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Original Article

Clinical Evaluation of potentiating effect of Honey with Mandur Bhasma (Herbo-mineral preparation) in anemic children

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ABSTRACT

Honey is known as natural sweetener since ancient time with medicinal value. In Indian system of Medicine, honey's well described propertie is Yogavahi (synergism/potentiating).We clinically evaluated the potentiating effect of honey with mandur bhasma on 30 patients both male and female upon oral delivery of medicine with honey. We observed better improvement in level of Hemoglobin /Serum Iron / TIBC in the patients given mandur bhasma with honey, in comparison to the mandur bhasma alone. Recovery of symptoms such as loss of appetite, lethargy and pallor have been noted in entire anemic patients attended in both groups i.e. honey+ mandur bhasma and mandur bhasma alone. However, significant increase in the Hb has been observed in 21.86% honey+ mandur bhasma in comparison to mandur bhasma alone which is only 9.77%, showing potentiating effects of honey.

Keywords: Anemia, Mandur Bhasm , Honey, Yogavahi.

INTRODUCTION

Honey, the world's oldest sweetener, was the major sweetener until the sugarcane was cultivated on a large scale in the new world. Currently, information regarding honey's utility in human diseases is available in general magazines, beekeeping journals and natural products leaflets, and suggesting a wide variety of unfounded properties. In this study, we examined and utilized the information available and supported by laboratory and clinical studies in which honey has shown positive results for the Synergistic effect (yogavahi property) or improvement of human health[1]. Naturally obtained honey contains Moisture (17.2%), Fructose (38.19%), Glucose (31.28 %), Disaccharides (7.31%), Sucrose (1.31%), and Higher Sugars (1.5%). Other constituents are identified as isomaltose, nigerose, turanose, maltulose[2], kojibiose[3], alpha beta-trehalose, gentiobiose, laminaribiose[4] maltotriose, 1-kestose, panose, isomaltosyl glucose, erlose, isomaltosyltriose, theanderose, centose, isopanose, isomalto- syltetraose and isomaltosylpentaose[5]. Gluconic acid is another component that is predominantly present in all honey that originates largely from the activity of glucose oxidase which the bees add at ripening[6].The honey is normally acidic with pH ranges from 3.2 to 4.5. The honey has no nutritional significance as it contains 0.02% weight/weight minerals and vitamins... The amino acids that are present in significant amount i.e. >200 ppm are proline, phenylalanine and aspartic acid.[7.] The enzymes that are present in all honey originates from plants are; catalase (a regulator of glucose oxidase activity); acid phosphatase; and very small proportion of amylase[8,9] . In Ayurvedic Indian medicine, different types[10,11,12,13], Pharmacological properties[14,15] and therapeutic uses[16,17,18,19,20] of honey have been described elaborately. Among the properties Yogavahi (synergism) property has been clinically described in details when given with drugs. Hence honey can be called as Yogavahi Dravya. Yogavahi dravya means it acts synergistically to potentiate or enhance/ complement (purana) the capability or

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potency of that Dravya or drugs without disturbing/ reducing own potency. The compound the potency of which is enhanced or increased is called Aphrodisiac compounds. Synergism term has been obtained from the Greek word Syn means together and ergon means work is used frequently in modern medicine to enhance the action of other when delivered in the patient together.

Hemoglobin (Hb) carry oxygen value normally denoted in Hb gm%-oxygen and children with low values are called physiological anemia of childhood[22] (Card RT et al., 1973).

Immense population of the world is suffering from Anemia (Pandu – Roga due to poverty, multiple offspring in low socio economic family, malnourishment and unattended children. Anemia is a one of the reason for under development and compromised efficacy (Potency) of a child. Based on our observation of current research work, Mandur Bhasma[23,24,25] is routinely prescribed drug by the medical practitioner for treating anemia (Pandu roga).

So considering it in mind, the work has been planned to analyze the potentiating (Yogawahi) property of honey in terms of hemoglobin level and variation in other biochemical parameters for the assessment when given with the Mandur Bhasma in anemic children.

MATERIAL AND METHODS

A written informed consent was obtained from the parents of 30 children aged 5 month to 12 year approached before participation in the study. The study protocol was approved by the ethical committee, IMS, BHU.

A total of 30 cases, selected irrespective of sex, capable of taking orally, divided in two groups i.e. **Group A-** 20 cases in which Mandur Bhasma was given with honey (3 ml) and Group B -10 cases in which Mandur Bhasma was given without honey were selected from the Outdoor Patient Department of Kaumarbhritya, Sir Sunderlal Hospital, Banaras Hindu University, Varanasi, India. Majority of the cases had visited for treatment of minor ailments, such as diarrhea, infections, common cold, pyoderma and bacillary dysentery etc., After the clinical evaluation, patients were selected for the present study. patients having Hb gm% <4.5 gm% on first visit were not included in study. Major medical, hematologic, gastrointestinal conditions, cardiac conditions, burn, dehydration, Hypothyroidism and acute blood loss conditions were also excluded.

Diagnostic criteria: For the purpose of diagnosis of Anemia (Pandu Roga) and evaluation of results, following sign and symptoms were taken into account, viz. *Panduta* (Pallor), *Shrama* (fatigue). Shotha (edema), *Daurbalya* (weakness), *Bhrama* (giddiness), appetite, H/o pica and pallor on the basis of clinical assessment. To make confirm diagnosis and monitoring changes, following hematological parameters, viz. Hb gm%, total RBC count, TLC, DLC, ESR, serum Iron, total Iron Binding Capacity (TIBC) and General blood Picture (G.B.P.) were carried out at the time of registration and subsequent follow ups.

Sample Collection: 5 ml blood (2 ml in EDTA and 3 ml in Plain) of each patient was collected at first visit and on the subsequent follow ups for the investigations via the sterile syringe from a peripheral vein under aseptic precautions. All the samples were collected in between 10 -12 AM to reduce diurnal variation in reports of S. Iron and TIBC.

SELECTION OF DRUG:

Mandura: The selection of Mandura Bhasma was based on the textual indication[23,24,25]. The drug Mandura Bhasma was provided by Ayurvedic pharmacy, BHU, Varanasi, to each patient up to two follow-up. The drug was prepared according to method as described in Ayurvedic formulary of India; 1976.

Honey: Honey was given with Mandur Bhasma to analyze its Yogawahi property. The selection of honey for the purpose of clinical study was taken from GANDHI ASHRAM GRAMOUDHYOG Varanasi. (batch no. L/54/2008) Patient's attendants were advised neither fridge nor to heat it.

Dose and administration of drug: After registration, Mandura Bhasma was administered in dose of 8 mg/kg q 12 hr, orally. The parents were advised to use the drug mixed with honey (3 ml). Total duration of treatment with Mandura Bhasma with honey was 30 days.

Follow up: There were two follow up to every registered patient- first on 15th day (approx) and second on 30th day (approx). The clinical response of the treatment of each case was observed and recorded on follow up on a prior designed Performa for the study. The following investigations were done at the time of registration and an subsequent follow up i.e. FU-I and FU-II 15 days apart. TLC, DLC, ESR, Serum Iron, TIBC, Hb gm%.

RESULTS

Total 30 cases out of which 19 (63.33%) cases including 13 males and 6 female belonged between 1-5 yrs rest 4 were below 1yrs and 7 were above 5 yrs.

Table no. 1: Weight change from registration to follow up II.

	Initial Mean ± SD (n = 30)	**FU I (n = 30)**	**FU II (n = 29)**
Weight	12.52 ± 6.13	12.81 ± 6.19	13.31 ± 4.88
Weight	Initial vs. follow up I	Initial vs. follow up II	FU- I vs. FU- II
	.2870 ± .384 t = 4.09	.4538 ± .458 t = 5.34	.19.14 ± .271 t = 3.81

The above table reveals that mean weight with SD of children were 12.52 ± 6.13, 12.81 ± 6.19 and 13.31 ± 4.88 at registration, on follow up I and follow up II respectively in group.

Table No. 2 : Frequency distribution of chief complaints at registration and subsequent follow Ups in Group A and Group B.

S.No.	**Symptoms**	**Incidence**					
		Mandur Bhasma with honey Group A (n=20)			**Mandur Bhasma without honey Group B (n=10)**		
		At Registration	**FU I**	**FU II**	**At Registration**	**FU I**	**FU II**
1.	Loose stool	5(25%)	2 (10%)	0	2(20%)	0	0
2.	Pica	4(20%)	1 (5%)	0	1(10%)	0	0
3.	Lethargy	18(90%)	9 (45%)	0	7(70%)	2(20%)	0
4.	Common cold	6(30%)	1 (5%)	0	4(40%)	1(10%)	0
5.	Fever	6(30%)	2 (10%)	0	7(70%)	1(10%)	0
6.	Constipation	19(5%)	1 (5%)	0	0	0	0
7.	Pain abd.	2(10%)	0	0	2(20%)	0	0
8.	Vomiting	2(10%)	1 (5%)	0	0	0	0
9.	Headache	1(5%)	1 (5%)	0	0	0	0
10.	Loss of Appetite	18(90%)	9	0	9(90%)	5(50%)	0
11.	Pyognic abscess	1(5%)	1 (5%)	0	0	0	0
12.	Swelling on face	2(10%)	1 (5%)	0	0	0	0
13.	Burning Micturation	1(5%)	0	0	0	0	0
14.	Leg. Swelling	1(5%)	1 (5%)	0	0	0	0

Table No. 2 is based on the chief complaints for which the children came to OPD/IPD.

Lethargy (90%) and loss of appetite (90%) were present in most of the cases while the fever (30%), common cold (30%), loose stool (25%), pica (20%) were less frequent. Pain-abdomen(10%) Vomiting (10%), swelling/puffiness on face (10%), headache (5%), burning micturation (5%), leg swelling (5%) and pyogenic abcess (5%) were other reported symptoms at registration in group A. In group B, loss of appetite (90%), lethargy (70%) and fever (70%) were main symptoms, followed by common cold (40%),loose stool (10%), pain in abdomen (20%) and pica (10%) were less frequent.

Table No. 3 : Number of patients with change in weight during treatment with Mandura bhasma.

Change in weight from initial to 2nd follow up	**Group A (n=20)**	**Group B (n=10)**
	No. of patients	**No. of patients**
No change	1(5%)	1(10%)
≤ 250 gm	6(30%)	8(80%)
≥ 250 gm to 500 gm	5(25%)	1(10%)
> 500 gm to 1 kg,	6(30%)	0
> 1 kg to 2 kg	2(10%)	0

In group A, 10% cases had the weight gain above the 1000 gm, 30% cases above 500 gm, 25% cases above the 250 gm, 30% cases up to 250 gm and 5% cases had no change in weight. While in group B 80% cases had the weight gain less than 250 gm, 10% above the 250 gm and 10% had no changes. Group A showed significant increase in weight than Group B.

Table No. 4 : Clinical manifestations persisted after the management of associated disease.

Clinical manifestation	Group A (n=20)			Group B (n=10)		
	After Management Associated Disease	I FU	II FU	After Management Associated Disease	I FU	II FU
Loss of Appetite	16(80%)	9(45%)	0	7(70%)	5(50%)	0
Lethargy	15(75%)	9(45%)	0	6(60%)	2(20%)	0
pallor	20(100%)	19(95%)	10(50%)	10(100%)	9(90%)	6(60%)

Appetite improves and become normal in all cases after II follow up in both the groups. **In Group A,** letharginess in children was observed in fifteen (75%) cases, reduced to 45% and relieved in all the cases on follow up-I & II respectively. While **in Group B**, 60% cases had the complain of letharginess at registration which on first follow up reduced to 20% and complete recovered on second follow up.

Pallor was present in all of the children (100%) showing suffrage with iron deficiency anemia at registration. In **Group- A**, it reduced in 19 (95%) and 10 (50%) children over follow-up-I & II respectively, while in **Group B**, It reduced to 90% on follow up-l and 60% on follow up II.

Table No. 5: Statistical analysis including intra group correlation of hematological data in group - 'A'

Investigations		Initial (n20)	FU I (n19)	FU 11 (n=17)
Hb%	Mean±SD	8.46±1.95	9.42±1.74	10.31±1.88
	d' ± SD paired 't'	0.96 ±0 .634 t = 6.80; p>0.001	1.87 ± 0.853 t= 9.60; p>0.001	0.90 ± 0.494 t=7.93; p<0.001
S. Iron	Mean ± SD	65.03 ± 36.00	65.03 ± 36.00	88.81 ± 20.83
		Initial - FU I	Initial - FU II	FU I- FU II
	d' ± SD paired 't'	14.36 ± 20.26 t = 3.01 ; p > 0.05	24.96 ± 36.52 t=2.73	10.06 ± 31.87 t = 1.22
TIBC	Mean±SD	574.84± 184.42	462.56± 154.71	354.25±56.71
	d' ± SD paired 't'	Initial - FU I	Initial - FU II	FU I- FU II
		93.88± 101.599 t=3.92	263.43± 164.02 t=6.42	135.86± 143.80 t=3.66

Table No. 6 : Statistical analysis including Intra group correlation of TLC & ESR in group – 'A'.

Investigations		Initial (n20)	FU I (n19)	FU 11 (n=17)
TLC (mm^3)	Mean±SD	12805.26 ± 6396.83	10865.00 ± 3207.27	9831.58 ± 2527.20
		Initial - FU I	Initial - FU II	FU I- FU II
	d' ± SD paired 't'	2036.84 ± 4083.46 t = 2.17	3227.77 ± 6386.73 t=2.14	1131.57 ± 2476.34 t = 1.99
ESR (mm in 1st hour)	Mean±SD	24.01± 10.37	24.01± 10.37	11.37± 3.54
		Initial - FU I	Initial - FU II	FU I- FU II
	d' ± SD paired 't'	05.93 ± 5.97 t=3.71	17.76 ± 10.57 t = 5.04	9.24 ± 9.04 t = 4.21

Mean hemoglobin status with standard deviation was 8.46±1.95 at initial, 9.42±1.74 at follow up I (average at 15th day) and 10.3 1±1.88 at follow up-II (average at 30th days) in rising pattern. Mean serum iron level with standard deviation was 65.03±36.00, 79.78±3 1.09 and 88.8 1±20.83 at initial, follow up-I and follow up-II respectively. Mean TIBC level was 574.84±184.42, while in the subsequent follow ups it came down to 462.56±154.71 & 354.25±56.71 respectively. Total leucocyte count (TLC) with standard deviation was 12805.26±6396.83, 10865.00±3207.27 and 9831.58±2527.20, both fall in ESR and TLC values were observed on subsequent follow ups (Table No 6). Analysis of data related to mean difference of Hb gm%, TIBC, S. Iron and TLC, ESR among initial Vs FU-1 Initial Vs FU-Il and FU-I Vs FU-II , reveals that gain in Hb gm % is found significant between FU-I Vs FU-Il (t=7.93) in comparison to initial Vs FU-I (t=6.80). Overall gain in hemoglobin of total mean period of therapy i.e. 30 day is highly significant. Reduction in TIBC value is more significant during last 15 days after registration i.e. between Initial and II FU in comparison to FU-I and FU-II. Significant positive change in mean serum iron level are observed during first 15 days i.e. between initial and follow up I (Table No.5).On comparison of Mean difference of TLC between Initial Vs FU-I and initial Vs FU-II indicate almost same changes. There was more significant fall in ESR during initial & FU II in comparison to initial and FU I.

Table No. 7 : Statistical analysis including intra group correlation of hematological data in group - 'B'.

Investigations		**Initial (n20)**	**FU I (n19)**	**FU 11 (n=17)**
Hb%	**Mean±SD**	**7.98 ± 2.50**	**8.72 ± 2.25**	**8.76 ± 1.90**
		Initial - FU I	**Initial - FU II**	**FU I- FU II**
	d' ± SD paired 't'	**0.75 ± .29** t = 7.76 ; p	**1.22 ± 0.41** t = 6.58	**0.36 ± .25** t = 3.59
S. Iron	**Mean ± SD**	**54.33 ± 12.14**	**71.20 ± 9.35**	**76.50 ± 6.45**
		Initial - FU I	**Initial - FU II**	**FU I- FU II**
	d' ± SD paired 't'	**14.45 ± 9.29** t = 4.40	**26.75 ± 11.64** t = 4.59	**12.33 ± 4.93** t = 3
TIBC	**Mean±SD**	**614.11± 166.51**	**499.50±96.94**	**408.75± 18.21**
		Initial - FU I	**Initial - FU II**	**FU I- FU II**
	d' ± SD paired 't'	**136.43 ± 100.93** t = 3.82	**122.37 ± 72.86** t = 3.36	**65.33 ± 52.59** t = 2.15

Table No. 8: Statistical analysis including Intra group correlation of TLC & ESR in group – 'B'.

Investigations		**Initial (n20)**	**FU I (n19)**	**FU 11 (n=17)**
TLC (mm^3)	**Mean±SD**	**11677,78 ± 3161.00**	**9962.00 ± 3118.51**	**9656.25± 2967.86**
		Initial - FU I	**Initial - FU II**	**FU I- FU II**
	d' ± SD paired 't'	**1008.88 ± 2306.01** t = 1.31	**1921.42 ± 1664.29** t = 3.05	**131.25 ± 1184.70** t = .31
ESR (mm in 1st hour)	**Mean±SD**	**24.01± 10.37**	**24.01± 10.37**	**11.37± 3.54**
		Initial - FU I	**Initial - FU II**	**FU I- FU II**
	d' ± SD paired 't'	**10.50 ± 12.55 t=2.05**	**7.66 ± 6.80 t=1.95**	**2.66 ± 5.13** t=.90

Mean hemoglobin status with standard duration was 7.98±2.50 at initial, 8.72±2.25 at follow up I (average at 15th day) and 8.70±1.90 at follow up-Il (average at 3O days). Mean serum iron level was 54.33±12.14, 71.20±9.35 and 76.50±6.45 at subsequent follow-ups. Mean serum level of TIBC was 614.11±166.51, while subsequently it was 499.50±96.94 & 408.75±18.21 respectively. Total leukocyte counts were 11677.78±3161.00, 9962.00±3118.51 and 9656.25±2967.86 at different intervals. At the same time ESR was 26.17±11.87, 17.00±5.01 and 12.67±3.21.

On intra group comparison **:** On analysis of data related to mean difference of Hb gm%, TIBC, S. Iron and TLC,ESR among initial Vs FU-I; Initial Vs FU-Il and FU-I Vs FU-Il revealed that Gain in Hb gm % was found significant between Initial Vs I & II follow up in comparison to FU-I Vs FU-Il. Reduction in TIBC value is more significant during

last 15 days after registration. Gain in mean serum level of iron was almost same on comparison between initial Vs FU-l and initial Vs FU-II. On comparison of Mean difference of TLC between initial Vs FU-II indicate more changes occurred during last 15th days of therapy. There was almost same decrease in ESR during initial Vs FU I & FU II.(Table No. 8)

Statistical analysis of SI/TIBC: Increasing trend of SI/TIBC ratio (Transferrin Saturation) was a very encouraging output throughout all follow-ups.and decrease in p-value of SI/TIBC ratio when comparison of initial with FU-I and FU-II and FU-I with FU-II in both groups was appreciable.

Table No. 9 : SI/TIBC ratio in group - 'A' and 'B". (Transferrin saturation)

S.No.	Group 'A' (SI-TIBC)			Group – 'B' (SI/TIBC)		
	Initial	FU-I	FU-II	Initial	FU-I	FU-II
1.	0.113	0.172	0.250	0.088	0.147	0.187
2.	Initial Vs FU-I 0.152	Initial Vs FU-II 0.094	FU-I Vs FU-II 0.074	Initial Vs FU-I 0.33	Initial Vs FU-II 0.218	FU-I Vs FU-II 0.118

DISCUSSION

A total of 30 children, aged 5 month to 12 year, comprised 20 children in Group-'A' and 10 children in Group- 'B'(drug given without honey), having mean weight 12.52 ± 6.13 kg at registration, which increased on subsequent follow ups. Gain in weight during the course of treatment in group 'A' was higher in comparison to group 'B' in most of the cases.

Improvement in the appetite was the first early symptom in the children. In addition, on 2nd FU, all the cases gain appetite in both groups. However the gain in appetite and activeness in anemic children were earlier in group 'A' in comparison to Group-'B', while the duration taken in subsidence of other symptoms was almost similar.

Mean hemoglobin status observed in rising pattern is evident. Increase in hemoglobin of group 'A' is higher between the Initial Vs FU-I (t = 9.60) i.e. 1.87 ± 0.85 in comparison to in group –'B' i.e. 1.22 ± 0.415. This increase in hemoglobin over 45 days of treatment is good to correct anemia.

In previous study (Agrawal N et al, 2007), change in hemoglobin was 2.16±0.66 (n=14) when Mandur Bhasma given with honey in IDA cases. In other studies, gain in mean hemoglobin was 3.8 gm% and 3.43 gm% when elemental iron as ferrous sulphate was given in 3 mg per kg per day for 4 & 3 month respectively[27]. (Idrjadinata P & Pollitt E, 1993; Lozoff et al 1996).

Significant gain in serum iron level is occurred during the treatment in group-'A', rise in serum level of iron ($p<0.001$) was occurred in between the initial and first follow up, again, In group –'B' the gain in serum level is almost similar.

Reduction in TIBC has been observed better in group 'A' than group-'B' after the treatment. However the reduction in TIBC was better in group-'B' at 1st follow up but on next follow up and overall therapy period ,group 'A' has served better. SI/TIBC suggested that the improvement in serum iron and TIBC in group 'A' was better and early towards the normalcy than the group 'B'.
Change in the finding of TLC and ESR found due to proper treatment of associated infection at registration and correction of hemoglobin during the treatment.

CONCLUSION

Improvement in appetite is the first early symptom in children and appeared quick and earlier in group 'A' in comparison to Group 'B'. Mean hemoglobin and Serum Iron Level status observed in rising pattern. It is concluded that Sr. Iron has risen equally in both groups, while change in Hemoglobin is high in group A than group B, hence can inferred that honey does not have potentiating effect on the absorption of iron but it has potentiating action probably in enhancing hemopoiesis. TIBC is suggesting that the improvement in group-'A' is better and early towards the normalcy than the group 'B'. These findings suggests that use of Mandur with Madhu (honey) compared to mandur bhasma alone, is good for the early improvement of clinical and biochemical markers. Drug induced vomiting and other undesired effects were also reduced by adding honey to drug. Study shows that honey not only makes preparation more palatable but also shows potentiating (Yogavahi) effects in countering symptoms in IDA patients and making drug more effective.

REFERENCES

1. Amy E. Jeffrey, Carlos M. Echazarreta. Rev Biomed 1996; 7:43-49.
2. White JW, Hoban N. Composition of honey, identification of disaccharides. Arch Biochem Biophys 1959; 80:386- 392.
3. Watanabe T, Aso L. Studies on honey, Isolation of kojibiose, nigerose, maltose and isomaltose from honey. Tohoku J Agr Res 1960; 1:105-115.]
4. Siddiqui IR, Furgala B. Isolation and characterizationof oligosaccharides (Disacharides) from honey. J Apic Res 1967; 6:139-145.
5. Siddiqui IR, Furgala B. Isolation and characterization of oligosaccharides (Trisacharides) from honey. J Apic Res 1968; 7:51-59.
6. White JW, Subers MH, Schepartz AI. The identification of inhibine. The antibacterial factor in honey as hydrogen peroxidase and its origin in a honey glucose oxidase system. Biochem. Biophys Act 1963; 73:57-70.
7. Bosi G, Battalglini M. Gas chromatographic analysis of free and protein amino acids in some unifloral honeys. J Apic Res 1978; 17:152-166]
8. White JW. Composition of honey. En: Crane E, ed. Honey, a comprehensive survey. London: Bee research Association and Chalfont St Peter, 1975:157- 06.])
9. White JW. Honey. En: Chichester CO, ed. Advances in Food Research. New York: Academic Press, 1978:287- 374.
10. Dr.Dwivedi Lakshmidhar, editor(1st edition) charak samhita of maharshi agnivesh , sutra sthan , chapter No. 27 verse no. 243, Varanasi choukhamba Krishna das academy. 2008.
11. Dr.Prasad V.V.,editor(1st edition) sushruta samhita , sutra sthan , chapter No. 45 verse no. 133, New Delhi, rashtriya Ayurveda VidhyaPeeth punlication 2002.
12. Dr. Niteshwar K. Edition 1, Ashtanga Sangraha of Vaghbatt Sutra.Sthan. 6 chapter verse no. 93
13. Dr. Ganga Sahay pandey, Dr. K.C. Chunekar comentator,publisher chaukhambha bharti academy.Pu 6/22/6
14. Dr.Dwivedi Lakshmidhar, editor(1st edition) charak samhita of maharshi agnivesh , sutra sthan , chapter No. 27 verse no. 245, Varanasi choukhamba Krishna das academy. 2008
15. Dr. KR Shrikantha Murthy edition -1, Ashtanga Sangraha of Vaghbatt Sutra.Sthan. 6 chapter verse no. 87.
16. Dr.Prasad V.V.,editor(1st edition) sushruta samhita , sutra sthan , chapter No. 45 verse no. 132, New Delhi, rashtriya Ayurveda VidhyaPeeth punlication 2002.
17. Dr.Dwivedi Lakshmidhar, editor(1st edition) charak samhita of maharshi agnivesh , sutra sthan , chapter No. 27 verse no. 244-245, Varanasi choukhamba Krishna das academy. 2008
18. Dr. KR Shrikantha Murthy edition -1,(Translated) Ashtanga Hridya of Vaghbatt Sutra.Sthan. 6 chapter verse no. 39.
19. Dr. KR Shrikantha Murthy edition -1, Ashtanga Sangraha of Vaghbatt Sutra.Sthan. 6 chapter verse no. 8.
20. Dr. Ganga Sahay pandey, Dr. K.C. Chunekar comentator,publisher chaukhambha bharti academy. Pu. 6/22/2-5)
21. De Mayer EM, Dallman P, Gurney JM, Halberg L, Sood SK, Srikanta SG. Preventing and controlling iron deficiency anemia through primary health care. A Guide for health administrators and program managers. Geneva: WHO; 1999.
22. Card RT and Brain MC, the anemia of childhood:evidence for the physiologic response to hyperphosphetemia. N England J Med 1973;288 (8) : 388-392).
23. Dr. Kashi Nath Shastri, edition-1,Rasa Tarangini. Motilal Banarsidass Publisher,New Delhi.
24. Vd. Gulraj Sharma, rasa Kaamdhenu , Chaukhambha orientaliaVaranasi, Chapter -1, verse no. 196, Edition -2014.
25. Ed. Brahmashankar Mishra and Eng. Tr. Kanjiv Lochan Bhaishajaya Ratnavali, Choukhambha Sanskrit Bhawan, Varanasi-2006.
26. Ayurvedic Formulatory, Ist-edition Ministry of ayush,Government of India 1978..
27. Idrjadinata P & Pollitt E, 1993; Lozoff et al 1996. Journal of Nutrition.