AYU

Access this article online

Website: www.ayujournal.org

DOI: 10.4103/0974-8520.182761

Quick Response Code:

Clinical Research

Clinical efficacy of *Amalaki Rasayana* in the management of *Pandu* (Iron deficiency anemia)

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Abstract

Introduction: Iron deficiency anemia (IDA) is one of the most common nutritional deficiencies worldwide, which can be correlated to *Pandu* described in ayurvedic classics. Poor absorption of iron is one of the main reasons of IDA. *Amalaki* (*Phyllanthus emblica* L.) has *Tridoshahara,* especially *Pittashamaka* (pacifying *Pitta*) and *Rasayana* (rejuvenative) properties, thus nourishes the *Dhatus* and is also known to enhance the absorption of iron. **Aims:** To evaluate the efficacy of *Amalaki Rasayana* in the management of *Pandu* w.s.r. IDA. **Materials and Methods:** A randomized controlled open clinical trial was conducted at Institute for Post Graduate Teaching and Research in Ayurveda, Jamnagar. Iron deficient anemic patients (*n* = 25) having Hb <12g% in females and 13g% in males and S.Iron <50mg/dl were selected and divided into two groups. Group A was given 2 g of *Amalaki Rasayana* thrice a day with unequal quantity of honey and ghee for 45 days, while Group B was given 150 mg ferrous fumarate + 1500 mcg folic acid (standard control) once a day with water for 45 days. Assessment was done on the basis of relief in cardinal symptoms of *Pandu* and hematological parameters. **Results and Conclusion:** The formulation showed highly significant relief in *Panduta* (pallor), *Daurbalya* (weakness), *Shirahshoola* (headache), *Shrama* (fatigue), and *Gaurava* (heaviness) while statistically significant relief in *Aruchi* (anorexia) and *Pindikodweshtan* (leg cramps) was reported. On hematological parameters statistically significant increase was found in mean corpuscular volume and mean corpuscular hemoglobin while on biochemical markers statistically significant decrease was found in total iron binding capacity only. However the formulation was not found as effective as standard control.

Key words: *Amalaki Rasayana*, ferrous fumarate, folic acid, iron deficiency anemia, *Pandu*

Introduction

According to Ayurveda, body comprises of seven dhatus, which are responsible for sustenance of the being. Amongst them the first dhatu i.e. Rasa has given more importance.

Any imbalance in *Dhatu* will lead to imbalance in further *Dhatus*. Its own functioning depends on the *Agni*, which if vitiated will lead to its vitiation too. In Charaka Samhita after the description of the concept of *Agni*, *Ajirna*, *Aama*, etc., the next chapter *Pandu* has been described, which is a *Rasapradoshaja* condition.

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Anemia is a ubiquitous health problem marked by the reduction of hemoglobin (Hb) concentration or the hematocrit below the range of values occurring in healthy persons,[1] affects a major population. According to World Health Organization (WHO) Global Database on Anemia - "Worldwide Prevalence of Anemia 1993–2005", it affects 1.62 billion people who correspond to 24.8% of the population.[2] Since anemia is the most common indicator used for iron deficiency, the terms anemia and iron deficiency anemia (IDA) are sometimes used

How to cite this article: Layeeq S, Thakar AB. Clinical efficacy of *Amalaki Rasayana* in the management of *Pandu* (Iron deficiency anemia). Ayu 2015;36:290-7.

interchangeably. Iron deficiency is ranked at the top of three global hidden hungers with about one-fifth of the world's population is suffering from IDA.[3]

The main approach for treating anemia is iron supplementation without correcting the metabolism. However, besides the lack of iron in diet, one of the main reasons of IDA is poor absorption that needs correction at the prime level.

Pandu is a *Pitta* dominant *Tridoshaja* disorder with involvement of vitiation of *Rasavaha Srotas*. The symptoms of *Rasavaha Srotas* vitiation are similar to symptoms of *Kapha* vitiation. Thus, to reverse the *Samprapti* (pathogenesis) such formulation is needed which can counteract *Pitta-Kapha* and act at *Srotas* level and correct the metabolism thereby increasing iron absorption. Since *Amalaki Rasasyana* is having *Tridoshaghna*, especially *Pitta Shamaka* (pacifying *Pitta*) property, *Rasayana* (rejuvenative), *Shonitsthapana* property and also have the capability to increase the bioavailability of iron, hence, it is planned to check the role of the drug through a randomized controlled open clinical trial in the management of *Pandu* (IDA).

Materials and Methods

A total of 25 patients of IDA attending IPD/OPD of Institute for Post Graduate Teaching and Research in Ayurveda Hospital, Jamnagar, India were selected irrespective of their sex, caste, etc., taking due considerations of inclusion and exclusion criteria. The study has been approved by the Institutional Ethics Committee (PGT/7A/Ethics/2011-12/2087) and is registered to CTRI (CTRI/2013/03/003503) and consent from each patient was obtained before starting the course of treatment.

Inclusion criteria

- The presence of symptoms of *Pandu* as described in classical Ayurvedic texts[4] such as *Panduta* (pallor), *Daurbalya* (weakness), *Shirahshoola* (headache), *Shrama* (fatigue), and *Gaurava* (heaviness)
- Age between 16 and 60 years
- Hb% <12 g% (Female) and <13 g% (male) as per WHO;[5] low mean corpuscular volume (MCV) (<80 fl); serum iron <50 μg/dl, total iron binding capacity (TIBC) >360 μg/dl, and transferrin saturation <20%.

Exclusion criteria

- Hemoglobin <7 g%
- Patients suffering from hematological disorders such as sickle-cell anemia and thalassemia were excluded
- Patients suffering from severe systemic disorders such as uncontrolled hypertension, uncontrolled diabetes mellitus, AIDS, and cancer
- Pregnant female and lactating mothers.

Laboratory investigation

- Complete blood count for hemoglobin percentage (Hb%), total red blood cell (RBC) count, hematocrit, blood indices, total leukocyte count, and differential leukocyte count. Urine for routine and microscopic, stool for routine, microscopic, and occult blood
- Biochemical investigation for serum iron, total iron binding capacity (TIBC), fasting blood sugar, urea, creatinine, lipid profile, and proteins.

Grouping and posology

Registered patients were divided into 2 groups randomly using random number table method.

- Group A: *Amalaki Rasayana* group
- Dose - 2 g of *Amalaki Rasayana* thrice a day for 45 days
- *Anupana* (adjuvant) - honey and cow's ghee in unequal proportion
- Group B: Standard control group (ferrous fumarate + folic acid)
- Dose - ferrous fumarate in the dosage of 150 mg/day equivalent to 50 mg of elemental iron once a day empty stomach for 45 days with water.

Method of preparation of *Amalaki Rasayana*

Powdered *Amalaki Churna* (powder of *Phyllanthus emblica* L.) was procured from the Pharmacy, Gujarat Ayurved University, Jamnagar, while mature and fresh fruits of *Amalaki* were procured from the local market and juice was extracted out of them. The powder was triturated with fresh *Amalaki* juice in an end runner for 8 h/day for 7 days. It was then sun-dried and powdered in grinding machine.

Criteria for assessment

Subjective parameters

The effect was assessed on the basis of relief in symptoms. For the assessment, a scoring pattern was adopted which is as follows

Symptom	Score
1. *Panduta* (Pallor)	
Absent	0
Visible only in the sclera	1
Visible only in the sclera and nail both	2
Visible in the sclera, nails, face, tongue, etc.	3
2. *Daurbalya* (general weakness)	
No weakness	0
Slight weakness but work can be completed	1
Weakness due to which work is interrupted	2
Weakness affecting routine work	3
3. *Shirahshoola* (headache)	
No headache	0
Occasional headache 1–2 times/month; mild and relieved by rest	1
Headache 3–4 times/month; relieved by rest or local application	2
>4 times/month; severe with nausea and require medicine	3
4. *Shwasa* (dyspnea)	
Dyspnea after heavy work but relieved soon and up to tolerance	0
Dyspnea after moderate work but relieved later and up to tolerance	1
Dyspnea after little work but relieved soon and up to tolerance	2
Dyspnea without any work, not relieved and beyond to tolerance	3
5. *Hridspandan* (palpitation)	
Absent	0
Present only during some exercise that subsides	

itself on rest	1
Present during the normal routine activities that subsides itself on rest	2
Present during the normal routine activities but does not subside on rest	3
6. *Aruchi* (anorexia)	
Normal desire for food	0
Desire for food, little late than normal time	1
Desire for food only to favorite items	2
No desire at all	3
7. *Akshikuta Shotha* (periorbital edema)	
Absent	0
Occasional	1
Daily, periorbital edema in morning relieved in later part of day	2
Persistent	3
8. *Pindikodweshtanam* (leg cramps)	
Absent	0
After heavy work	1
Only at night but beyond tolerate	2
Whole day, without work, severe, require medicine	3
9. *Brahma* (giddiness)	
No giddiness	0
Sometimes experience giddiness which is not disturbing the routine work	1
Often experience giddiness which needs rest and disturbs routine work	2
Regular giddiness which needs treatment	3
10. *Rukshata* (dryness) in - *Twaka*, *Nakha*, *Hastapadatala*, *Kesha*	
Absent	0
In any 2 of these	1
In any 3 of these	2
In all	3
11. *Gaurava* (heaviness)	
No heaviness	0
Feeling of heaviness once/twice a day without affecting normal routine	1
Feeling of heaviness throughout the day but not up to the extent to affect normal routine	2
Feeling of heaviness throughout the day which hampers normal routine	3
12. *Shrama* (fatigue)	
No fatigue	0
Increased fatigue over baseline, but not altering normal activities	1
Moderate/difficulty in performing some activities	2
Severe, loss of ability to perform activity	3

Objective parameters

The following laboratory findings were assessed before and after treatment: Hemoglobin percentage (Hb%), red blood cell (RBC) count, hematocrit, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), serum iron, total iron binding capacity (TIBC).

Overall effect of therapy

The overall effect of therapy was assessed on the basis of following criteria:

- Complete remission: 100%
- Marked improvement: >75–<100% improvement
- Moderate improvement: >50–<75% improvement
- Improved: >25–<50% improvement
- Unchanged: <25% improvement.

Statistical analysis

In a single group, the Wilcoxon signed rank test was used to check the significance of subjective criteria and paired '*t*'-test for objective criteria was applied. To compare the effect of therapy in two groups, Chi-square test for subjective criteria and unpaired '*t*'-test for objective criteria were used. The value $P < 0.05$ considered to be significant.

Follow-up

One month follow-up was taken after treatment to check recurrences.

Observations

Total 25 patients were registered, 14 in Group A and 11 in Group B. One patient dropped out in each group. The 48% (n = 12) patients registered for the study were in between 16 and 25 years followed by 28% (n = 7) in 36–45 years and 20% (n = 5) in 26–35 years. Maximum 92% (n = 23) patients were females while remaining were male. 82.6% females were having regular menstruation. Menorrhagia was found in 34.78% females. Forty-eight percent (n = 12) patients were vegetarians. Poor appetite was found in 44% patients (n = 11). Habit of *Vishamasana* was found in 64% (n = 16) patients. *Mandagni* (diminished digestive capacity was found in 56% (n = 14) patients. Majority of the patients 76% (n = 19) were afflicted to *Lavana Rasa* (salty taste) while *Guru* (heavy), *Ushna* (hot), and *Snigdha* (unctuous) dominant diet was found in 68% (n = 17), 76% (n = 19), and 52% (n = 13) patients, respectively. Sixty percent (n = 15) and 64% (n = 16) patients had the habit of *Diwaswapa* (day sleeping) and *Vega Vidharana* (suppression of urges) while 68% (n = 19) were addicted to tea. *Chinta* (anxiety) was found in 96% (n = 24) and *Krodha* (anger) in 60% (n = 15).

On *Srtoasa* examination in *Annavaha Sroto Dushti*, *Chardi* (vomiting) was reported by 24% (n = 6), *Aruchi* (anorexia) by 80% (n = 20) patients, *Avipaka* (indigestion) by 52% (n = 13) patients. In the symptoms of *Rasavaha Sroto Dushti*, *Panduta* (pallor) was found in 100% (n = 25), *Tandra* (drowsiness) in 92% (n = 23) patients and *Angmarda* (body ache) in 84% (n = 21) patients. 68.42% patients each complained of *Glani* and *Agnimandya Tama* was reported by 63.16% while *Shabdasahishnuta* (intolerance to noise) and *Hrillas* (nausea) were reported by 68% (n = 17) and 48% (n = 12) patients, respectively. *Amla Prarthana* (desire for sour items), cardinal feature of *Raktavaha Srotodushti* was seen among 64% (n = 16) patients. Among the total patients, 80% (n = 20) complained of *Gatrasadanam* (a feature of vitiation of *Mamsavaha Srotas*). Chief complaints presented by the patients are enlisted in Table 1.

Results

After completion of therapy, Group A showed highly significant relief in *Panduta* (pallor), *Daurbalya* (weakness), *Shirahshoola* (headache), *Shrama* (fatigue), and *Gaurava* (heaviness in body) while statistically significant improvement was found in *Aruchi* (anorexia) and *Pindikodweshtan* (leg cramps) [Table 2]. Standard Control showed significant relief in *Panduta* (Pallor), *Daurbalya* (weakness), *Hridspandana* (palpitation), *Pindikodweshtan* (calf muscles cramps), *Bhrama* (giddiness), *Shrama* (fatigue), and *Gaurava* (heaviness in the body) [Table 3]. On hematological values, both the groups showed insignificant increase in Hb%, RBC, and packed cell volume. On blood cell indices, A*malaki Rasayana* showed significant increase in MCV and MCH while standard control showed insignificant increase on cell indices. On biochemical markers, the standard control group showed significant increase n serum iron ($P < 0.01$) and significant decrease in TIBC ($P < 0.05$). On transferrin saturation, both the groups showed significant increase ($P < 0.01$) [Tables 4 and 5].

On comparing Group A with Group B statistically insignificant results were found indicating that both the groups are equally effective in alleviating the chief symptoms [Table 6]. On comparison, highly significant difference ($P < 0.001$) was noted statistically on transferrin saturation while significant difference was found in S. Iron and TIBC ($P < 0.05$). On rest other parameters insignificant results were found [Table 7]. Overall effect of therapy depicted in Figure 1.

During the follow-up the patients were kept on routine OPD treatment and insignificant changes were noticed.

Table 1: Cardinal symptom wise distribution of 25 patients of *Pandu* (IDA)

Symptoms	Number of patients	Percentage
Panduta (pallor)	25	100
Daurbalya (general weakness)	23	92
Shirahshool (headache)	21	84
Shrama (fatigue)	25	100
Shwasa (dyspnea)	15	60
Hridspandana (palpitation)	19	76
Aruchi (anorexia)	20	80
Akshikuta Shotha (periorbital edema)	12	48
Pindikodweshtana (leg cramps)	24	96
Brahma (giddiness)	20	80
Rukshata (dryness)	18	72
Gaurava (heaviness)	24	96

Table 2: Effect of *Amalaki Rasayana* on clinical features of *Pandu* (IDA) in Group A

Symptoms	*n*	Mean BT	Mean AT	Mean difference	Percentage of relief	*W*	*n*	*P*
Panduta (pallor)	13	2.231	1.462	0.761	34.48	36	8	<0.01
Daurbalya (weakness)	13	1.692	1.000	0.692	40.91	45	9	<0.01
Shirahshool (headache)	10	2.300	1.100	1.200	52.17	36	8	<0.01
Shwasa (dyspnea)	7	1.429	0.714	0.714	50.00	15	5	>0.05
Hridspandan (palpitation)	8	1.375	0.625	0.750	54.55	10	4	>0.05
Aruchi (anorexia)	9	2.000	1.111	0.889	44.44	21	6	<0.05
Akshikootshotha (periorbital edema)	7	1.429	1.000	0.429	30.00	6	3	>0.05
Pindikodweshtan (calf muscle cramps)	11	2.000	1.182	0.818	40.91	28	7	<0.05
Brahma (giddiness)	10	1.100	0.600	0.500	45.46	15	5	>0.05
Rukshata (dryness)	9	1.889	1.222	0.667	35.29	15	5	>0.05
Gaurava (heaviness)	12	1.917	0.917	1.000	52.17	45	9	<0.01
Shrama (fatigue)	12	1.583	0.667	0.917	57.89	45	9	<0.01

BT: Before treatment, AT: After treatment

Table 3: Effect of therapy on clinical features of *Pandu* (IDA) in Group B

Symptoms	*n*	Mean BT	Mean AT	Mean difference	Percentage of relief	*W*	*n*	*P*
Panduta (pallor)	10	3.849	1.547	1.439	37.38	21	6	<0.05
Daurbalya (weakness)	10	2.000	1.000	1.000	50.00	21	6	<0.05
Shirahshool (headache)	9	2.556	0.778	1.778	69.57	36	8	<0.01
Shwasa (dyspnea)	7	1.429	0.571	0.857	60.00	15	5	>0.05
Hridspandan (palpitation)	9	1.556	0.556	1.000	64.29	28	7	<0.05
Aruchi (anorexia)	9	1.667	0.889	0.778	46.67	15	5	>0.05
Akshikootshotha (periorbital edema)	4	2.000	1.000	1.000	50.00	3	2	>0.05
Pindikodweshtan (calf muscale cramps)	10	1.900	0.900	1.000	52.63	28	7	<0.05
Brahma (giddiness)	9	1.333	0.556	0.778	58.33	21	6	<0.05
Rukshata (dryness)	7	2.143	1.714	0.429	20.00	3	2	>0.05
Gaurava (heaviness)	10	1.800	1.100	0.700	38.89	21	6	<0.05
Shrama (fatigue)	9	1.333	0.778	0.556	41.67	28	7	<0.05

BT: Before treatment, AT: After treatment

Table 4: Effect of *Amalaki Rasayana* on hematological and biochemical parameters in Group A (*n*=13)

Parameters	Mean		Mean difference	Percentage of relief	SD	SE	*t*	*P*
	BT	AT						
Hb% (gm%)	10.35	10.6	00.25	2.45↑	00.72	0.20	1.27	>0.05
RBC (million cells/cu.mm)	4.72	4.5	00.22	4.58↓	00.47	0.13	1.67	>0.05
PCV (%)	33.48	33.75	00.27	0.80↑	01.98	0.55	0.49	>0.05
MCV (fl)	72.31	75.23	02.92	4.04↑	04.54	1.26	2.32	<0.05
MCH (pg/cell)	22.32	23.67	01.35	6.07↑	01.85	0.51	2.64	<0.05
MCHC (gm/dl)	30.83	31.51	00.68	2.20↑	01.21	0.34	2.01	>0.05
S. Iron (µg/dl)	32.69	32.98	00.29	0.89↑	04.01	1.11	0.26	>0.05
TIBC (µg/dl)	383.92	369.15	14.77	3.85↓	14.69	4.07	3.62	<0.01
T. Saturation	8.51	8.95	00.44	5.16↑	01.00	0.28	1.58	>0.05

Hb%: Hemoglobin %, RBC: Red blood cells, PCV: Packed cell volume, MCV: Mean corpuscular volume; MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration; S. Iron: Serum iron, TIBC: Total iron binding capacity, T. Saturation: Transferrin saturation, BT: Before treatment, AT: After treatment, SD: Standard deviation, SE: Standard error

Table 5: Effect of therapy on hematological and biochemical parameters in Group B (*n*=10)

Parameters	Mean		Mean difference	Percentage of relief	SD	SE	*t*	*P*
	BT	AT						
Hb% (gm%)	10.29	11.27	00.98	09.52↑	01.59	00.5	1.94	>0.05
RBC (million cells/ cu.mm)	4.58	4.72	00.13	02.92↑	00.38	00.12	1.11	>0.05
PCV (%)	33.01	36.66	02.65	08.03↑	04.35	01.37	1.93	>0.05
MCV(fl)	71.66	75.50	03.84	05.36↑	05.55	01.75	2.19	>0.05
MCH (pg/cell)	22.57	24.05	01.48	06.58↑	02.44	00.77	1.92	>0.05
MCHC (gm/dl)	31.36	31.82	00.46	01.46↑	01.06	00.34	1.36	>0.05
S. Iron (µg/dl)	31.69	35.97	04.28	13.51↑	03.88	01.23	3.49	<0.01
TIBC (µg/dl)	383.3	324.7	58.60	15.29↓	61.15	19.34	3.03	<0.05
T. Saturation	8.33	11.34	03.00	36.01↑	02.69	00.85	3.53	<0.01

Hb%: Hemoglobin %, RBC: Red blood cells, PCV: Packed cell volume, MCV: Mean corpuscular volume; MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration; S. Iron: Serum iron, TIBC: Total iron binding capacity, T. Saturation: Transferrin saturation, BT: Before treatment, AT: After treatment, SD: Standard deviation, SE: Standard error

Table 6: Comparative effect of therapy on clinical features in Group A and B

Symptoms	Percentage of relief		Number of patients				Total		χ^2	*P*
	Group A (*n*=13)	Group B (*n*=10)	Group A		Group B		Group A	Group B		
			<50% (NS)	>50% (S)	<50% (NS)	>50% (S)				
Panduta (pallor)	34.48	37.38	11	2	5	5	13	10	1.773	>0.05
Daurbalya (weakness)	40.91	50.00	10	3	6	4	13	10	0.174	>0.05
Shirahshool (headache)	52.17	69.57	7	3	3	6	10	9	1.295	>0.05
Shwasa (dyspnea on exertion)	50.00	60.00	4	3	3	4	7	7	0.285	>0.05
Hridspandan (palpitation)	54.55	64.29	4	4	5	4	8	9	0.052	>0.05
Aruchi (anorexia)	44.44	46.67	7	1	6	3	8	9	0.192	>0.05
Akshikootshotha (periorbital edema)	30.00	50.00	6	1	3	1	7	4	0.196	>0.05
Pindikodweshtan (calf muscle cramps)	40.91	52.63	8	3	6	4	11	10	0.024	>0.05
Brahma (giddiness)	45.46	58.33	5	5	6	3	10	9	0.073	>0.05
Rukshata (dryness)	35.29	20.00	7	2	5	2	9	7	0.085	>0.05
Gaurava (heaviness)	52.17	38.89	8	4	7	3	11	10	0.028	>0.05
Shrama (fatigue)	57.89	66.67	7	6	6	3	13	9	0.026	>0.05

n: Number of patients, NS: Not significant, S: Significant

Discussion

The prevalence of IDA was found to be more in females. This can be due to insufficient dietary habits, social negligence, unawareness and menstrual causes. Menorrhagia, is one common cause of Iron deficiency anaemia and affects nearly 2 million women. Heavy menstrual bleeding has been reported in approximately 10-15% of all women at some point during

Table 7: Comparative effect of therapy on hematological and biochemical parameters in Group A and B

Parameters	Mean score		Percentage of relief		Mean difference	*t*	*P*
	Group A	Group B	Group A	Group B			
Hb% (gm%)	00.25	00.98	2.45↑	09.52↑	00.726	1.467	>0.05
RBC (million cells/cu.mm)	00.22	00.13	4.58↓	02.92↑	00.350	1.928	>0.05
PCV (%)	00.27	02.65	0.80↑	08.03↑	02.381	1.760	>0.05
MCV (fl)	02.92	03.84	4.04↑	05.36↑	00.919	0.4376	>0.05
MCH (pg/cell)	01.35	01.48	6.07↑	06.58↑	00.130	0.1457	>0.05
MCHC (gm/dl)	00.68	00.46	2.20↑	01.46↑	00.220	0.4544	>0.05
S. Iron (µg/dl)	00.29	04.28	0.89↑	13.51↑	03.988	2.398	<0.05*
TIBC (µg/dl)	14.77	58.60	3.85↓	15.29↓	43.831	2.508	<0.05*
T. Saturation	00.44	03.00	5.16↑	36.01↑	02.562	3.177	<0.001**

*Significant, **Highly significant. Hb%: Hemoglobin %, RBC: Red blood cells, PCV: Packed cell volume: MCV: Mean corpuscular volume, MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration, S. Iron: Serum iron: TIBC: Total iron binding capacity, T. Saturation: Transferrin saturation, ↑: Increase, ↓: Decrease

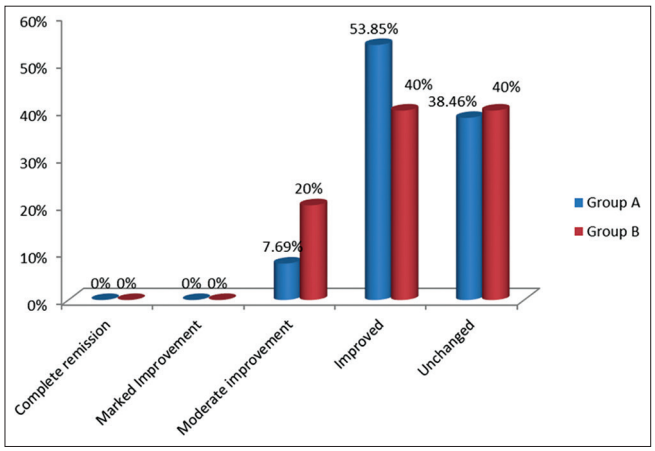

Figure 1: Overall effect of therapy

their life. Among these women, as many as 20% develops anaemia.[6] The WHO report also shows that worldwide sex incidence is more in females (41.8% pregnant and 30.2% non-pregnant females).[7] A maximum number of patients were of 16–25 years of age. This is the growing period with extra needs. Furthermore, in this age group, there is more indulgence to faulty dietary habits and regime. Most of the patients in the study were vegetarian. The reason can be: (1) Vegetarian dominant area and (2) iron which is available from vegetarian sources is non-heme iron which has less bioavailability.[8] The increased tannin and phytate content with vegetarian diet inhibit iron absorption.

Maximum patients were having *Mandagni*. The hampered *Agni* ultimately leads to *Agnimandya*, which leads to *Dhatvagnimandya*. These also produce *Dhatushaithilya* or *Dushti* and may also cause the vitiation of *Dosha*. Maximum patients, i.e., 63.16% were taking *Lavana Rasa* dominant diet. According to classics, excessive use of *Lavana Rasa* causes *Pitta Prakopa* (vitiation of *Pitta*).[9] Majority of the patients were addicted to tea. Polyphenolic compounds present in tea also strongly inhibit dietary non-heme iron absorption.[10]

Diwaswapa (day sleeping) was found in a maximum number of patients which vitiates all three *Doshas* as per Sushruta[11] and especially *Kapha* and *Pitta* as per Acharya Charaka[12] which then pin down the normal functioning of *Agni*.

Since in this study majority of the patients were female, it was quite obvious to have habit of *Vegadharana* (suppression of urges) as there is a general tendency of females to suppress their urges not only due to shyness in public gatherings, etc., but also at home too in an urge to finish the household work first. Such a habit leads to *Vata prakopa* (vitiation of *Vata*) and diminution of *Agni*. *Chinta* (anxiety) was profoundly found in patients followed by *Krodha* (anger). *Chinta* weakens the digestive power and that ultimately is responsible for vitiation of *Rasavahasrotas* resulting in *Aruchi* (anorexia), *Angamarda* (body ache), etc.[13] *Krodha* is also responsible for *Jatharagni Mandya* and leads to *Aam* formation[14] and is also a symptom of *Pitta Prakopa*, the main *Dosha* involved in *Pandu*.

In Group A, statistically highly significant improvement was found in pallor, weakness, headache, fatigue and heaviness in body while statistically significant improvement was found in anorexia and leg Cramps. This can be attribute to *Tridoshahara*, *Rochana*, *Dipana*, and *Anulomana* properties of *Amalaki Rasayana* which have a role in the digestion, absorption, and motility of digestive materials in the gut. Again because of having properties such as *Hridya*, *Tridoshahara*, and *Madhura Vipaka*, *Amalaki Rasayana* does nourishment of *Rasa Dhatu* which further nourishes all the *Dhatus*. It has been considered as a potent *Rasayana* enhancing the essence of all the *Dhatus*.[15] *Pandu* is a disease with *Kleda Adhikya*. *Amalaki* contains 5 *Rasas* including *Tikta* (bitter) and *Kashaya* (astringent) which are *Srotoshodhaka* and *Ruksha* in property. *Tikta* and *Kashaya* are said to be *Kledopshoshana* and *Kleda Upyokta*, respectively.[16] All these properties help in *Kleda Shoshana* thus alleviating the symptoms. *Amalaki* is also a potent source of Vitamin C (ascorbic acid) which is the most potent enhancer of nonheme iron absorption.[17] Adding a Vitamin C source to a meal increases non-heme iron absorption up to six-fold which makes the absorption of nonheme iron as good as or better than that of heme iron.[18] Further, ascorbic acid facilitates iron absorption by forming a chelate with ferric iron at acid pH that remains soluble at the alkaline pH of the duodenum.[19] *Amalaki* is also having antioxidant properties by virtue of antioxidants present in it which include Vitamin C, bioflavonoids, flavones, polyphenols, and carotenoids.[20] As oxidative stress, an increase in oxidants and/or a decrease in antioxidant capacity is one of the potential biochemical mechanisms involved in the pathogenesis of IDA,[21] supplementation of antioxidant

vitamins with iron supplementation may offer a better response in the management of IDA.[22]

Standard control provided statistically significant relief in pallor, weakness, palpitations, calf muscle cramps, giddiness, fatigue and heaviness in the body. Biochemical markers increased significantly while Hb%, PCV MCV and MCH were insignificantly increased. According to WHO guidelines for iron supplementation, iron supplements are necessary for rapid treatment of IDA.[23]The standard control contains elemental iron fortified with folic acid. leading to replenishment of deficient iron and correction of disease.

On Comparing the effect of therapy on symptoms, insignificant difference show that more or less both the therapies have more or less equal effect. However on objective parameters significant increase was found in S.Iron and TIBC. This may be attributed to the presence of *Iron* in *standard control.*

Conclusion

Iron Deficiency Anemia can be studied under the broad umbrella of *Pandu*. *Pandu*, a *Rasaja* disorder vitiates the *Kapha* which in turn may cause the disease by *Ama* and *Mandagni*. In the present study, there was no statistical difference between ferrous fumarate + folic acid group and *Amalaki Rasayana* group but clinically ferrous fumarate + folic acid group was more effective than Amalaki *Rasayana*. On biochemical markers that is Serum Iron and ferrous fumarate + folic acid was found to be more effective than *Amalaki Rasayana* owing to iron supplementation. Replenishment of deficient iron by iron supplementation may correct the anemia but it doesn't correct the ongoing pathogenesis which is the prime aim of Ayurvedic management. A sufficient time is required to cure *Ama* and *Agnimandya* at *Dhatu* level. In this study trial drug was given for 1½ months which might not be the sufficient time to disrupt the pathogenesis. Results could have been more effective if study would have been done for longer duration considering the chronic nature of disease.

Financial support and sponsorship
Institute for Post Graduate Teaching and Research in Ayurveda, Gujarat Ayurved University, Jamnagar.

Conflicts of interest
There are no conflicts of interest.

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हिन्दी सारांश

पाण्डु में आमलकी रसायन के प्रभाव का चिकित्सकीय अध्ययन

शैझी लयिक, अनुप बी. ठाकर

आयरन डेफिशियेन्सी एनीमिया मुख्य रुप से पोषण कमी जनित अवस्था है जिसकी तुलना आयुर्वेद के पाण्डु रोग से किया जा सकता है। जिसमें पाण्डुता दौर्बल्यता, श्रम, आलस्य, हृत्पीड़ा आदि का बाहुल्य रहता है। प्रस्तुत अध्ययन में शास्त्रीय योग आमलकी रसायन का प्रयोग किया गया जिसमें मुख्यतः दीपन, रोचन, त्रिदोषशामक, स्त्रंसन, स्रोतोशोधन, रसायन आदि गुणों का समावेश है। रोगियों के एक समूह ग्रुप 'ए' को आमलकी रसायन ४५ दिनों तक दिया गया जबकि दूसरे समूह ग्रुप 'बी' को फ़ेरस सल्फेट–फोलिक एसिड का प्रयोग भी ४५ दिनों तक कराया गया। चिकित्सा के बाद दोनों समूहों में लक्षणों में सुधार पाया गया। आमलकी रसायन में लोहतत्व के अभाव तथा चिकित्सकीय अवधि मात्र डेढ़ मास होने के कारण विषयात्मक एवं उद्देश्य मानदण्डों मे ग्रुप ए की तुलना में ग्रुप बी में बेहतर परिणाम प्राप्त हुये।