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SUBSTANTIATING THE RELEVANCE OF IRON IN HERBAL AND HERBOMINERAL PREPARATIONS FOR COMPREHENSIVE HAIR CARE

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ABSTRACT

Background: *Hair is known as the crown which we never take off. It represents our personality, status, thought, belief and much more. It is indicator of health of a person. Disorders of hair may lower one's morale as it plays a major part in sculpturing his/her persona. Iron plays a paramount role in maintaining vitality of hair. Its inadequacy can lead to loss and depigmentation of hair. In addition to that, it is the most common nutritional deficiency in the world. Researches are being carried out to establish relation between low serum ferritine and hair loss. Hence supplementing iron is considered as a solution for multifold disorders of hair. Ayurvedic classics consider the usage of formulations containing Loha bhasma as Keshya Rasayana. References pertaining to utilization of Iron containing herbs like Bhringraja, Tila and Amalaki are also obtained to support this view.*

Aim: *The present article attempts to emphasize the role of Loha in safeguarding the health of hair through the medium of Ayurvedic formulations.*

Materials and Methods: *Consolidating references of formulations containing Loha and Iron rich herbs from Ayurvedic classics and research articles of various branches so as to establish importance of Iron in maintaining healthy hair.*

Conclusion: *By scrutinizing Ayurveda classics, it is inferred that Loha is used abundantly in various forms by Acharyas forhair care. Ensuring adequacy of Iron in the body helps in maintaining the vitality of Hair.*

KEYWORDS*: Hair Loss, ferritine, depigmentation, Loha, Iron*

INTRODUCTION

Exquisite hair is analogous to crown of an individual. It is not just a standard for beauty buta lot more. It's a scale to assess one's body health. Current trend of hair care is limited to external therapies like keratinization, protein treatment, smoothening of hair etc. Rationality behind these therapies has to be questioned as the genuine factor contributing to healthy hair is being neglected. In other words, measure to sustain a healthy body is not emphasiszed in the run for beautiful hair.

Micronutrients are essential elements needed for bodies in small quantities.They include micro minerals and vitamins. Iron is one among them, the relevance of which has been established long before for health of body. Iron deficiency is one of the most

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common types of nutritional insufficiency distressing a vast amount of mortals worldwide. According to the National Health and NutritionExamination Survey (NHANES) 1999-2000, the prevalence of Iron Deficiency Anaemia is 2% to 5%.[1]Sadly, ongoing researches are pointing to the fact that Iron deficiency is indeed the reason behind a majority of hair problems. But once and again, Ayurveda has proved its foresightedness by including *Loha* in the context of hair care, way before contemporary researches could think of it.

The concept of *Keshya*

Kesha is synonymous to hair in Ayurveda, deriving itself from root word *ke* meaning *mastaka* (head) with *shi* to *shete* (sleep).[2]*Kesha* are the elements that grow on scalp(*mastaka*, *shirah*). [3]*Kesha* is the *mala* of *asthi dhatu*[45]and is *Upadhatu* of *Majja Dhatu.*[6]Torephrase it, *Kesha* is formed as a by-product during conversion of *AsthiDhatu* to *MajjaDhatu*.A recent study has shown that medicine used for treatment of bone marrow disease has indeed lead to improvement of aloepecia[7].Importance of iron can be validatedfrom the fact that iron is needed for the proper functioning of bone marrow for erythropoiesis.A recent study concluded that premature hair graying is associated with low bone density thus proving the inter relation between hair and asthi dhatu[8]. It is hypothesized that chronic iron deficiency induces bone desorption and risk of osteoporosis, thus complete recovery from anemia and its prevention should be promoted in order to improve quality of life including bone health.[9]Thus we can assume that iron is essential for *Asthi* and *Majja Dhatu*.

Nutrition and essential body elements are required for proper growth and colour of hair which is explained with the concept of ***Keshya***. The word '*keshya'* is suggestive of '*keshaaya hitam yat tat*'meaning that which is good for hair. So the goodness of hair can be understood by three perspectives like-

1. ***Kesha sanjanana*—**that which helps in the origin of hair.
2. ***Kehsha vardhana*—**that which promotes hair growth or which makes hair dense and thick.
3. ***Kesha ranjana*—**that which imparts colour to hair.[10]

Loha is categorized under *Dhatu Varga* in *Rasashastra.*It is used internally after shodhana and marana.*Loha Bhasma* is *ruksha, guru* and *Lekhana,Tikta,Kashaya Rasa* and *Shita Virya* and is *Kapha Pitta hara.*[11]Iron in the context of *Keshya* drug will be studied in the later part of article.

MATERIALS AND METHODS

References from *Ashtangahridaya*are selected to assess the role of Iron. The role and content of Iron in some of the formulations are listed below:

1. Kesha Ranjana

Many formulations of Iron are present in *Ashtanga hridaya Uttarasthana*for its *ranjana karma*.

a) *Lauhadi Rasayanam*-"***Shatam jeevathi krsnakeshaha"***- contains *Loha bhasma, vidanga* mixed in ghee and kept in vessel made of *Bijaka sara*.It is used for internal administration.[12]

i. Iron content in a)*Vidanga*(*Embelia ribes)*: 0.23%[13]
ii. *Asana(Pterocarpus marsupium)* :0.20 mg/gm[14]

b) *Shwadamshtradi Rasayanam*- ***"Samashatam jeevathi Krshnakeshaha"***[15]

Ingredients and Fe content

i. *Gokshura (Tribulus terrestis)* : 1.17 – 3.105mg/gm[16]
ii. *Amalaki (Embelica officinalis)* : 0.21 mg/100gm iron, ascorbic acid- 590mg/100gm[17]

iii. *Guduchi (Tinospora cordifoli a)* : 26.058 ppm[18]

c) *Narasimha Rasayanam*- "***Keshe bhrngambu nileye"-*** contains *Loha Bhasma* and is made *surya paka* along with

i. *Khadira (Acacia catechu)* *:* iron chelator[19]
ii. *Chitraka (Plumbago zeylanica)* *:* 2.92 ppm[20]
iii. *Simsipa (Dalbergia sissoo)*
iv. *Asana(Pterocarpus marsupium)* :0.20 mg/gm[14]
v. *Kanmada* :5-147 ppm
vi. *Vidanga (Embelia ribes)* :(0.23%)[13]
vii. *Bhallataka (Semecarpus anacardium)* :(178 mg/kg)[21].

This preparation is specifically made in *Lohakrta patra*[22].It can be used externally also if made into taila.[23]- "***Krshnakeshashcha jayate"***

PALITYA

d) *Nilyadi taila*[24]: Specifically mentioned to prepare in iron vessel and to be kept in sun.It is used as *Nasya.*

i. *Neeli (Indigofera tinctoria)* : 20.95 ± 3.84mg/100g[25]
ii. *Shirisha (Albizzia lebbeck)* : 14.6mg/100 gm[26]
iii. *Sahachara (Nilgirianthus ciliatus)*
iv. *Bhrngaraja*(*Eclipta alba)* : leaf-1.83%, stem- 2.09%, root- 3.20%[27]
v. *Tila* : 3.83 ± 0.75 mg/100gm [28]
vi. *Vibhitaki(Terminalia bellerica)``* *: :*Iron chelating property[29]

e) *Snuhi(Euphorbia nerifolia)* *:* For E/A
Karavira[30]*(Nerium indicum)*

f) i. *Padmakinjalka*
iii. *Madhuka (Glyccirhiza glabra)* :0.14%[31]

g) ***Samoolam palitam jayet:*** *E/A*[32]

i. *Loha bhasma*
ii. *Bhrngaraja(Eclipta alba)*
iii. *Triphala*- Amla contains ascorbic acid which facilitates absorption of iron
*Haritaki (Terminalia chebula) :*Metallic mordants as well as bio-mordants can be used to enhance the color characteristics and fastness properties of natural dyes[3334] *T.chebula* natural dye can provide bright hues with good color fastness properties with different types of mordants.[35] *Terminalia chebula* may also have iron chelating property thus preventing iron overdose.[36]
*Vibhitaki (Terminalia bellerica) :*Iron chelating property[29]
iv. *Krshna mrttika*

h) *Prapaundarika tailam*: ***Hanti palitani cha shilitam"*** E/A &*Nasya*

i. *Loha raja*
ii. Prapaundarika*(Nelumbo nucifera)* : leaves 25.32 ± 0.0002ppm, roots- 128.07 ±0.0034ppm, stem- 0.986 ± 0.0004ppm[37]
iii. *Madhuka(Glyccirhiza glabra)* : Fe chelation[38]

iv. *Pippali(Piper longum)* :62.1mg/100gm[39]
v. *Amalaki*[40]*(Emblica officinalis)* :0.21 mg/100gm iron, ascorbic acid- 590mg/100gm[17]

i) ***"Valakamapi ranjayet"***[41]***-*** *yava, kodrava* made in yavagu kept in *iron vessel* for 3 days – E/A

The above mentionedformulations show beyond doubt that *Acharyas* have included *Loha* as a main compound in *Kesha ranjana* for *Palitya*.Few of them contain *Loha bhasma* while others suggest the usage of vessels made of iron to make formulations.In a nutshell, *Loha* is being used for *Kesha ranjana* in one or the other form. Much of the formulations contain *Amla* or *Triphala* along with *Loha bhasma*.*Loha Bhasma* is a microfine powder containing Fe , Fe_2O_3, Fe_3O_4.[42]On external application, Iron oxide interact with fine *amla* particles (ascorbic acid) to produce fused black particles (chelates) capable of dyeing hair.[43]Non-heme iron, found in plants and iron-fortified foods, has a bioavailability of less than 10%.Iron in food is mostly Ferric iron and is most soluble and best absorbed below a pH of 3. Ferrous iron, found in oral iron supplements, is soluble even at a pH of 7 to 8 and is more easily absorbed.[44]Enhancers of iron absorption include ascorbic acid or vitamin C (found in broccoli, cauliflower, and many fruits)[45].Ascorbic acid helps in conversion of Ferritin Fe^{3+} to more absorbable Ferrous Fe^{2+} form in the body.Thus *Amla* facilitates iron absorption if administered internally. The recommended oral daily dose for the treatment of iron deficiency in adults is in the range of 150-200 mg/day of elemental iron.[46]

Various studies are being carried out to identify the relation between Fe and greying of hair. A study of young Indian population reported lesser serum levels of ferritin,calcium, and Vitamin D3 levels in subjects prone to Premature Greying of Hair (PGH)[47].An older study concludes that among copper, zinc, and iron, a low serum copper concentration may play a role in premature graying of hairs in our society than Fe and Zn.[48]A case study in South Korea has shown that PGH can be treated by Supplementing Ferrous Sulpahate.[49]Sonthalia et al found no correlation of PHG with patients' hemoglobin (for age and gender) or serum ferritin levels, a marker of body's iron stores. However, a statistically significant relation was established with deficiency of Vitamin b12.[5051]Thus, deficiency of iron and/or Vitamin B12 may have a role to play in the pathogenesis of PHG.

2. Kesha sanjanana

Role of Iron in growth of new hair will be assessed below.

Indralupta

a) *Malatyadi Taila*[52]: for *abhyanga*

i. *Malati (Jasminum grandiflorum)*
ii. *Chitraka(Plumbago zeylanica)* *:* 2.92 ppm[20]
iii. *Ashwaghna(Nerium indicum)*
iv. *Naktamala(Pomgamia pinnata)* *:* iron chelator[53]
v. *Laksha (Laccifer lacca)*
vi. *Aragwadha(Cassia fistula)* *:* 559 micro gm/gm[52]
vii. *Amalaki(Emblica officinalis)* : 0.21 mg/100gm iron, ascorbic acid- 590mg/100gm[17]

b) For E/A after *prachanna*[54]

i. *Kasisa*: Is basically $FeSO_4.7H_2O$, a compound of Iron. Widely used for *roma sanjanana. Ch. Chi. 26/271 Khalitya Mahanila Taila*[55]*, Su. Chi. 1/103 Romasanjanana Lepa*[56]
ii. *Manashila* : As_2S_2

iii. *Tutha* :$CuSO_4.5H_2O$
iv. *Maricha(Piper nigrum)* :155 micro gm/gm[57]
v. *Gunja moola(Abrus precatorius)*:
vi. *Karavira(Nerium indicum)*
vii. *Kshudra vartaka* :4.47% in seeds[58]
viii. *Dhurdhura patra(Datura metel)* :674.2 mg/kg[59]
ix. *Bhallataka(Semecarpus anacardium)* : 178 mg/kg[21]
x. *Tilapushpa*:
xi. *Gokshura* : 1.17 – 3.105mg/gm[16]

2. Kesha samvardhanam:

a) *Mamsyadi pralepa:* ***Kesha samvardhanam param[60]***

i. *Jatamansi (Nardostachys jatamansi)* *:* 747-770 micro gm/gm. The higher concentration of Fe in Jatamansi suggests the possible use of this medicinal plant to compensate for an iron deficiency[61].

ii. *Kushta (Saussurea lappa)* *:* 0.233%[62]

iii. *Tila (Sesamum indicum)* *:* 3.83 ± 0.75 mg/100gm [28]

iv. *Shariba (Hemidesmus indicus)* *:*195.8 mg/100gm[63]

v. *Nila ulpala (Nymphaea nouchali)* *:*flowers4.23mg/100gm, stem3.50mg/100gm[64]

RESEARCHES DONE TO FIND RELATION BETWEEN HAIR LOSS AND IRON

Author	**Type of Alopecia**	**Results**
Hard S. (1963)[65]	Diffuse Hair Loss	100% regrowth in 18/96 (18.8%) non-anemic women with iron deficiency (measured by serum iron) and DH treated with oral iron therapy
Rushton DH, Ramsay ID, James KC, Norris MJ, Gilkes JJ. (1990)[66]	Diffuse Androgen dependent alopecia	72% of 50 premenopausal women with DA had serum ferritin Levels less than 40 mg/L.
Rushton DH, Norris MJ, Dover R, Busuttil N. (2002)[67]	CTE	65% of 200 healthy women with increased hair shedding had ferritin levels less than 70 ug/L.
Rasheed H (2013) [68]	TE, FPHL	Serum ferritin levels were significantly lower in TE and FPHL Compared to control patients.

Kantor J, Kessler LJ, Brooks DG, Cotsarelis G. (2003)[69]	TE, AGA, AA, AU, AT	Serum ferritin levels were significantly lower in women with AGA (37.3 ug/L) and AA (24.9 ug/L) compared to control patients.
Boffa MJ, Wood P, Griffi ths CE (1995)[70]	AA	No increased incidence of iron deficiency in patients with AA compared with general population.
Sinclair R (2002)[71]	DTHL	There is no clear association between low serum ferritin andCTE,AGA
Moeinvaziri *(2009)*[72]	DTHL	The mean ferritin level and transferrin saturation was statistically significantly lower in patients with DTHL than in subjects without hair loss. Total iron binding capacity was significantly higher in patients than in control group Of nine patients with iron deficiency anemia (Hb <12 g/dL), eight patients had DTHL
Deo K,[73]	TE, FPA	Neither low hemoglobin nor low serum ferritin levels were found to be statistically significant

AGA: androgenetic alopecia; AA: alopecia areata; AT: alopecia totalis; AU: alopecia universalis; CTE: chronic telogen effluvium; DA: diffuse alopecia; DH: diffuse hair loss; DTHL: diffuse telogen hair loss; FPA, female pattern alopecia, DTE: diffuse telogen effluvium

There are review articles[7475] that examined therelationship between hair loss and iron deficiency. Almost all of these studies had focused on non-scarring alopecia and addressed women.[43] [44] The authors of most studies suggested that iron deficiency may be related to TE, AA and AGA but a few did not. In 2017, Thompson et al. reviewed five other studies investigating the relationship between AA and iron[76]. None of these studies supported an association between AA and iron deficiency[7778798081].In order to reverse severe hair loss due to TE, some authors recommend maintaining serum ferritin at levels of 40 ng/dL [42]or 70 ng/Dl.[46] Almohanna Hind M et in his review concludes as follows:TE/AGA- Most authors agree on iron supplementation in patients with iron or ferritin deficiency and hair loss, AA- Iron deficiency reported in female patients, likely coincidental, Premature hair graying- Iron/Ferritin Screening for deficiency and supplementation are recommended, ACP outcome study grading- Moderate in all studies[82]

Mechanism by which reduced iron stores may affect hair loss

The mechanism by which reduced iron stores affect hair loss is not known. Iron is a known cofactor for ribonucleotide reductase, the rate-limiting enzyme for the synthesis of DNA. Hair follicle matrix cells are among the most rapidly dividing cells in the body and may be exquisitely sensitive even to a minor decrease in iron availability, thus resulting in diminished hair

growth in the presence of irondeficiency[8384]In 2008, Du et al. described iron-dependent genes in the hair follicle bulge whose mutation causes highlevels of hepcidin, a liver protein that decreases iron absorption[85].

DISCUSSION

The discussion can be carried out in two contexts: *Kesha ranjana and Kesha sanjanana*. *Acharyas* have widely used *Loha* in the form of *loha bhasma* and *loha* vessel for treating *Palitya*. They have also encorporated iron containing *dravyas* in the formulations. On keen observation of the yogas, the formulations for external application is a mixture of dyeing agent, mordant, hair growth promoting drugs and Iron chelating agents.*Haritaki, Nili, Bhrngaraja, Henna* are some of the dyeing agents.Iron acts a mordant (dye fixative), i.e a substance used to set dyes on tissues by forming a coordination complex with the dye, which then attaches to the tissues.*Loha* has been mentioned for internal administration as*Rasayan*a for black hair. Here ascorbic acid in *Amalaki* helps in conversion of ferric ion to more absorbable ferrous ion in the body. There is presence of Iron chelators also to prevent toxicity due to iron overload.Most of the researches have established relation between premature greying of hair and Iron deficiency.Cells of the hair follicle are rapidly dividing and proliferating, making them dependent onSynthesis of DNA that in turn required sufficient supply of micronutrients especially iron, andVitamin B12.[868788]Thus we can conclude that Iron has indeed a role in causing and treating PGH.

Looking into the *Kesha sanjanana yogas*, there is no usage of *Loha bhasma*. Iron is being used in other forms like *Kasisa* (Fe sulphate) and other Iron containing drugs.Formulations for external usage are only provided in this context. However researches have been carried out by supplementing iron internally.The conclusions of researches performed provide a mixed response.Though most of them conclude that Iron has a positive role in causing and treating hair loss, some doesn't agree to it.Thus iron may have a role in *kesha sanjanana*, but it has to be established with further more researches investigating the type of hair loss dependent on iron.

JatamansyadiLepa in *Ashtangahridaya Uttarasthana* is a *kesha samvardhana yoga* i.e for increasing length and thickness of hair.All of the contents are good source of iron thus establishing the role of iron in it. Resesearches are yet to be carried out exploring this aspect.

CONCLUSION

Micro nutrients are necessary elements required in very low amount for our body. Iron is one among them.Our *Acharyas* had understood its importance and used it in *Rasashastra* by making *bhasmas* like *Loha* (Fe), *Yashada*(Zn), and *Tamra* (Cu).After going through classics and researches, we come to a conclusion that Iron is essential for comprehensive hair health care.Ayurveda has also conceded with it by using iron in different forms for maintaining hair health

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