



AN AYURVEDIC REVIEW OF PANDU ROGA W.S.R. TO IRON DEFICIENCY ANEMIA IN CHILDHOOD AGE

Ayurveda

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ABSTRACT

Anemia is global problem of immense public health significance. It is a very common disease occurring in all ages without sex discrimination and all season. It may develop as a separate disease or, as a consequence of much life threatening disease. Pandu roga is such a disease in which Vaivarna (means change of normal colour of the body) occurs. In Ayurvedic texts, almost all acharyas describes Pandu Roga in detail. According to the Ayurvedic classics, there are various factors mentioned for the occurrence of Pandu roga. Iron preparations available used in treatment of iron deficiency anemia has many adverse effect. In Ayurvedic texts, the Indian system of medicine, various herbs and herbominerals formulations described for treatment of Pandu roga. Research studies now show that commonly available herbs and herbominerals like Punarnavasav, Navayas Lauha, Lauha bhasma, Mandura bhasma, Panduhara Yoga, Navayasa Churna, Punarnavadi Mandura, Dhatri Lauha, Pradarantaka Lauha, Sarvajvarahara Lauha and Vrihatyakraudi Lauha, & Phalatrikadi Kwatha etc. possess significant antianemic activity in experimental and clinical trials.

KEYWORDS

Pandu roga, Anemia, Punarnavasav, Navayas Lauha, Lauha bhasma.

INTRODUCTION

Iron deficiency affects a significant part of the population in nearly every country in the world. Nutritional status is a major determinant of the health and well-being of children. Inadequate or unbalanced diets and chronic illness are associated with poor nutrition among children. *Pandu roga* (anemia) is global problem of immense public health significance. It is a very common disease occurring in all ages without sex discrimination and in all seasons. It may develop as a separate disease or, as a consequence of much life threatening disease. *Pandu* is such a disease in which *vaivarnya* or change of normal colour of the body occurs.

The word *Pandu* is derived from the root 'PADI-NASANE' with suffix 'KU' in the sense of *nashan*. In *Pandu* change is in the colour of body so *nashana* here signifies *varna nashan*. *Vachaspatyam* refers *Pandu* as mixture of white and yellow colour which resembles with the pollen grains of *ketaki* flower. So, various meaning of *Pandu Varna* found as *Peeta Bhagardha*, *Samvalitha Sukla*, *Peetha*, and *Pallor*. In Ayurvedic texts, almost all acharyas describe this disease in detail.

Anemia word is derived from Greek which means lack of blood. Anemia is defined as a haemoglobin concentration in blood below the lower limit of the normal range for the age and sex of the individual (Harsh Mohan, 2000)^[1] or Anemia means deficiency of haemoglobin in the blood, which can be caused by either too few red blood cells or too little haemoglobin in the cells. Anemia is the result of a wide variety of causes that can be isolated, but more often coexist. So, a variety of aetiologies exist for anemia, including: anemia due to blood loss, anemia due to impaired red cell formation which may occur as a result of various factors as cytoplasmic maturation defects, nuclear maturation defects, haemopoietic stem cell proliferation abnormalities, bone marrow failure and infiltration, and anemia due to increased red cell destruction.

However, worldwide, the most prevalent form of anemia is that of iron deficiency, but its prevalence is higher in the developing countries. It occurs at all stages of the life cycle, but most affected are infants, pre-school children and women of child bearing age in the developing world. Adolescents are also susceptible to iron deficiency because of high requirements due to the growth spurt, dietary deficiencies, and menstrual blood loss.

In the United States, about 9% of 1 to 2 year old children are iron deficient; 3% have anemia. Of adolescent girls, 9% are iron deficient and 2% have anemia^[2]. The World Health Organization (WHO) has estimated that, globally, 1.62 billion people are anaemic, with the highest prevalence of anemia (47.4%) among preschool-aged children; of these 293 million children, 89 million live in India^[3]. More than 75% of Indian toddlers are anaemic^[4].

Iron deficiency is the most frequent and widespread nutritional deficiency in the world. Iron plays a important role in the formation of

haemoglobin (which is important for oxygen carriage) as well as for other essential elements in the body (e.g. myoglobin, cytochromes, cytochrome oxidase, peroxidase, catalase). So, Iron deficiency anemia is characterized by a defect in haemoglobin synthesis, resulting in red blood cells that are abnormally small (microcytic) and contain a decreased amount of haemoglobin (hypochromic). As a result, the capacity of the blood to deliver oxygen to body cells and tissues is thus reduced. Anemia goes undetermined in many people, and symptoms can be minor or vague. The signs and symptoms can be related to the anemia itself, or the underlying cause. The large number of population of world is suffering from anemia (*Pandu roga*) because of number of factors like poverty, malnutrition, worm infestation, pregnancy etc.

Iron is absorbed primarily in the duodenum and proximal jejunum. Iron from diet containing haem is better absorbed than non-haem iron. Many factors such as Vitamin C (ascorbic acid), citric acid, sugars, gastric secretions and hydrochloric acid help in absorption of non-haem iron. There are numbers of factors which impaired iron absorption as milk, pancreatic secretions, phytates, phosphates, medicinal antacids etc.

Causes

In Ayurvedic texts, various causes of *Pandu roga* given as acharya Charaka (Charaka Samhita Chikitsashasthana 16/7-8) that mentioned excessive uses of some particular food like salty (*Lavana*), sour (*Amla*), alkaline (*Kshara*), and bitter (*Tikta*) substances, *Teja* (*Theekshna*), hot (*Ushna*), astringent (*Ruksha*) diets, wine, fishes, meat and habit of eating clay (*mridabhakshan*) etc. can be produced *Pandu Roga*. Similarly acharya Sushruta (Sushruta Samhita Uttartantra 44/3) described similar *nidana* (causes). Likewise following are the causes of iron deficiency as decreased iron stores (e.g. preterm-birth, twins, small for date infants), decreased intake in children (delayed weaning, malnutrition, chronic infection, chronic diarrhea, malabsorption syndrome etc.), increased losses (GI bleeding, hookworm infestation, repeated venous sampling etc.), increased demands (prematurity, low birth weight baby, adolescence etc.)^[5].

Clinical Features

In Ayurvedic texts, acharya Charaka (Charaka Samhita Chikitsashasthana 16/12) describes following prodromal (premonitory) features in anemic person as *hyridyasampadanum* (palpitation), *rauikshya* (dryness of skin), *sweda-abhava* (not sweating), and *shrama* (weakness and exertion). Similarly acharya Sushruta (Sushruta Samhita Uttartantra 44/5) described dry skin, weakness, pica, periorbital oedema, yellowish urine and faeces, poor digestion, and exertion as prodromal features. Clinical features of Pandu by Acharya Charaka (Charaka Samhita Chikitsashasthana 16/13-16) are as weakness, general debility, easily fatigability, tinnitus (*karna-kshveda*), dizziness (*bhrma*), dyspnoea (*Swasa*), anorexia, periorbital swelling, fever, dislike of food and cold things, hair loss etc. Similar clinical features described in modern medicine as well as pallor, failure

to grow, decreased exercise tolerance etc. During acute anemia symptoms are - tachycardia, dyspnoea, palpitation, shortness of breath, and symptoms of congestive cardiac failure.

Diagnosis

Commonly used tests for diagnosing IDA (Iron Deficiency Anemia) are based on evaluation of red cell indices and peripheral smear examination (e.g. haemoglobin, red cells, reticulocyte count, absolute values of MCV, MCHC, MCH, leucocytes, platelet count) and Biochemical findings (e.g. serum iron level, TIBC (total iron binding capacity), serum ferritin, red cell protoporphyrin) and Bone marrow findings (e.g. marrow cellularity, erythropoiesis other cells etc.). Other investigations are as per specific causes.

Management

Basic principle of IDA management includes correction of anemia and treatment of underlying cause. Treatment of IDA depends upon the severity and associated complications. A person with severe anemia and/or congestive heart failure, with haemoglobin less than 5gm/dl requires hospitalization. Blood transfusion is required only in most severe cases with haemoglobin concentration less than 5gm/dl. Oral administration of iron (e.g. ferrous salts as sulfate, gluconate, and fumarate etc.) is the ideal treatment which is safe, economical and satisfactory therapy. For infants and children, the recommended dose is 3 to 5 mg of elemental iron per kg body weight per day in divided doses. After correction of anemia, oral iron should be continued for 4-6 months to replenish iron stores. Close follow-up is required to assess for adequate response and correction of anemia, this will help to identify iron therapy failure. Hookworm infestation is the most common cause of gastrointestinal blood loss in the rural population of India at all ages. Dietary counseling should be done and enhanced dietary iron sources which include vegetables, dried beans, grain products, dried fruit, lentils, meat, fish and poultry, and molasses. The long term treatment with iron salts is associated with several adverse effects, like epigastric pain, heartburn, nausea, vomiting, staining of teeth, metallic taste, constipation and diarrhea^[6].

Ayurvedic preparations are also effective in curing the above disease with better palatability, as well as cost effectiveness.

There is no specific treatment of *Pandu roga* mentioned for children in ayurvedic texts. Thus drugs prescribed for children first planned in respective of *matra* (quantity), type of formulation (e.g. *churna* (powder), *vati* (tablet form) and type of *anupana* (means vehicle to administer the drug with substances like honey, clarified butter, buttermilk, ginger extract etc.). In general, treatment of *Pandu roga* includes *Snehpana* (internal oleation by medicated *ghee* i.e. *Panchgavya ghrutam*, *draksha ghrutam*, *dadimadya ghrutam*, *pathya ghrutam* etc. All *ghritams* result in *Pitta shamanam*), *Vamana* (induced emesis), *Virechana* (induced purgation), *Shamana Aushadhi* (medicines which normalize the *vitiated doshas* or symptom relieving drugs), and *Pathya-Apathya* (dietetic protocol) (Charaka Samhita Chikitsasthana 16/39-41). In children *Shamana* therapy is used in respective of *Shodana* therapy (includes *Vaman*, *Virachana* etc.) mention first.

Ayurveda also offers a large number of iron preparations which have been used for centuries. For example in *Bhaisjyarnavali Panduroga chikitsa*: *Dhatril Lauha*, *Navayasa Loham*, *Punarnavadi Mandura*, *Trayasunadi mandura*, *Panchamamritalohamandura*, *Nishaloham*, *Darvadiloham*, *Vajravatakamanduram*, *Lohaasva* etc., *Sarvajvarahara Lauha* (*Bhaisjyarnavali*, *Javra chikitsa*), *Yakrita-palihari Lauha* (*Bhaisjyarnavali*, *Paliha-yakritroga chikitsa*), *Pradaramtaka Lauha* (*Rasasarasangreha*) etc.

The present review paper is an attempt in this direction, which includes, screening of classical Ayurvedic texts, texts of contemporary Science, journals and internet sources to collect sufficient data for the study where experimental trials as well as clinical studies were included in the review to search out for medicinal plants with significant anti-anemic activity. Only research articles which are in English language were considered. These studies are summarized as follows:-

1. In Patil S et al., 2000^[7] study showed that use of Ayurvedic drugs *raktavardhak*, *Punarnavasav* and *Navayas Louh* in albino rats possess the potency to cure anemia by protection of RBCs from haemolysis and simultaneously lowering cathepsin D activities from the spleen.

2. Diallo A et al., 2008^[8] conduct study on the extract of *Tectona grandis* leaves on anemia model of rat which was induced by intraperitoneal injection of phenylhydrazine and results reported the increased the concentration of haemoglobin, red blood cells number, haematocrit and reticulocytes rate as well as enhanced the osmotic resistance of the red blood cells.
3. In PK Sarkar et al., 2007^[9] study observed that the *Lauha bhasma* and *Mandura bhasma* possess significant haematinic and cytoprotective activity.
4. Asish Kumar Garai et al., 2009^[10] done a study with *Panduhara Yoga* (which consists of *Mandura Bhasma* one part and *amalaki churna* ten parts) in the management of iron deficiency anemia in children. After 6 weeks treatment with *Panduhara Yoga* overall 93.33% children showed very good improvement on clinical features, whereas 50% children showed very good improvement on blood haemoglobin level. No adverse effect has been noticed during the therapy.
5. Ragamala KC et al., 2010^[11] done a trail in children by using *Dhatril loha* which showed significant response in haemoglobin concentration in the study group.
6. Panda S et al., 1999^[12] study demonstrate that use of *Louha Bhasma* (50 *puta*) found to be statistically significant in the management of agar gel diet and phlebotomy induced iron deficiency anemia in animal model in comparison to the control and standard drug Fefol treated groups.
7. Mohapatra S, CB Jha, 2011^[13] study evaluate the effect of conventionally prepared *Swarna makshika (chalcopryrite) bhasma* on different bio-chemical parameters in experimental animals and was observed that Hb% was found significantly increased and LDL and VLDL were found significantly decreased in Group *Swarna makshika (chalcopryrite) bhasma* when compared with vehicle control group.
8. K.P. Singh et al., 2008^[14] study demonstrated antioxidative effect of ethanolic extract of *Emblia officinalis* fruit which was used in mercury induced oxidative stress in rat erythrocytes. *Emblia officinalis* fruits have significant antioxidant effect as well (Juree Charoenteeraboon et al., 2010).^[15] Vitamin C in *Emblia officinalis* fruits accounts for approximately 45-70% of the antioxidant activity.^[16] Rajak S et al., 2004 study results demonstrates that chronic *Emblia officinalis* administration produces myocardial adaptation by augmenting endogenous antioxidants and protects rat hearts from oxidative stress associated with ischemic-reperfusion injury.^[17]
9. V. Sharma, D. Pandey, 2010^[18] noted protective role of aqueous extract of stem and leaves of *Tinospora cordifolia* (TC) on the toxic effects of lead on the hematological values in male albino mice. On administration of *T. cordifolia* stem and leaves extract, these influences of lead were prevented by concurrent daily. So, *T. cordifolia* has role in anti-anemia.
10. P. S. Lohar et al., 2009^[19] study erythropoietic effects of some medicinal plants (*Aegle marmelos*, *Asparagus recemosus*, *Boerhavia diffusa*, *Carissa congesta*, *Eugenia jambolana*, *Ficus carica*, *Phoenix sylvestris*, *Phyllanthus emblica*, *Spinaca oleracean*, and *Vitis vinifera*) on experimental rat model. The study results indicate that most of the plant extracts increase synthesis of haemoglobin and formation of RBCs.
11. Megha Doshi et al., 2012^[20] during trail evaluated the effect of *Trigonella foenum-graecum* (Fenugreek/ *Methi*) on haemoglobin levels on females of child bearing age and found beneficial effects to raise blood haemoglobin which might further help to prevent and cure anemia.
12. Pradhan V.G., Bhat J.V. 1960^[21] study demonstrate effect of *Lohaasva* in rats which were made anaemic with phenylhydrazine. Likewise Vijay Gupta, K.R.C.Reddy 2007^[22] study *lohasava* clinical trial on anemic patients and observed significant improvement in anemia in respect of symptomatic and haematological parameters.
13. Mykola H.Haydak et al., 1942^[23] study shows that honey use also result in the prevention and cure of nutritional anemia in rats. Vikas Nanda et al., 2003^[24] study the physico-chemical properties of honey produced from different plants with estimation of mineral content in honey and found that honey also have iron content as about 8.86–13.25 mg/kg. So, honey also has good iron content as well.
14. Rokeya Sultana et al., 2011 study the immunomodulatory effect of methanol extract of *Solanum xanthocarpum* fruits and noticed administration of cyclophosphamide (30 mg/kg, i.p) produced a significant decrease in the total leukocyte count, RBC count, and

- haemoglobin % and then methanol extract of fruits of *Solanum xanthocarpum* was administered and found increasing all the haematological parameters (e.g. WBC count, RBC count, and % haemoglobin values) which were better than untreated control groups.^[25]
15. R.Caroline Jeba et al., 2011 study showed that aqueous extract of the *Ocimum sanctum* showed increasing antibody production in dose dependent manner as well as enhance the production of RBC, WBC and haemoglobin during use in experiment on rats.^[26]

DISCUSSION

Anemia is major nutritional global health problem affecting persons of all ages' groups and sex but anemia prevalence in children is high, especially in developing countries. Anemia is often associated with childhood malnutrition, producing interlinked factors, many of which could be related to the morbidity and mortality risk. Iron deficiency adversely affects the cognitive performance, behaviour, and physical growth of infants, preschool and school-aged children. The ideal antianemic regimen should be safe, cheap, well tolerated by children and able to achieve a high cure rate. Iron preparations available used in treatment of iron deficiency anemia has many adverse effects. Therefore, researchers are looking forward to find its answer from medicinal plants which are described in Ayurvedic texts, the Indian system of medicine. In Ayurvedic texts, the Indian system of medicine, various herbs and herbominerals formulations described for treatment of Pandu roga. Research studies now show that commonly available herbs and herbominerals like Punarnavasav, Navayas Lauha, Lauha bhasma, Mandura bhasma, Panduhara Yoga, Navayasa Churna, Punarnavadi Mandura, Dhatri Lauha, Pradarantaka Lauha, Sarvajvarahara Lauha and Vrihatyakrdari Lauha, & Phalatrikadi Kwatha etc. possess significant antianemic activity in experimental and clinical trials. Thus, these formulations can be used in anemic patients. However, more research work has to be carried out to replicate these results in more clinical trials.

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