

Finest medicinal plants governing Hematinic Property – Review

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Abstract

There are various medicinal plants, which enrich hemoglobin content and on the other hand it also it help cure multiple health conditions such as cancer, diabetes, ulcer, lipid control, cure pain, fever, common cold and so on. The given highlights are the magnificent role of Hemoglobin and the process of its production in the human body, the disorders that would pop up due to its absence that in order leads to multiple health concerns. In this regard, a vivid picture on various medicinal plants is seen which have been used as an archaic source of medicine that elevates back the hemoglobin content in the blood. It also quotes the traditional medicinal plants, their various parts that cure diversified status of ailments due to the nourishment of hemoglobin in the human system, and so rolls out on diverse medicinal plants detailing their role in upraising the enrichment of hemoglobin thereby possessing the Hematinic property in the body. This Hematinic property shows both curing and treating medical conditions by raising the red blood cell component in the blood. This sheds light that there is an absence or minimal adverse effect seen by using medicinal plants, than that of other drugs in various branches of medicine. This Review Article will throw light on such various medicinal plants and their hematinic property that helps treating and cure hemoglobin levels as well as multiple, divergent medical conditions.

Keywords: Hematinic Property, Hemoglobin, Medicinal Plants, Red Blood Cells

I. INTRODUCTION

Hemoglobin is one of the most vital proteins that are predominant in red blood cells. It helps carrying oxygen to the various parts of the body. The oxygenated state of Hemoglobin is termed as oxyhemoglobin that is characterized usually in bright red color, and the reduced state is termed as deoxyhemoglobin that is usually in purple-blue. Heme is an iron porphyrin structure is synthesized in the bone marrow and the action of erythropoietin formation that takes place in the kidney, helps formation maturation as well as release of these erythrocytes from the bone marrow. Studies suggest that that the normal level of Hemoglobin varies in males and females. The reference of this biochemical parameter ranges from in 13.5 to 17.5g/dL male and 12.0 to 15.5g/dL female ¹. The current day encompasses of various number of illnesses which are associated with co-morbidities. Every disease is associated with another comorbid medical condition and anemia being one of the most occurring illnesses is seen as a co-morbidity to a prevailing health illness. It exists all throughout the world irrespective of the population size, geographical condition of the country. However, it could be related to the economic condition of the family status, studies suggest that poor income status of the family have shown the prevalence of anemia, especially in children across low economic groups ².

II. LIST OF HEMATINIC PLANTS

It is one of the widespread medical conditions that is prevailed and is characterized by the lack of hemoglobin in blood, the most common blood disorders, there could empty number of pivotal reasons contributing to this such as lack of nutritional status, due to an existing disease condition, medication, Pregnancy-related anemia and so on. Hemoglobin is a very important component in blood; it's the protein in red blood cells (RBCs) that carries oxygen from lungs to all of tissues and organs in the human system. Hemoglobin is responsible for the shape of RBCs, which usually appear as circles with a thin center with a hole. In conditions involving abnormal hemoglobin, such as sickle cell anemia, nutritional anemia, the abnormal shape of the RBCs can lead to problems such as Weakness, fatigue, lack of energy, Jaundice, Pale skin (pallor), severe pain, shortness of breath. This prevailing problem of lack in hemoglobin could be addressed with the use of various medicinal plants. Such medicinal plant help have magnificent healing properties and aid in curing in various illness and one such in increasing hemoglobin levels in blood, and the usage of such medicinal plants are an old treatment method to old mankind itself. Few such medicinal plants that have shown great results in improving the hemoglobin panel in blood have been discussed below.

Decalepis hamiltonii

Decalepis hamiltonii is one of the very known and used medicinal plants, belonging to the family of Apocynaceae and the Genus *Decalepis*. This plant has shown to possess great medicinal properties like the property of anticancer, antiulcer, anti-inflammatory, anti-diabetic, hepatoprotective as well as antimicrobial activities³. A study suggested that the aqueous extract of *D.hamiltoni* was prepared by cold maceration. Two doses at 100mg/kg and 200mg/kg were used to examine the immunomodulatory activity *in vivo* as well as *ex vivo*, assessing their hemagglutination, antibody as well as their hematological profile

especially with regard to Hemoglobin, red blood cells in rats. Administration of this plant also showed to increase the hemoglobin in treated rats. This medicinal plant has also shown emphasis on governing good amount of antioxidant properties that thereby also improve the iron and the vitamin C levels in the blood and shown to be blood purifier ⁴.

Hibiscus cannabinus

Hibiscus cannabinus is yet another medicinal plant belonging to the family Malvaceae, and the genus *Hibiscus* commonly known as Kenaf, has shown the ability of increasing the iron levels and thereby reducing the occurrence of Anemia. A Study showed that the red blood cells, Hemoglobin, Packed cell volume of treated rats that were administered with Phenylhydrazine gave rise to macrocytic anemia, a week later of the treatment of the anemic rats with *Hibiscus cannabinus*, was administered through the oral route where the aqueous solution was studied on anemia induced rats through phenylhydrazine and red blood cells, haemoglobin and mean cell volume were studied. The rats were administered 1ml of the extract for about three weeks. It was shown to reverse anemia and also showed increase in Hemoglobin, red blood cells as well as packed cell volume ⁵.

Phyllanthus emblica

Phyllanthus emblica, belonging to the phyllanthaceae and genus *phyllanthus*, commonly known as Indian gooseberry or Amla has shown to be used as a medicinal herb governing anti-anemic properties which usually characterized due to low hemoglobin in the blood., it is also used to treat various disorders of the Gastro Intestinal system such as diarrhea and also help as a major cure in jaundice. It has also shown to contain iron and vitamin C which is Ascorbic acid that helps in increasing the absorption of iron in the human body, it has also said to increase the absorption of iron from the different kind of foods that we tend to take in our diet ⁶.

Withania somnifera

Withania somnifera, is one of the widely used medicinal plant for over centuries, it belonging to the family Solanaceae and genus *Withania*, commonly known as Indian Winter cherry or Indian ginseng or Ashwagandha, has possessed high properties which are to enhance the hemoglobin levels. A study suggested that the hemoglobin and the red blood cells count improved in Ashwagandha treated rats ⁷. Another study showed administration of this herb, which was used in aqueous root extract form as capsules to the subjects being cyclists. This was in the form of 500mg gelatin capsules, given for eight weeks twice a day, one in the morning and one in the evening. Overall 1000mg was administered to the subjects in a day. Thew administration of this medicinal plant in cyclists to note their performance, showed that there was an increase in red blood cell mass, had an impact on increasing the ability of blood in transporting oxygen to the muscles thereby increasing the aerobic capacity ⁸.

Apium graveolens

Apium graveolens, belonging to the Apiaceae family, and *Apium* genus, commonly known as celery. This has shown to have great effect on treating disorders of spleen, treating sleep cycle and also most importantly increase red blood cell production. A study suggested that, 24 rats were randomly divided into 3 groups and were drenched either in drinking water of one group containing 50mg/kg body weight and other of 100mg/kg body weight of hydroalcoholic extract of celery seed and the other group of just distilled water for about 30 days. Results have suggested that *Apium graveolens* have shown to increase the

erythropoietin levels that there by shoots up the red blood cell production and leads in increase in hemoglobin, packed cell volume in the blood. They have also shown to contain Vitamin C that could help absorption of Iron in the body ⁹.

Mangifera indica

Mangifera indica belongs in the Anacardiaceae family, belonging to the Magnifera genus. It is one of the most popular plants which has a lot of medicinal values. *Mangifera indica* is also commonly called as the mango and is cultivated across the world. There are different parts of this plant that contain great medicinal values. The administration of *Manifera indica* leafs at 10 and 20mg/kg once every day for 28 days on rats, showed that the stem, bark, root as well as leaves have anti diabetic, anti-malaria properties, tend to cure asthma as well as govern the property of anti-anemic that was seen when this plant was administered to albino rats ¹⁰. It was also showed that a group of treated rats governed the property of increasing various blood parameters including hemoglobin and red blood cell production along with the property of curing hyperlipidemia as well as cardiovascular complications in a group of treated rats ¹¹.

Psidium guajava L.

Psidium guajava L. belonging to the Myrtaceae family and psidium genus, popularly called as guava. It is popularly used for oral administration as can be used topical due to its presence of various medicinal properties and has shown to be a great cursor for the enhancement of hemoglobin. A study suggested that, Subjects of females were supplemented with 100ml red guava juice every day for 2 weeks. This 100ml of juice had been decided based on the calculation that each 100ml juice will contain 0.69 mg of iron. It was there by concluded that, red guava juice was highly significant in increasing the hemoglobin as well as the hematocrit levels of females suffering from anemia. It was also shown that the administration along with iron supplementation had improved the iron as well as the hemoglobin levels in blood ¹².

Trigonella foenum-graecum

Trigonella foenum-graecum belonging to the Fabaceae family under the Trigonella genus, commonly known as Fenugreek, has been used as medicine to treat various disorders of the human body. A study suggested that was performed in young females in the child bearing age between 20-22 years, which were exposed to similar dietary as well as environmental conditions. Group 1 was not exposed to administration of this medicinal plant where as group B, were asked to ingest 5mg of fenugreek seeds, upon drinking water every morning after breakfast for three months. It was shown that there was a significant raise in the hemoglobin levels of group B, that was administered fenugreek for three months. Fenugreek seeds have suggested to possess sources of Proteins, such as essential amino acids like Lysine, Threonine, minerals such as iron, copper and vitamins such as Folate and ascorbate that are highly important components of hemoglobin and that they could have a significant factor that helps increase the biosynthesis of hemoglobin and raise them in subjects those were supplemented with the same medicinal plant ¹³.

Cymbopogon citratus

Cymbopogon citratus, belongs to the Poaceae family, and the Cymbopogon genus, popularly known as Lemon grass is a widely used herb across many parts of the world. There are many vital components present in this herb such as tannins, saponins, alkaloids, flavonoids, macro- and micronutrients that are reported to significantly increased the Packed Cell Volume (PCV)

of blood, Hemoglobin (Hb) and also the red blood cells (RBC) in the body. A study suggested that was performed, with the study sample of 100 humans comprising of both male and females between the age 18 to 35 years, were assigned to groups and orally given infused citratus leaves at 2,4,8g of the medicinal leaves every day for 30 days. Results were compared to day 10 and day 30 of administration of the leaf powder. Results concluded that, there was a raise noticed in hemoglobin, red blood cells as well as the packed cell volume ¹⁴.

Hygrophila spinosa

Hygrophila spinosa belongs to the herbaceous family, with magnificent medicinal properties. A present study that was conducted with wistar rats, that were induced anemia by giving an intra-peritoneal dose of phenylhydrazine and were administered crude leaf at about 40mg plant extract kg-1 body weight orally for 30 days. 2ml was administered to each rat, for 30 days and the results were being examined. The hematinic activity of spinosa administered orally at pre-flowering extract at 40 mg kg-1 body weight and powdered aerial part at 40 mg extract kg-1 body weight was examined by treating anemic induced rats for 30days. It was inferred that the condition of anemia was improved with hemoglobin as well as other hematological parameters like red blood cell indices through spinosa extract administered orally (pre-flowering extract at 40 mg kg-1 body weight) and powdered aerial part) was assessed by treating the induced anemic rats for 30 days. Results showed that there were a significant raise in the hemoglobin, red blood cell parameters, Treatments did show to reform, the anemic condition by improving hematological parameters and RBC indices ¹⁵.

Bryophyllum pinnatum

Bryophyllum pinnatum also known as the *Kalanchoe pinnata* belonging to the Crassulaceae family and the Kalanchoe genus, has shown to increase the biochemical parameters in blood especially in regard with hemoglobin levels. It was shown to treat ear aches, burns, ulcers, kidney stones as well as to increase in hemoglobin levels. A study that was performed with rats was characterized with segregating them as different groups, and each were given different dosage of the ethanolic extract of the plant ranging from 300mg to 100mg/kg for 15 days. Post this process the blood sample was collected to analyze the results that shown tremendous results in the biochemical parameters of the rats. An immune-modulatory activity seen in rats with a significant increase in platelet count, hemoglobin levels as well as the packed cell volume there by showing an overall increase in the hematological parameters ¹⁶.

Limonia acidissima

Limonia acidissima belongs to the Rutaceae family and the Limonia genus, commonly called as the wood apple. It is a characterized of an edible fruit, which contains great medicinal values. A study that was performed with human subjects, were administered 150ml of juice per day for about 90 days. The biochemical parameters of before and after the experiment were compared and studied. It was concluded that there was a hike in the hemoglobin panel. It was also suggested that they contain phenolic compounds, that tend to poses antioxidant activities thereby act on increasing hemoglobin levels, and also govern other medicinal values such as to reduce blood glucose levels, reduce serum creatinine levels, blood pressure ¹⁷. Another study reviewed that this plant administered at 50mh in the form of juice made from the fruit of the plant and mixed with warm water, this showed that this medicinal plant was shown to enhance further great levels of the biochemical panel such as to enhance red blood cell production, as well as increase the iron content when ingested upon. It was hence concluded that this could be strongly used to treat and cure anemia ¹⁸.

Datura metel

Datura metel, belongs to the Solanaceae family and the *Datura* genus commonly called horn of plenty, devil's trumpet has magnificent medicinal values that varies from it being an analgesic, great anti-inflammatory as well as other factors that help increasing the biochemical parameters such as hemoglobin and production of RBC in blood. The study was performed with male albino rats that were grouped and administered the leaf extract of *Datura metel* through oral route with the help of gavage intubation. The group of rats treated with leaf, seed and fruit extracts, showed to increase hemoglobin levels and red blood cells in the blood much tremendously after the administration to subjects compared to administration of only the leaf extract in high dose ¹⁹.

Calotropis procera

Calotropis procera belongs the family Apocynaceae and genus *Calotropis*. It is commonly called Swallow-Wort in English. This plant has shown benefits of increasing hemoglobin levels in albino treated rats. There was an increase in hemoglobin percentage along with other biochemical parameters ²⁰. It is shown to be known for its governing pharmacological properties like, it being anticancerous, ascaricidal, schizonticidal, anti-microbial, anthelmintic, insecticidal, anti-inflammatory, antidiarrhoeal, properties ²¹. The study was performed in rats, which was induced anemia through intra-peritoneal administration of phenylhydrazine of the dose 40mg/kg per day for two days. The Hydroalcoholic extract was given orally to these anaemic rats at the dose of 100-200mg/kg body weight once a day for 28 days. A study reported that, the hemoglobin levels increased in rats that were induced anemia through phenylhydrazine. Administration orally of aqueous and ethanol extract of *Calotropis procera* in the dose of 200mg/ kg/ day showed significantly increase the hemoglobin within the first week of administration ²².

Mesua ferrea

Mesua ferrea, is an yet another great medicinal plant possessing high medicinal value in Indian system of medicines. It is commonly known as Iron wood in English. It belongs to the family Calophyllaceae and genus *Mesua*. It is widely distributed across many parts in the world and especially In India, it is seen in Himalayas, Bengal, Assam, Andhra Pradesh, Western Ghats. It is shown to possess great antioxidant properties, act as a CNS depressant, and act as a great analgesic as well has the property to increase biochemical parameters such as red blood cells. A study strongly recommended that this magnificent plant, when administered in the form of seed extract was showed to increase all hematological changes especially with regard to WBC, RBC and especially a great higher significance in the hemoglobin level count in treated rats ²³.

Gmelina arborea

Gmelina arborea, belonging to Lamiaceae family and *Gmelina* genus, commonly known as *beechwood* is an important medicinal plant in the Indian Ayurvedic system of medicine. The drupes, leaves, flowers, roots, and bark are used in traditional medicine ²⁴. A study was performed with albino rats, through the administration of aqueous *gmelina arborea* extracts. Haematological tests were performed with the help of blood samples. About 0.5g/kg of the extract was administered orally for 28 days. It was concluded that the extract of *Gmelina arborea* induced in albino rats, significantly increased the haemoglobin concentration and

Packed cell volume. Since it was also containing rich levels of carbohydrates and calcium, it hence plays a significant role in hemopoieses process in the body ²⁵.

Polyalthia longifolia

Polyalthia longifolia, is a medicinal plant and has been shown to treat various disease conditions, it has been used as the traditional medicine over multiple years. This magnificent plant has shown to cure fever, skin disease, as well as diabetes ²⁶. It is commonly called as, the false Ashoka. A study that was performed characterized of methanol extract of the plant was administered for up to 14 days. The dose administered was 3g/kg every day. The biochemical and hematological parameters were examined after 15 days. It was shown that there was a significant raise in the biochemical parameters especially with regard to the hemoglobin, red blood cells and packed cell volume in blood when this medicinal plant was administered to rats ²⁷.

Phyllanthus niruri

Phyllanthus niruri locally called sampa-sampalukan, is seen among various tropical regions. It governs multiple health benefits. It is also shown to possess hematinic properties. A study suggested that Packed cell volume, hemoglobin, red blood cell concentration raised after the administration of *Phyllanthus niruri* in adult wistar albino rats. It was also concluded that the aqueous plant extract of *Phyllanthus niruri* is safe and possesses a very high vital anti-anemic property and that thereby it could be a potential lead in the discovery of drug treatment of anemia. Further studies could be done under this plant in order to probe its hematinic property that pays a very vital role to treat various diseases that are characterized with low biochemical levels mainly seen in conditions such as leukemia as well as other types of cancers ²⁸.

Justicia carnea

Justicia carnea is a medicinal plant that has shown to have many diverse functions which is characterized of multiple medicinal values. This plant is native to India, Srilanka, Pakistan. It has been adopted as a cure to various illness using various systems of medicine in the present day. A study was performed with experimental rats, that were administered 80mg/kg body weight of phenylhydrazine to induce anemia and were administered with the plant extract. After about 28 days, the biochemical analysis was being done reported that a group of albinos treated rats, improved the hemoglobin and the red blood cell content in the blood right after the administration of *Justicia carnea* and had shown evidences to reverse anemia in rats that were induced anemia before the administration of the medicinal plant ²⁹.

Chrysopogon zizanioides

Chrysopogon zizanioides, commonly known as vetiver or khus, belongs to the Poaceae family. Its cultivation is seen in various parts of Southern India like in Kerala, Tamil Nadu, Karnataka, Andhra Pradesh as well as in Pakistan, Sengal, Indonesia, Sri Lanka. It has various medical properties ranging from treating nervous disorders, used as a sedative, calming the body, arthritis. It also showed to have great has the antianemic property and has tended to increase the hemoglobin content in the blood ³⁰. Another study reported that the therapeutic role of this plant showed to stimulate the production of red blood cells and thereby used beneficial for treating anemia³¹.

Achyranthes aspera

Achyranthes aspera is a medicinal plant that belongs to the Amaranthaceae family and the genus *Achyranthes*, that encompasses multiple medicinal values and is used as one of the traditional sources of medicines curing multiple illness. In a study, after the ingestion of *Achyranthes aspera* leaf, methanolic extracts in rats. About 0.2 ml of the extract was administered to the rats for four days. Post this, about 1ml of blood was extracted from the rats and examined there hematological and biochemical profile. However, results showed a significant change in the hematological and biochemical parameter. It was shown to increase the levels of hemoglobin, red blood cells as well as white blood cells³². Another studied that was performed in diabetic rats, that were administered oral, ethanolic seed extract of *Achyranthes aspera* for 28 days, showed that it had a great remedy to cure diabetes as well as increase the hemoglobin panel in the blood³³.

Punica granatum

Punica granatum is a fruit bearing plant that is commonly known as pomegranate that belongs to the lythraceae family and the genus *Punica*. It has been traditionally used over many years and has been considered highly nutritious as well as is characterized of multiple medicinal values³⁴. The presence of polyphenols namely ellagitannins, flavonoids, anthocyanins, phenolic acids, tannins, stilbenes contain great multiple medicinal properties³⁵. A study showed to have performed to examine the effects of pomegranate juice supplementation on various biochemical parameters in healthy individuals. It was concluded that the red blood count, hemoglobin concentration and hematocrit levels after the consumption of Pomegranate juice of 500ml every day for two weeks in healthy individuals³⁶.

Syzygium cumini

Syzygium cumini is one on the other vital medicinal plants emphasizing on tremendous medicinal values. It is also known as black plum, Jamun. It belongs to the Myrtaceae family and *syzygium* genus. It has shown to significant medicinal properties. It contains multiple micronutrients such as calcium, iron, phosphorous, sodium, vitamin C and iron. This has shown to increase the hemoglobin count and thereby also reduce the occurrence of anemia³⁷. Another study suggested that, leaf extracts of *Syzygium cumini* was administered to albino rats, RBC and Hb levels were significantly increased, in comparison with before and after administration of the medicinal plant. It was also shown that *S. cumini* plant extract could contain few chemical components that can help promote erythropoietin secretion that thereby helps the formations of red blood cells in the bone marrow³⁸.

Murraya koenigii

Murraya koenigii is one of the most known plants that has great medicinal values and that has also been a source in Indian culinary. It belongs to the Rutaceae family and the *Murraya* Genus. It is commonly known as curry tree or sweet neem. It is also shown to carry great health benefits such as act as an analgesic, great antioxidant properties, and also helps increase vital blood parameters in the body. A study showed that administration of this plant to experimental rats of fresh leaf extracts, with the dose of show that this plant when administered to rats, showed to have 300 to 1000mg/kg for 28 days respectively across all groups. The results showed that there were hematological influences seen when it was

administered to the highest dose of about 900mg/kg, it was also shown to increase the hemoglobin levels, and reverse anemia³⁹.

Mentha arvensis

Mentha arvensis is a flowering species that belongs to the Lamiaceae family and Mentha Genus that governs multiple useful properties. It is generally known as common mint in English. It has been used as one of the basic medicinal herbs for over generations as well as used as at culinary⁴⁰. A study showed that *Mentha arvensis* that was administered to experimental fish, where the plant leaf was extracted and administered to the fish mixed with their meal with the duration of four weeks. When the biochemical values were compared to before and after the experiment study there showed a significant raise in Hemoglobin, Red blood cells after 4 weeks of feeding of *Mentha arvensis*, compared to the values before the administration of the plant⁴¹. Another study showed that, leaf extracts were administered in the diet of laying hens, up to 12th week of age. After the 4th week blood samples were collected to analyze the biochemical parameters of the subjects. It was reviewed that the dose of 10.0g/kg administration of pudhina, showed to increase erythrocytes production as well as a strong antioxidant that further protects against oxidative damage⁴².

Eclipta alba

Eclipta alba belonging to the Asterceae family. It governs multiple medicinal properties and can be used as a topical as well as an oral administration⁴³. This plant has shown to carry adequate medicinal values that range from analgesic activity, antioxidant, antimicrobial, antibacterial activities. However, it is also most commonly known for its low cost and safe method of treatment in the traditional system of medicine⁴⁴. A study reported that upon administration of this plant to albino rats and swiss mice with the administration of the plant as leaf extracts and was reported that, administration only with pure leaf extract showed that there was a great raise that was noted in the biochemical parameters, especially with regard to hemoglobin levels as well as increase in lymphocytes and neutrophils⁴⁵. Another study showed that administration of the entire plant of *Eclipta alba* other than the roots were extracted and used for the study. There was administration of Phenylhydrazine to the grouped rats at 10mg/kg body weight for 7 days, to induce hemolytic anemia, through oral gaging cannula. The subjects were then administered 125, 250 and 500mg/kg body weight respectively to the three groups. Blood samples were collected at three points of the study, initially at the start of the experiment, after the induction of anemia as well as at the end of the experiment. It was inferred that this plant showed tremendous results against hemolytic anemia. It helped treating as well as curing and there by recovering illness of anemia which is characterized by low hemoglobin levels in blood⁴⁶.

Aegle marmelos

Aegle marmelos, belonging to the Rutaceae family and the Aegle genus, commonly called bael or golden apple. It has shown traces of possessing great characteristics of pharmacological functions. They have been used as one of the most ancient and traditional system of medicine⁴⁷. Health benefits that range from Anticancer activity, Immunomodulatory activity, helps stimulation of hair growth, and also helps to prevent and cure various disease and illness. A study reported that a group of fish that were treated with this medicinal herb along with a combination of other herb namely *Nelumbo nucifera* for 30 days, of the dose *Nelumbo Nucifera* at 500mg/kg body weight and *Aegle marmelos* at 500mg/kg body weight a dietary supplement. Results that were analysed after 30 days was

seen that there was a great increase in the red blood cells, packed cell volume, and raise in hemoglobin⁴⁸. Another study suggested that the administration of *Aegle marmelos* to aquatic fish, for about a span of 30 days showed great enhancement of the biochemical parameters, especially with regard to increase of hemoglobin as well as red blood cells that were analyzed after the administration⁴⁹.

III. CONCLUSION

Medicinal plants show great viability in order to cure and treat various disease conditions due to its pharmacological properties. There could be further studies done with the involvement of the nutrients that are majorly related to help curing anemic condition and those that govern the hematinic characteristics. This, thereby could be a vitally used in order to treat various disease conditions that are directly due to low hemoglobin in blood due to nutritional factors or that could be caused due to an existing disease condition. The above discussed are such medicinal plants, that have shown the tendency of hematinic properties that could thereby increase the production of red blood cells, hemoglobin and thereby could reverse the condition of anemia. Treating various disease and illness could show a better impact on the body with the usage of traditional system of medicines, which predominantly encounters the usage of medicinal herbs /medicinal plants that show to possess great properties pharmacologically. These plants are a rich source of medicinal values and hence have a potential to cure many spectrums of health ailments. There are diversified types of medicinal plants, in some cases the entire plant is used in order to treat one disease condition however, in a few other plants its part of the plant like the root, shoot, leaves, and flowers give different medicinal properties that could be targeted at treating different ailments. These have a definite relationship with more effectiveness to cure and mild side effects as it is obtained from a natural source, than that compared to other allopathic drugs. A huge variety of such medicinal plants are still left unpondered, and this review article could be useful for those who are studying upon medicinal plants that increase hemoglobin levels in blood. It can be an aided as a tool on these plants that yield as an effective source of medicine due to its pharmacological properties that can be used for treating and curing various diseases encountered by human beings and also having a major prospect of having minor or absence of side effects than compared to another modern system of medicines.

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REFERENCES

1. Awad KM, Amir A, Bashir, et.al. Reference value for hemoglobin and red blood cells indices in Sudanese in Kharatoum State. Health Science and Research. 2019;211-212.
2. Dongmei Luo, Rogbin Xu, Xiaojin Yan, et al. The associations of economic growth and aneamia for school-aged children in China. 2019;5-8.
3. Chandrasekhara Reddy M, Sri Rama Murthy K. A review on *Decalepis hamiltonii* Wight & Arn. Journal of Medicinal Plants Research. 2013;3019-3023.
4. Sunitha TG, Dhadde SB, Durg S, Ahmed SM. Immunomodulatory Effect of *Decalepis hamiltonii* Wight and Arn Roots Extract on Rodents. Indian Journal of Pharmaceutical Education and Research. 2016; S449-S50.

5. Agbor GA, Oben JE, Ngogang JY. Haematinic activity of *Hibiscus cannabinus*. African Journal of Biotechnology. 2005;833-837.
6. Sean R, Lynch, James D, Cook. Interaction of Iron and Vitamin C. Annals of the New York of Academy of Sciences. 1980; 32-36.
7. Ziauddin M, Phansalkar N, Patki P et al. Studies on the immunomodulatory effects of Ashwagandha. Journal of Ethnopharmacology. 1996;69-75.
8. Shenoy S, Chaskar U, Sandhu JS, Paadhi MM. Effects of eight- week supplementation of Ashwagandha on cardiorespiratory endurance enhance in elite Indian cyclists. Journal of Ayurveda and Integrative Medicine. 2012;210-213.
9. Masar Jabbar Al-Kurdy. Effects of hydroalcoholic extract of celery (apium graveolens) seed on blood & biochemical parameters of adult male rats. Kufa Journal of Veterinary Medical Sciences. 2016;90-92.
10. Muruganandan S, Srinivasan K, Gupta S, et al. Effect of mangiferin of hyperglycemia in streptozotocin diabetic rats. Journal of Ethnopharmacol. 2005;497-501.
11. Ojewole JA. Antiinflammatory, alagesic and hypoglycemic effects of *Magnifera indica* Linn. (Anacardiceae) stem- bark aqueous extract. Methods and findings in experimental clinical Pharmacolgy .2005;547-554.
12. Mega WH, et al. Effects of Red Guava Juice on Hemoglobin and Hematocrit Levels in Female Adolescent Students with Anemia. Journal of Research in Medical and Dental Science. 2019;146-149.
13. Doshi M, Mirza A, Umarji B, Karambelkar R. Effect of *Trigonella foenum – graecum* (Fenugreek/Methi) on hemoglobin levels in females of child bearing age. Journal of Biomedical Research. 2013;47-50.
14. Ekpenyong CE, Daniel NE, Antai AB. Bioactive natural constituents from lemongrass tea and erythropoiesis boosting effects: potential use in prevention and treatment of anemia. Journal of medicinal food. 2015;120-126.
15. Mandal S, Thakur KK, Dutta GK. Hematinic effect of *Hygrophila spinosa* on induced anaemic rats. Applied Biological Research. 2013;1-4.
16. Okpoho JE, Evbuomwan L, Ebiala FI. Antifungal and immunomodulatory activity of *Bryophyllum pinnatum* leaf extract. Asian Journal of Immunology. 2018;2-6.
17. Anitha S, Umadevi S, et al. Therapeutic effect of wood apple on hypertension and diabetes. Eco. Env & Cons. 2015; 1104-1105.
18. Kerkar SP, Patil S, et al. *Limonia acidissima*: versatile and nutritional fruit of India. International Journal of Fruit Science. 2020; S405-S408.
19. Imo C, Arowora KA, et al. Haematological effects on ethanolic leaf, seed and fruit extract of *Datura metel* on male albino rats. FUW trends in Science & Technology Journal. 2016; 509-511.
20. Patil RA, Makwana AB. Anti- hyperbilirubinemic and wound healing activity of aqueous extract of *Calotropis procera* leaves in Wistar rats. Indian journal of pharmacology. 2015; 399-401.
21. Rahimi M. Pharmacohnositical Aspects and Pharmacological activities of *Calotropis procera*. Bull Env Pharmacol. Life Sci. 2015; 156-160.
22. Hariom K, Joshi A et al. Anti- Anemic activity of Hydroalcoholic extract of *Calotropis procera* flower on phenylhydrazine induced anemic rats. International Journal of Comprehensive and advanced Pharmacology. 2017; 6-9.
23. Ansari SH, et al. An Ethnobotanically Important plant Poonam Arora. American Journal of Pharm tech Journal. 2019; 32-36.
24. Nadkarni KM. Indian Materia Medica. Vol 1. 2007.

25. Oguwike FN, Ofor CC. The effects of aqueous leaf extract of *Gmelina arborea* on the haematological and biochemical profile of Albino Rats. IOSR Journal of Dental and Medicinal Sciences. 2013;54-57.
26. Thenmozhi M, Sivaraj R. Phytochemical analysis and antimicrobial activity of *Polyalthia longifolia* . International Journal of Pharma and Bio Sciences. 2010; 01-03.
27. Chanda S, Dave R, Kaneria M, Shukla V. Acute oral toxicity of *Polyalthia longifolia* var. pendula leaf extract in Wistar albino rats. Pharmaceutical Biology. 2012; 1408-1409.
28. Mohammed A. Anti-Anemic activity of aqueous extract of *Phyllanthus niruri* on anaemic rats. 2020.
29. Onyeabo C, Achi NK, et al. Haematological and biochemical studies on *Justica carnea* leaves extract in Phenylhydrazine induced – anemia in albino rats. Acta Scientiarum Polonorum Technologia Alimentaria. 2017;217-228.
30. Balasankar D, Vanilarasu, et al. Traditional and medicinal uses of Vetriver. J Med Plants Stud 2013; 191-196.
31. Bushan B, Kumar SS, et al. *Vetriver zizaniodes* (Linn) Nash: A Pharmacological Overview. International Research Journal of Pharmacy. 2013;18-20.
32. Etim EA, Adebayo YA, Ifeanyi OE. Effect of *Achyranthes aspera* Leaf Extract on Hematological Parameters on Swiss albino mice. World Journal of Public health. 2019; 96-99.
33. Vijayaraj R, Kumaran N. Evaluation of in vivo antidiabetic and antioxidant activity of *Achyranthes aspera* Linn. Seeds by streptozotocin induced diabetic rats. International Journal Green Pharmacy. 2019; 32-34.
34. Vidal A, Fallareora A, et al. Studies on the toxicity of *Punica grantu*, L. (Punicaceae) whole fruit extract. Journal of Ethnopharmacology. 2003;295-300.
35. Gil M, Tomas Barberan FA, et al. Antioxidant activity of pomegranate juice and its relationship with phenolic composition and processing. Journal of Agricultural Food Chemistry. 2000; 4582-4588.
36. Manthou E, Georgakouli K, Deli CK, Sotiropoulos A, Fatouros IG, et al. Effect of Pomegranate Juice consumption on biochemical parameters and complete blood count. Experimental and therapeutic medicine. 2017; 1756-1762.
37. Ayyanar M, Subash Babu P. *Syzygium cumini*: A review of its phytochemical constituents and traditional uses. Asian Pacific Journal of Tropical Biomedicine. 2012;240-246.
38. Rehman AA, Riaz A, et al. In vivo assessment of anticoagulant and antiplatelet effects of *Syzygium cumini* leaves extract in rabbits. BMC complementary and alternative medicine.2019;2-8.
39. Sakarkar DM, Tembhurne SV, More BH. 28 Days Repeated Dose Toxicity Study of ethanolic extract of *Murraya koenigii* in Wistar rats. Annals of Pharmacology and Pharmaceutics. 2017;1-4.
40. Thawakar BS. Phytochemical and Pharmacological review of *Mentha arvensis*. International Journal of Green Pharmacy. 2016;71-74.
41. Jaiswal NR. Effect of Mint (*Mentha arvensis*) Leaf supplementation diet of Hematological changes in Common Carp Cyprinus Carpio. Journal of Emerging Technologies and Innovative Research. 2020;1383-1384.
42. Devi KM, Palod J, et al. Ameliorative role of Pudina (*Mentha arvensis*) leaf powder against oxidative stress on laying hens. Journal of Entomology and Zoology studies.2018;1616-1619.
43. Jahan R, AI-Nahain, et al. Ethnopharmacological Significance of *Eclipta alba* (L.) hassk.. (Asterceae). International Scholarly Research Notes. 2014;3-6.

44. Thenmozhi M, Jayanthi M. Phytochemical screening and Antioxidant activity of *Eclipta alba* L. Asian Journal of Pharmaceutical and Clinical Research. 2019; 215-217.
45. Aziz S, Ganaie MA. Assessment of ethanol and *Eclipta alba* L. extract on haematological parameters on liver of *Rattus rattus*. The Pharma Innovation Journal. 2017;671-674.
46. Pandey P, Meena AK, Yadav S, Singh RK. *Eclipta alba* a herbal remedy for the prevention of Hemolytic anemia. European Journal of Biomedical and Pharmaceutical Sciences. 2017;359-363.
47. Sivaraj R, Balakrishnan A, et al. Preliminary Phytochemical Analysis of *Aegle marmelos* , *Ruta graveolens*, *Opuntia dellini* , *Euphorbia royleana* and *Euphorbia antiquorm*. International Journal of Pharmaceutical Sciences and Research. 2010; 132-133.
48. Vinodhini R. Detoxifying effect of *Nelumbo nucifera* and *Aegle marmelos* on hematological parameters of Common Carp (*Cyprinus carpio* L.). Interdisciplinary Toxicology .2010;127-131.
49. Pratheepa V, Ramesh S, Sukumaran N. Immunomodulatory effect of *Aegle marmelos* leaf extract on fresh water fish *Cypinus carpio* infected by bacterial pathogen *Aeromonas hydrophilia*. Pharmaceutical Biology. 2010;1224-1229.