
Arucī	2.075	0.85	1.225	59.04	-7.289
Āsyavairasya	2.1125	0.885	1.225	57.99	-7.289
Arasajñatā	2.0	0.8215	1.1875	59.38	-7.173
Hṛllāsa	1.3375	0.525	0.8125	60.75	-6.031
Gaurava	2.075	0.575	1.5	72.29	-7.06
Tandrā	2.0375	0.6	1.4375	70.55	-7.379
Aṅgamarda	2.1125	0.575	1.5375	72.78	-72.68
Pāṇdūtā	2.0875	0.9125	1.175	56.29	-7.725
Kṛśatā	0.8375	0.6375	0.2	23.88	-3.771
Agnimāndya	2.1125	0.5375	1.575	74.56	-7.352
Hṛtspanda	2.0	0.4625	1.5375	76.88	-6.981
Amlapritī	2.0875	0.525	1.5625	74.85	-6.959
Śiśiradweṣa	1.9875	0.4875	1.5	74.47	-6.914
Rukśatā	2.0375	0.525	1.5125	74.23	-6.86
Śramaśwāsa	1.975	0.5375	1.4375	72.78	-6.835
Kaṃakśweḍa	1.9375	0.45	1.4875	76.77	-6.968
Daurbalya	1.9625	0.4875	1.475	75.16	-6.992
Śotha/Akśikūṭaśotha	1.9375	0.425	1.5125	78.06	-7.027
Nidrā	2.0375	0.4625	1.575	77.30	-7.152
Pādaśūla/Piṇḍikodweṣṭana	2.025	0.5	1.525	75.31	-7.05

Table 4:
Effect of Control Drug on Symptomatology

Parameter	Mean BT	Mean AT	X	% of improvement	'Z' value
Aśraddhā	1.75	0.95	0.8	45.71	-5.695
Arucī	1.7875	1.0375	0.75	41.96	-5.568
Āsyavairasya	1.7875	0.9	0.8875	49.65	-6.037
Arasajñatā	1.875	0.9875	0.8875	47.33	-6.037
Hṛllāsa	1.7875	.885	0.9	50.35	-6.029
Gaurava	1.7625	0.925	0.8375	47.52	-6.057
Tandrā	1.6875	0.8625	0.825	48.89	-5.828
Aṅgamarda	1.5375	0.825	0.7125	46.34	-5.437
Pāṇdūtā	2.0	1.0	1.0	50.00	-8.105
Kṛśatā	0.7125	0.525	0.1875	26.32	-3.638
Agnimāndya	1.6125	0.8625	0.75	46.51	-5.502
Hṛtspanda	1.6125	0.9125	0.7	43.41	-5.24

Amlapritī	1.575	0.9125	0.6625	42.06	-4.895
Śiśiradweṣa	1.7	0.925	0.775	45.59	-5.513
Rukśatā	1.4625	0.825	0.6375	43.57	-4.754
Śramaśwāsa	1.45	0.825	0.625	43.10	-4.716
Kaṃakśweḍa	1.5875	0.875	0.7124	44.88	-5.097
Daurbalya	1.7375	0.9125	0.825	47.48	-5.828
Śotha/Akśikūṭaśotha	1.575	0.775	0.8	50.79	-5.664
Nidrā	1.6125	0.85	0.7625	47.29	-5.452
Pādaśūla/Piṇḍikodweṣṭana	1.0775	0.9375	0.8375	47.18	-5.935

Both the groups showed statistically significant effect in treating *Pāṇḍu Vyādhī* and improvement was observed persistently in all the symptoms. It was throughout observed for all symptoms, that the improvement/relief from symptoms of anemia was much better with the use of Dates compound. Dates compound showed to reduce the severity of symptoms faster than that of plain elemental iron supplement. The improvement in symptomatology with Dates compound far exceeded and fared better in comparison to elemental iron.

Table 5:
Effect of Interventional Combination on Anaemia Profile Parameters

Parameter	Haemoglobin	Serum Iron	Serum Ferritin	TIBC
Mean BT	7.9475	35.063	17.375	535.88
Mean AT	10.056	70.8	39.713	339.25
X	2.1088	35.738	22.338	196.63
% of improvement	20.97%	50.48%	56.25%	57.96%
't' value	-29.57	-42.25	-19.37	20.337

Table 6:
Effect of Control Drug on Anaemia Profile Parameters

Parameter	Hemoglobin	Serum Iron	Serum Ferritin	TIBC
Mean BT	8.0087	34.75	18.9	527.588
Mean AT	10.0338	69.125	47.65	328.5
X	2.025	34.375	28.75	199.088
% of improvement	20.18	49.73	60.34	60.61
't' value	-35.547	-46.425	32.667	-79.248

.

The increment in hemoglobin and serum iron level concentration and total iron binding capacity was almost similar in both the groups, with a very marginal difference. Contrary to the expectation, hemoglobin level and serum iron levels fared marginally better with the use of Dates compound as compared to elemental iron, though as expected, none of the group showed an increment in hemoglobin levels that could match the normal hemoglobin window. Ferritin increment was better with the use of elemental iron rather than Dates compound, though the

difference on all these parameters in both the groups was very minimal and statistically insignificant, thus indicating the positive effect of both the drugs in comparable amount an iron deficiency anemia.

Discussion

The demographic analysis of prevalence of anemia in children shows a considerably higher number in the age group of 6-7 years and 8-9 years. The findings are consistent with other studies conducted which underline the fact that the highest prevalence of anemia is seen in children less than 10 years. This particular survey highlights the incidence across all ages [23]. The dried Figs are reported to be an important source of different vitamins, minerals, carbohydrates, sugars, organic compounds, phenolic etc. [24, 25]. The fresh as well as dried fruits of figs are good source of fibre and polyphenols [26, 27, 28]. Figs are quoted in the traditional systems of medicine like as *Āyurveda*, *Unānī*, and *Siddha* and are used to treat diseases of the endocrine system (diabetes), respiratory system, digestive tract (indigestion and vomiting), menstrual disorders and menstrual pain etc. As per data of USDA for the mission variety, dried figs are rich in fibre, copper, manganese, magnesium, potassium, calcium, iron and vitamin K. Fruits also have other nutrients in smaller proportion. Fruits of *Ficus carica* (Figs) are consumed fresh or dried, which are an excellent source of minerals, vitamins, carbohydrates, and dietary fibre, having a low fat and cholesterol content and ample amount of amino acids [27, 29, 30, 31].

Kharjūra term is used for fruits of *Phoenix dactylifera* Linn. Dates fruits are rich in carbohydrates in the form of sucrose, glucose and fructose (65% – 80%), and is a good source of fibres and certain essential minerals. *Kharjūra* or dates fruits contain low fats and protein but contain high sugar concentration and do not have starch. *Kharjūra* or dates fruits are rich source of niacin, B_6, riboflavin, thiamine, pantothenic acid, manganese, magnesium, iron and phosphorus. *Kharjūra* or dates fruits also contain a good amount of zinc, copper, potassium selenium and folic acid [32].

Dried fruits of Grape Vine (*Vitis vinifera*) i.e Black Currant is considered as *Drākśā* in *Āyurveda*. The important basic constituent of grape is manganese. *Vitis vinifera* or grape vine contains vitamin B_6, thiamine, riboflavin, vitamin C and potassium. Various studies concluded that it also contains a chemical substance like resveratrol, a polyphenol having antioxidant properties [33].

Table 3:
Nutritional values [34]

	Aṅjīra	*Drākśā*	*Kharjūra*
Edible Portion (Percentage)	99.0	98.0	94.0
Moisture (Grams)	38.0	20.2	15.3
Protein (Grams)	1.3	0.3	2.5
Total Fat (Grams)	0.2	0.5	0.4
Total Minerals (Grams)	0.6	1.2	3.15
Total Edible Fibre (Grams)	2.2	1.7	3.9

Carbohydrates (Grams)	57.6	75.2	75.8
Total Calories (Kcal)	373	316	317
Calcium (Milligrams)	80.0	130.0	120.0
Phosphorus (Milligrams)	30.0	110.0	50.0
Iron Compounds (Grams)	0.87	0.69	1.54
Elemental Iron (Milligrams)	102	7.7	173
Carotene (Micrograms)	162.0	21.0	26.0
Thiamine (Milligrams)	0.06	0.03	0.01
Riboflavin (Milligrams)	0.05	0.14	0.02
Niacin (Milligrams)	0.6	0.4	0.9
Ascorbic Acid (Milligrams)	5.0	1.0	3.0
Essential Amino Acids (Total Nitrogen Gram Percent)	2.8	2.3	0.4

Figs (*Aṅjīra*), Black Currants (*Manukā*) and Dates (*Kharjūra*) are fruits mentioned in classics of *Āyurveda* for treating *Pāṇḍu Vyādhī*. These fruits are rich in iron, having a competitive content of iron. Being of plant origin and being organic products, the iron content of Figs (*Aṅjīra*), Black Currants (*Manukā*) and Dates (*Kharjūra*) fruits is in the form of bio-iron. As compared to the control drug i.e. iron ascorbate which contains only iron, cyanocobalamin (B_{12}) and folic acid, the interventional combination i.e. Figs (*Aṅjīra*), Black Currants (*Manukā*) and Dates (*Kharjūra*) fruits contain in addition, other nutrients like carbohydrates, proteins, vitamins like cyanocobalamin (B_{12}), pyridoxine (B_6), niacin(B_3), riboflavin (B_2), thiamine (B_1), β carotene (A), ascorbic acid (C), essential amino acids, minerals like calcium and zinc that act and contribute as substrate for formation of hemoglobin. Thus can be considered as a complete nutritional medical supplement[28, 32].

Figs (*Aṅjīra*), Black Currants (*Manukā*) and Dates (*Kharjūra*), according to *Āyurveda*, are considered to be *Dīpana* (Appetizer) and *Pācana* (Digestive). Due to its *Dīpana* and *Pācana* function, it is useful in reducing the symptoms like *Hṛllāsa* and *Agnimāndya*. Treating IDA with iron enhances appetite and lowers ghrelin levels [35]. Iron from Dates compound is likely to be useful in reducing the levels of the hormone-Ghrelin and improving appetite and improving digestion, thus reducing the associated symptom like nausea. As gastric secretion increase, iron absorption also increases and that leads to improvement in appetite and decrease of nausea [36, 37]. The increment in hemoglobin and serum iron levels, which was comparable to the increment with elemental iron, probably might be due to better absorption of iron from the Dates compound, as it was a biological form of iron, whereas iron ascorbate is a mineral-chemical-non-biological form.

Conclusions

Iron deficiency is usually the result of inadequate bioavailable dietary iron, finally leading to iron deficiency anemia. Under nutrition is also generally responsible for iron deficiency. Dietary counselling is usually necessary for preventing iron deficiency anemia. Oral administration ferrous salts or intake of iron-fortified foods by six months of age is the recommended treatment, but these being

inorganic salts, have their own drawbacks. The iron from diet, i.e. biological form of iron, available from dietary sources can be a better alternative to inorganic salts as it is better absorbed, readily converted to haem and its consumption is devoid of any known complications arising due to intake of inorganic iron salts. Co-administration of ascorbic acid can enhance the absorption of iron from these sources.

Conflict of interest
None

References

1. "Soil-transmitted helminthic infections". Archived from the original on 2014-02-21. Retrieved 2014-03-05. World Health Organization Fact Sheet No. 366, Soil Transmitted Helminthic Infections, updated June 2013
2. Abdulameer, S. jasim, & Jaber, A. H. A. (2022). Cytogenetic study of types anemia patients. *International Journal of Health Sciences*, *6*(S7), 487–499. https://doi.org/10.53730/ijhs.v6n7.11090
3. Abdullah K, Birken CS, Maguire JL, et al. Re-evaluation of serum ferritin cut-off values for the diagnosis of iron deficiency in children aged 12-36 months. J Pediatr .2017;188:287–290
4. Agniveśa in Caraka Saṁhitā revised by Caraka and Dṛḍhbala with Āyurveda Dīpikā Commentry of Cakrapāṇidatta, ed. Jadavji Trikamji Acharya, Cikitsāsthāna 16/40-43.MunshiramMohanlal Publishers Pvt. Ltd., Mumbai. pp 528
5. Berglund SK, Westrup B, Domellöf M. Iron supplementation until 6 months protects marginally low-birth-weight infants from iron deficiency during their first year of life. J Pediatr Gastroenterol Nutr. 2015;60(3):390–395
6. Centre for Disease Control Prevention (CDC) (October 11, 2002). "Iron Deficiency – United States, 1999–2000". MMWR. 51 (40): 897–899. PMID 12418542. Archived from the original on May 5, 2012. Retrieved April 21, 2021
7. Congdon EL, Westerlund A, Algarin C, et al. Iron deficiency in infancy is associated with altered neural correlates of recognition memory at 10 years. J Pediatr. 2012;160:1027– 1033
8. DeLoughery TG. Microcytic anaemia. N Engl J Med. 2014;371:1324–1331
9. Falkingham M, Abdelhamid A, Curtis P, et al. The effects of oral iron supplementation on cognition in older children and adults: a systematic review and meta-analysis. Nutr J. 2010;9:4
10. Ferrara M, Capozzi L, Russo R, et al. Reliability of red blood cell indices and formulas to discriminate between beta thalassemia trait and iron deficiency in children. Haematology. 2010;15(2):112–115
11. Fu-Ping Lai, Yao-Jong Yang. The prevalence and characteristics of cow's milk protein allergy in infants and young children with iron deficiency anaemia Pediatr Neonatol. 2018 Feb; 59(1):48-52. doi: 10.1016/j.pedneo.2017.01.004. E pub 2017 Jun 30.
12. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015". Lancet. 388 (10053): 1545–1602.

October 2016. doi:10.1016/S0140-6736(16)31678-6. PMC 5055577. PMID 27733282
13. Hanin Ghrayeb, Mazen Elias, JeriesNashashibi, Awni Youssef, Mari Manal, LialaMahagna, MasalhaRefaat, Naama Schwartz, Adi Elias. Appetite and ghrelin levels in iron deficiency anaemia and the effect of parenteral iron therapy: A longitudinal study. PLoS One. 2020; 15(6): e0234209. Published online 2020. doi: 10.1371/journal.pone.0234209 PMCID: PMC7272047 PMID: 32497136.
14. http://namstp.ayush.gov.in/ accessed on 23.06.2022
15. ICMR-National Institute of Nutrition. In Nutritive Value of Indian Foods (NVIF).
16. Iriti M, Faoro F. 2006. Grape phytochemicals: A bouquet of old and new nutraceuticals for human health. Med Hypothesis 67: 833–838
17. Jeong WS, Lachance PA. Phytosterols and fatty acids in fig (Ficus carica var. mission) fruit and tree components. Food Chemistry and Toxicology. 2001; 66:278– 281.
18. Kaushansky K, KippsTJ. Haematopoietic agents: growth factors, minerals, and vitamins. In: Brunton LL, Chabner BA, Knollmann BC, ed. Goodman and Gilman's The pharmacological basis of therapeutics. 12thed. USA: McGraw Hill; 2011: 1076-85.
19. L. S. Valberg, K. B. Taylor and L. J. Witts, "The effect of iron deficiency on the stomach of the rat" Bd. J. Nut. (1961), 15, 473-80.
20. Longo, Dan L.; Camaschella, Clara (7 May 2015). "Iron-Deficiency Anaemia". New England Journal of Medicine. 372 (19): 1832–1843. doi:10.1056/NEJMra1401038. PMID 25946282
21. Mādhavakara in Mādhava Nidāna with Madhukoṣa commentary by Vijayarakśita and Śrikaṇṭhadatta. ed. Jadavji Trikmji Acharya. 8/1. Nirnay Sagar Press, Mumbai. pp 95
22. McDonagh MS, Blazina I, Dana T, et al. screening and routine supplementation for iron deficiency anaemia: a systematic review. Paediatrics. 2015;135(4):723–733
23. Peyrin-Biroulet, Laurent; Williet, Nicolas; Cacoub, Patrice (December 1, 2015). "Guidelines on the diagnosis and treatment of iron deficiency across indications: a systematic review". The American Journal of Clinical Nutrition. 102 (6): 1585–1594. doi:10.3945/ajcn.114.103366. PMID 26561626
24. Powers JM, Buchanan GR. Diagnosis and management of iron deficiency anaemia. Hematol Oncol Clin North Am. 2014;28(4):729–74
25. Powers JM, Buchanan GR. Potential for improved screening, diagnosis and treatment for iron deficiency and iron deficiency anaemia in young children. J Pediatr. 2017;188:8– 10
26. Shah RH, Meti Rajneesh, Arora MT, Gujarathi Rahul. Anjīra (Ficus carica L) – A food supplement with medicinal benefits. International Journal of Green Pharmacy. Oct-Dec 2020; 14(4):343-347
27. Shah RH, Pani Sudhirkumar, Arora MT, Gujarathi Rahul. Kharjoor (dates fruit)-an alternative balanced nutritional diet with medicinal benefits. Bulletin of Environment, Pharmacology and Life Sciences. 2022; 11
28. Slatnar A, Klancar U, Stampar F, Veberic R. Effect of drying of figs (Ficus carica L.) on the contents of sugars, organic acids, and phenolic compounds. Journal of Agricultural and Food Chemistry. 2011; 59(21):11696–11702

29. Smith RE (March 2010). "The clinical and economic burden of anaemia". The American Journal of Managed Care. 16 Suppl Issues: S59–66. PMID 20297873
30. Solomon A, Golubowicz S, Yablowicz Z, et al. Antioxidant activities and anthocyanin content of fresh fruits of common fig (Ficus carica L.) Journal of Agricultural and Food Chemistry. 2006; 54(20):7717–7723
31. Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2021). Health and treatment of diabetes mellitus. *International Journal of Health Sciences*, *5*(1), i-v. https://doi.org/10.53730/ijhs.v5n1.2864
32. Suryatika, I. B. M., Anggarani, N. K. N., Poniman, S., & Sutapa, G. N. (2020). Potential risk of cancer in body organs as result of torak CT-scan exposure. *International Journal of Physical Sciences and Engineering*, *4*(3), 1–6. https://doi.org/10.29332/ijpse.v4n3.465
33. Suśruta in Suśruta Saṁhitā with Nibandhsaṅgraha commentary of Dalhaṇa, ed. Jadavji Trikamji Acharya, Uttaratantra 44/3. Chaukhamba Surabharati Prakashan, Varanasi. pp 621
34. Upanandan Mandal, Kazi Monjur Ali, Kausik Chatterjee, Debasis De, Anjan Biswas, and Debidas Ghosh. Management of experimental hypochlorhydria with iron deficiency by the composite extract of *Fumaria vaillantii* L. and *Benincasa hispida* T. in rat. J Nat Sci Biol Med. 2014 Jul-Dec; 5(2): 397–403. doi: 10.4103/0976-9668.136202 PMCID: PMC4121923 PMID: 25097423.
35. Vāgbhaṭa in Aṣṭāṅga Hṛdaya. ed. Gadre GK. Sārtha Vāgbhaṭa Nidānasthāna 13/3. Published Ramesh Vitthal Raghuvanshi, Gajanan Book Depot, Mumbai. pp 200
36. Veberic R, Colaric M, Stampar F. Phenolic acids and flavonoids of fig fruit (Ficus carica L.) in the northern Mediterranean region. Food Chemistry. 2008; 106(1):153– 157
37. Veberic R, Jakopic J, Stampar F. Internal fruit quality of figs (Ficus carica L.) in the Northern Mediterranean Region. Italian Journal of Food Science. 2008; 20(2):255– 262
38. Vinson JA, Zubik L, Bose P, Samman N, Proch J. Dried fruits: excellent in vitro and in vivo antioxidants. Journal of the American College of Nutrition. 2005; 24(1):44–50
39. Vinson JA. The functional food properties of figs. Cereal Foods World. 1999; 44(2):82–87
40. Zimmermann MB, Hurrell RF: Nutritional iron deficiency, Lancet 370:511–520, 200