

Correlation of Organic Kitchen Garden for Nutrition, Awareness of Consumption of Vegetables and Nutritional Deficiency Anaemia

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Introduction

Anemia is one of the most serious global public health problems and the world's second leading cause of disability. Anemia can decrease physical and mental productivity of populations in industrialized and developing nations. An estimated 30% of the world's population is anemic. About half of the deaths from anemia in the world occur in South Asian countries. India accounts for over 80% of deaths due to anemia in South Asia. Anemia during pregnancy increases maternal and infant mortality. It impairs children's physical and cognitive development, and results in fatigue, reduced work performance and reduced immune status. Reductions in cognitive and work performance of substantial portions of the population can have detrimental economic consequences for entire nations.

Anemia can be caused by nutritional deficiency (e.g., iron, folate, vitamin B12, vitamin A) and non-nutritional factors (e.g., hemoglobinopathies and malaria, hookworm, tuberculosis, and other infections).

Anemia is defined by low oxygen carrying capacity of blood, particularly due to low hemoglobin concentration in the blood. Hemoglobin is needed to transport oxygen throughout the body.

Common symptoms of anemia are tiredness, lethargy (lack of energy), shortness of breath (dyspnea), while less common symptoms include headache, an altered sense of taste, Pica - a desire to eat non-food items, such as ice, paper or clay, a sore tongue, feeling itchy, hair loss, difficulty in swallowing (dysphagia).

Causes of anemia are as follows:

Anemia caused by destruction of red blood cells (Hemolysis), e.g. inherited conditions, such as sickle cell anemia and thalassemia, and/or stressors such as infections, drugs, snake or spider venom, or certain foods, blood loss due to physiological conditions like pregnancy, menstruation, chronic blood loss within the body such as from a peptic ulcer, a hiatus hernia, a colon polyp or colorectal cancer, hemorrhoids, use of nonsteroidal anti-inflammatory drugs (NSAIDS) such as aspirin or ibuprofen, which can cause ulcers and gastritis.

Other causes are either lack of iron in the diet over a time period leading to iron-deficiency or an inability to absorb iron from food into the bloodstream in the small intestine

e.g. intestinal disorder such as celiac disease and intestinal surgery, which affects the intestine's ability to absorb nutrients from digested food, can also lead to iron-deficiency anemia. Iron deficiency anemia rarely causes serious or long-term complications and may be unnoticed and neglected unless the patient is investigated for some other ailments.

The most common type of anemia is Iron deficiency or nutritional deficiencies anemia. It may be due to

- (1). Under-nutrition resulting in Protein Energy Malnutrition (PEM), Iron deficiency, Iodine deficiency, Vitamin "A" deficiency, Low Birth Weight in children;
- (2) Seasonal dimensions of Nutrition;
- (3) Natural calamities & landlessness.
- (4) Market distortion and disinformation;
- (5) Urbanization
- (6) Special Nutritional Problems of hill people, industrial workers, migrant workers, and other special categories;
- (7) Problems of over nutrition, overweight and obesity for a small section of urban population.

At Govt. level various Direct and Indirect Intervention policies are framed and implemented to some extent. A major challenge is identification of anemic population and reaching out to it. Various National Family Health Surveys conducted so far state that prevalence of anemia in women is around 55.3%.

The Ministry of Health and Family Welfare in 2013 launched the "National Iron Plus Initiative" as a comprehensive strategy to combat the public health challenge of Iron Deficiency anemia prevalent across the life cycle. There are age specific interventions with Iron and Folic Acid Supplementation and Deworming for improving the hemoglobin levels and reducing the prevalence of anemia for all age groups, that is children 6-59 months, 5 – 10 years, adolescent girls and boys (11-19 years), pregnant and lactating women and women in reproductive age group (20 – 49 years), health and nutrition education through IEC & BCC to promote dietary diversification, inclusion of iron folate rich food as well as food items that promote iron absorption.

The Sahayak Trust had initiated an anemia Free Vidarbha Forum (AFVF) for development of organic kitchen gardens for nutrition (OKGNs) in households in Vidarbha to combat anemia in January 2016

It was decided to first determine Hb levels in village populations to obtain baseline data. Various NGOs working in Vidarbha region either in health and /or agriculture were motivated to hold hands together. The Sahayak Trust conducted initial training programs for the volunteers from NGO partners of AFVF on causes and consequences of anemia and organic nutrition kitchen garden development to prevent or reduce anemia. The trainers from AFVF partners then conducted Hb camps for women in particular and for the general population in some cases in their area of work. The Sahayak Trust wished to assess the impact of various interventions on reducing anemia and commissioned this study by Aamhi Amchya Arogya Sathi (AAA).

The base line data from Hb testing done by AAA in more than 15 villages in Gadchiroli and Bhandara districts showed that more than 50% women are suffering from unnoticed mild to moderate anemia (Hb levels in between 8 to 11 g %). Common symptoms were fatigue, weakness, body ache, and lethargy, repeated infections like common cold and cough, loss of appetite, indigestion,

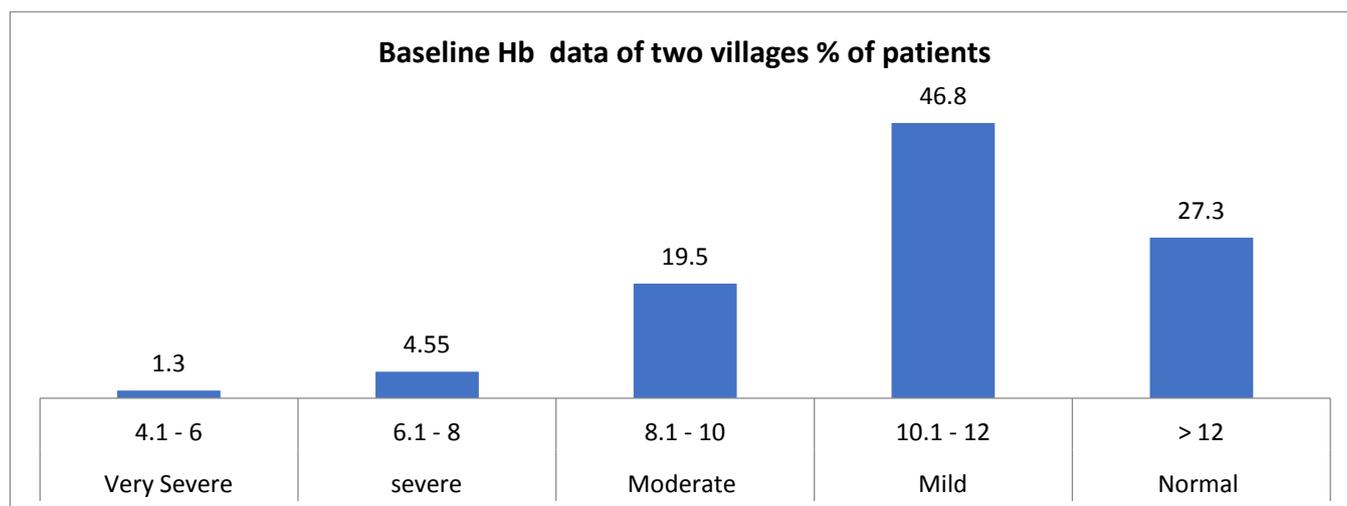
flatulence, and constipation. Most of them reported spending more than Rs 500 on medications per month.

Baseline data of 153 people from two out of the 15 villages in the above Hb survey, namely ttangati and Sillori is given below in table 1. Age group was from 2 years to 77 years. The female number was 137 and males 15.

The blood of these volunteers was analyzed for Hb content and peripheral smear to identify type of anemia. Out of 157 patients 42 (27.3%) people were showing Hb g % in the normal range of 12 to 14 G % while 111 (72.7 %) people were below normal range of 12 g %. 7 out of 15 (46.66%) males were anaemic too.

Table 1 Baseline data of Hb from Ittangati and Sillori.

Category of anemia	Range of Hb G %	Number of patients	MALES	FEMALES
Very Severe	4 - 6	2 (1.3%)	----	2
Severe	6.1 – 8	7 (4.55%)	2	5
Moderate	8.1 – 10	30 (19.5%)	3	27
Mild	10.1 – 12	72 (46.8%)	2	70
Normal	12.1 - 14	34 (22.1%)	6	28
	>14	8 (5.2%)	2	6



Aim and Objectives of this Study

Aim : To observe haemoglobin levels for women in the study group at the end of 3 months treatment and on follow up after one year with different treatment modalities.

Objectives:

- a) To determine Hb levels and create awareness about nutritional deficiencies anemia in rural population.
- b) To increase awareness of developing Organic Nutrition Kitchen Garden
- c) To increase awareness of consumption of vegetables daily in sufficient quantities

- d) To study effect of deworming in anemia
- e) To Study efficacy of consumption of Ambadi preparation and compare with standard treatment
- f) To Study correlation of Organic Nutrition Kitchen Garden development and increase in consumption of vegetables.
- g) To study correlation of awareness of nutrition and anemia.

Selection of study sites:

Amhi Amchya Arogyasathi (AAA) is working on health projects in Kurkheda block since last 30 years.

Based on easy approach from AAA office Kurkheda, adult women from six villages- Moushi, Palasgad, Chichewada, Neharpyali, Khairi, and Belgaon in Kurkheda block were selected based on availability of women fulfilling inclusion criteria. Participants were enrolled after oral consent.

Selection of volunteers:

Women fulfilling inclusion and exclusion criteria and consenting to participate were included in study groups after initial screening for anemia by detecting their Hb gm%.

Inclusion/Exclusion Criteria

Inclusion criteria

Healthy women in age group of 30-50 years were initially screened for their Hb and obstetric history. Those having Hb g % in the range of 8-11 gm (mild to moderate anemia) and with regular menstrual cycle were included in the study.

Exclusion criteria

Women having any health problem like bleeding piles, excessive bleeding in menstrual cycle, having fever, kidney problems, Sickle cell/ Thalassemia etc or having recently undergone any operation were not selected.

Women with severe anemia were excluded.

Adult Women from six villages in Kurkheda block were selected based on availability of women fulfilling inclusion criteria. Each group contained 38 to 41 women in the age group of 30 to 50 years. Study was initiated after conducting survey for baseline data. The women from six villages were divided into three groups. In Moushi and Palasgad ambadi capsules were administered in the dose of 2 capsules bd for 100 days. While in Khairi and Belgaon iron folic acid capsules were administered once a day for 100 days at night after dinner. They were advised about side effects like black stools and constipation. In such a case they were told to withhold capsule until symptoms subside and resume consumption again thereafter. They were advised to complete the dose. However only 70 % women from both the groups completed treatment while 30% women did not take complete treatment of 100 days. Chichewada and Neharpyali women were made aware of anemia and importance of consuming organically grown vegetables through a previous program by AAA. Out of these three groups from six villages, in the villages of Moushi, Chichewada and Khairi, a single dose of Albendazole tabs was administered while in the other three villages it was not administered. Worm infestation is a common cause of anemia and to study effect of deworming on Hb these subgroups were included.

Sample size

Each group consists of 40 women considering anticipated drop out of around 20 %, this being a field study

Study groups:

Adult women from six villages in the age group of 30-50 years and suffering from mild to moderate anemia (Hb gm% in the range of 8-11) were divided into three main groups, namely (1) Ambadi group, (2) Organic Kitchen garden group and (3) standard treatment group receiving iron folic acid capsules.

Each group was further subdivided into 2 subgroups i.e. with deworming or without deworming treatment as follows

Group 1 - Ambadi Group: included participants from two villages namely from Moushi and Palasgad which are subdivided into group 1A and group 1 B as follows:

Group 1A Moushi participants received deworming with Albendazole 1 tablet at the start of study + ambadi 4 capsules per day for 100 days

Group 1B Palasgad participants received ambadi 4 capsules per day for 100 days

Group 2 - Organic Kitchen Gardens for Nutrition: Included participants from two villages namely from Chichewada and Neharpyali which were subdivided into group 2A and group 2B

Group 2A Chichewada participants received Deworming with Albendazole 1 tablet at the start of study + motivation for developing Organic Kitchen Garden and awareness about diet and anemia

Group 2B Neharpyali participants were motivated for developing Organic Kitchen Garden and awareness about diet and anemia

Group 3 – Standard treatment of iron folic acid: included participants from two villages namely from Khairi and Belgaon which were subdivided into group 3A and group 3 B

Group 3A Khairi participants received deworming with Albendazole 1 tablet at the start of study + Merifol 1 cap per day for 100 days

Group 3B Belgaon participants received Merifol 1 cap per day for 100 days

Table 2: Study groups, no of participants and treatment received

Selection of Study Sites:

Group Name	Villages (N = 237)	Treatment
1. Ambadi Group	1 A. Moushi (N=38)	Albendazole OD (single dose) + Ambadi – 4 cap /day for 100 days
	1B. Palasgad (N=39)	Ambadi – 4 cap /day for 100 days
2. Organic Kitchen Garden for Nutrition	2A. Chichewada (N=40)	Albendazole OD (single dose) + Nutritional awareness through OKGN
	2B. Neharpyali (N=41)	Nutritional awareness through OKGN
3. Iron Folic Acid group	3A. Khairi (N=38)	Albendazole OD (single dose) + Merifol 1 cap/ day for 100 days
	3B. Belgaon (N=41)	Merifol 1 cap/ day for 100 days

Table 3 Medicines used in Study Group

Medicines	Contents per capsule	Manufacturer/Marketed
Hematinic capsules with zinc-- Merifol	Ferrous gluconate—259 mg (equivalent to Elementary iron 30 mg) Folic acid IP --- 0.5mg Vitamin B12 IP – 2.5 mg Dibasic calcium phosphate IP (dehydrate)—100mg Zinc sulphate IP —33mg	Pyre and Cure Healthcare , Pvt Ltd Haridwar Uttarakhand Marketed by Wockhart
Ambadi capsules	Hibiscus sabdariffa calyx powder—Iron content – Iron as Fe 48 mg /100g Vit C 76 mg/100g	Shreeram marketing , Nagpur specification on label
Vegetables grown in Kitchen	5-7 types of vegetables grown in kitchen garden in daily diet	Grown in village
Deworming tablets	Albendazole Tablets IP 400mg Once	Marketed by Wockhart

Study parameters:

Determination of Hb gm % was before start of study, after 3 months of treatment, and after 1 year from start of study.

Common Symptoms associated with anemia were assessed before and after treatment in study participants

Nutritional assessment: Forms (annexure 1) prepared for routine diet consumption were filled at the start and at the end of 3 months treatment for all groups.

Patient compliance for treatment was assessed orally and by filling follow up forms for symptomatic relief at the end of 3 months treatment.

Treatment and dose selection:

The main aim of the study was to observe haemoglobin levels for women in the study group at the end of 3 months treatment and on follow up after one year with different treatment modalities. The study was originally designed to compare awareness of anemia and diet and daily easy supply of nutrients through developing organic kitchen gardens at home with the standard treatment of anemia by administering generic marked preparations of iron folic acid capsules as per recommended schedule and dose. Nutraceuticals are also used by various companies as hematinic tablets or capsules like moringa, ambadi containing iron. It was decided to add one group using such marketed preparations to compare with natural source of vegetables made available through kitchen garden and standard iron preparations. Ambadi capsules were selected based on their availability and manufacturers were interested in conducting study.

Minimum Dose of iron folic acid capsules was selected as 100 mg OD for 100 days (three months) which is equivalent to 33mg of Fe per day.

Nutraceuticals are basically dietary supplements and are recommended to fulfil 30 % of daily dietary requirement. Each 500mg of ambadi capsule contains 0.24 mg of Iron as Fe. Four capsules per day provided 0.96 mg of Fe per day.

OKGN group: Women were trained under Upjivika Adhikar Prakalp programme related to Organic Kitchen Garden development by AAA. Awareness was created about importance of consumption of iron rich green leafy vegetables and cereals in enough quantity daily.

Nutritional assessment feedback forms were filled and collected for each participant on follow up visits. (Forms attached)

Hematologic parameters:

Hb was tested by routine Sahli's method, before start of treatment and at the end of three months treatment.

Drug distribution and follow up:

In each village one health worker residing in the same village was appointed for follow up and drug distribution after initial training of research methodology and filling of forms. In Group 1A, 2A and 3A Albendazole tablets were administered to all participants as deworming remedy. From the next day samples of ambadi capsules were given to Group 1 and Merifol capsules to Group 3 were distributed to participants of r groups 1 and 3 for 8 days. After returning the empty packets next supply was given. The procedure was repeated for 12 weeks. In group 2 awareness program for anemia, nutrition and development of organic kitchen garden was conducted in both villages. The participants, health workers were not informed about contents of capsules. Follow up forms were filled in by the health worker during follow up visits.

At the end of three months from date of initiation again Hb and CBC parameters were tested by conducting health camps at villages.

During the follow up camps participants were evaluated for their symptomatic relief, awareness about nutrition and health, particularly anemia, development of kitchen garden, dietary pattern, compliance of medicines and any other health related problems.

Observations and Results:

The study was initiated in Aug -Sept 2017 and completed in November 2018. Actual treatment period was of initial three months duration.

Table4. The base line data is given in below

Group	Sub –group	Ave age in yrs	Avg Hb gms%
1. Ambadi	1 A. Moushi (N=38)	36.18	10.63
	1B. Palasgad (N=39)	39.31	10.88
2. Organic Kitchen Garden for Nutrition	2A. Chichewada (N=40)	35	10
	2B. Neharpyali (N=41)	37	9.6
3. Iron Folic Acid	3A. Khairi (N=38)	41	10
	3B. Belgaon N=41)	35	9.8

The data shown in table 3 indicates that number of participants, their average age and Hb g % are not significantly different from each other in all groups.

Demography data: Women from Palasgad (23/38), Neharpyali (18/41) and Khairi (15/39) were having education up to primary level as compared to other groups such as Moushi (11/38), Chichewada (12/40), Belgaon (6/41) . * Education data for two participants from Neharpyali is missing.

The details are shown in corresponding table 4 and graph.

Table 5: Education status

Demography data				
	Nil	Primary	up to matriculation school	< matriculation
1. Ambadi group				
1A Moushi (+ Deworming) N=38	2	9	20	7*

1B Palasgad N= 38	15*	8	14	1
2 OKGN				
2A Chichewada (+Deworming) N=40	8	4	20	8*
2B Neharpyali N= 41	12*	6	15	6
3 Iron folic acid				
3A Khairi (+ deworming) N=39	12	3	15	9*
3B Belgaon N=41	1	5	32	3

Graph for table 5 : Educational Status

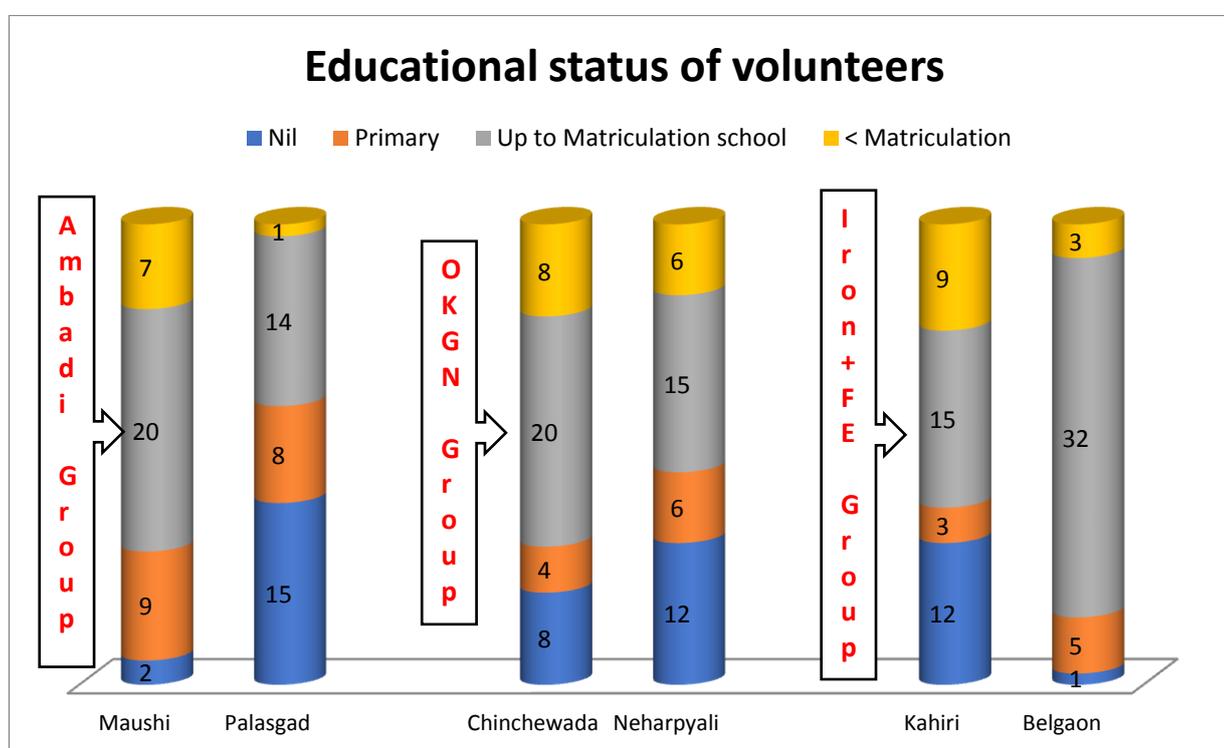


Table 6: Gynaecologic data and Habits

Group	No of Deliveries			Menstrual history		Habit Kharra/Gutkha/Nas	
	1-2	3-4	5-6	Regular	Irregular	Yes	No
	1A. Moushi (N=38) Deworming + Ambadi	17	17	4	32	6	16
1B. Palasgad (N=39)	21	14	1	38	--	28	10

Ambadi							
2A.Chichewada (N=40) Deworming+ OKG	28	9	3	39	1	4	32
2B. Neharpyali (N=41) OKG	24	17	--	38	3	32	9
3A. Khairi (N=38) Deworming + Iron, folic acid	21	18	--	36	2	30	8
3B. Belgaon (N=41) Iron, folic acid	24	14	--	40	1	27	13

Table 6 shows baseline health status and gynecologic data along with their habits. In Chichewada 70% women had only 1-2 deliveries and only 4/40 women had the habit of eating Gutkha, while in the rest of the groups, more than 50% women consumed Gutkha/Kharra or nas on regular basis.

Data after first follow up- at the end of treatment of three months

Table 7: Hb g % levels before and after treatment

Group	Hb g% before TT	Hb g% After TT	Diff	
1. Ambadi	10.63	10.37	-0.26	↓
1A. Moushi				
1B. Palasgad	10.88	11.20	0.32	↑
2. Organic KG	9.78	11.24	1.46	↑
2A.Chichewada				
2B. Neharpyali	9.61	10.86	1.25	↑
3.Fe + Folic acid	9.99	10.10	0.11	↔
3A. Khairi				
3B. Belgaon	9.80	9.89	0.09	↔

Graph for table 7: Hb g % levels before and after treatment

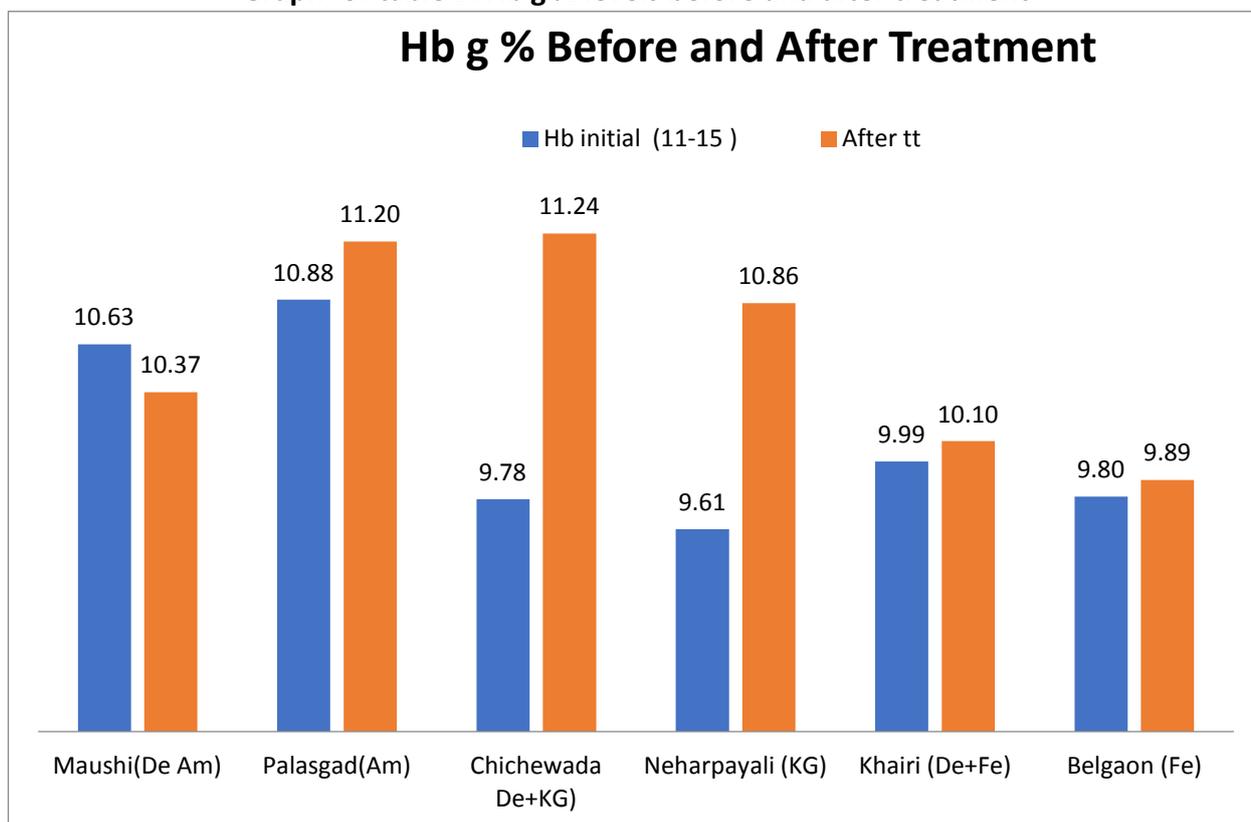


Table 7 and corresponding graph shows changes in Hemoglobin levels after treatment.

After completion of three months treatment period Hb testing was repeated in all study groups. In all study groups drop out was from 18 to 40%.

After completion of treatment it was observed that in the Moushi group treated with ambadi capsules and deworming Hb was slightly decreased or unchanged while in Khairi and Belgaon group treated with iron folic acid capsules no significant change was observed, which is surprising. In Palasgad Chichewada and Neharpyali group Hb increased. These findings suggested that women were more compliant in OKGN group when made aware about their diet and anemia, but they were not too happy with taking medicines. Many women complained about various symptoms which were not actually associated with treatment. Many women thought capsules of iron are consumed only during pregnancy.

Second follow up after 12 months

Table 8 determination of Hb after 12 months and comparison with initial and first follow up

Study Groups	Ave Hb g % Initial	Ave Hb g % First follow up	Ave Hb g % Final follow up
1 Ambadi group			
1A Moushi (+ Deworming)	N=38	N=27	N=21
	10.64	10.39	11.07*

1B Palasgad	N=38	N=22	N=5
	10.87	11.2	10.4
2 OKNG group			
2A Chichewada (+Deworming) N=40	N=40	N=16	N=31
	9.8	11.26	11.13*
2B Neharpyali N= 41	N=41	N=31	N=37
	10	10.86	10
3 Iron folic acid group			
3A Khairi (+ deworming) N=39	N=39	N=32	N=19
	10	10	11*
3B Belgaon N=41	N=41	N=30	N=36
	9.8	9.6	10.3

In Moushi, Chichewada and Khairi groups average Hb was elevated up to 11 g % almost by 1 g% after 1 year while in Palasgad, and Neharpyali it remained as it is. In Belgaon it was slightly elevated.

The first follow up was at the end of treatment of ambadi and iron folic acid capsules administered for 3 months and participants being made aware of eating vegetables from organic kitchen garden.

In group 1A where participants received ambadi capsules and albendazole as deworming, though the Hb was reduced after first follow up , after second follow up it was found to be elevated, while in ambadi group without albendazole Hb was found to be reduced to the initial level.

Participants from ambadi group were reluctant to continue with study once they came to know that the capsules contain ambadi powder and not iron folic acid. Moreover, the participants from this village refused to repeat Hb on second follow up

In 2A OKG group with Albendazole the average Hb was found to be elevated at the end of both follow ups as compared to 2B OKG group without deworming treatment. Similarly, in Iron folic acid treatment with albendazole

3A group average Hb was elevated by 1 gm at the end of second follow up as compared to non-deworming 3B group.

These results show clearly that treating worm infestation with single dose of albendazole with consumption of iron rich ambadi or Iron capsules or iron rich vegetables at the start of study helped in elevating Hb as compared to not administering deworming agent but giving ambadi or vegetables or iron tablets alone.

Table 9: Percentage of volunteers in study groups consuming Kharra

Moushi N=38		Palasgad N= 38		Chichewada N=40		Neharpyali N= 41		Khairi N=39		Belgaon N=41	
Kharra 42.11 %	No kharra 57.89 %	Kharra 73.68 %	No kharra 26.31 %	Kharr a 10%	No kharr a 90%	Kharra 78.04 %	No kharra 21.95 %	Kharra 76.95 %	No kharra 23.07 %	Kharra 65.85 %	No kharr a 31.7 %

Graph for table 9: Percentage of volunteers in study groups consuming Kharra

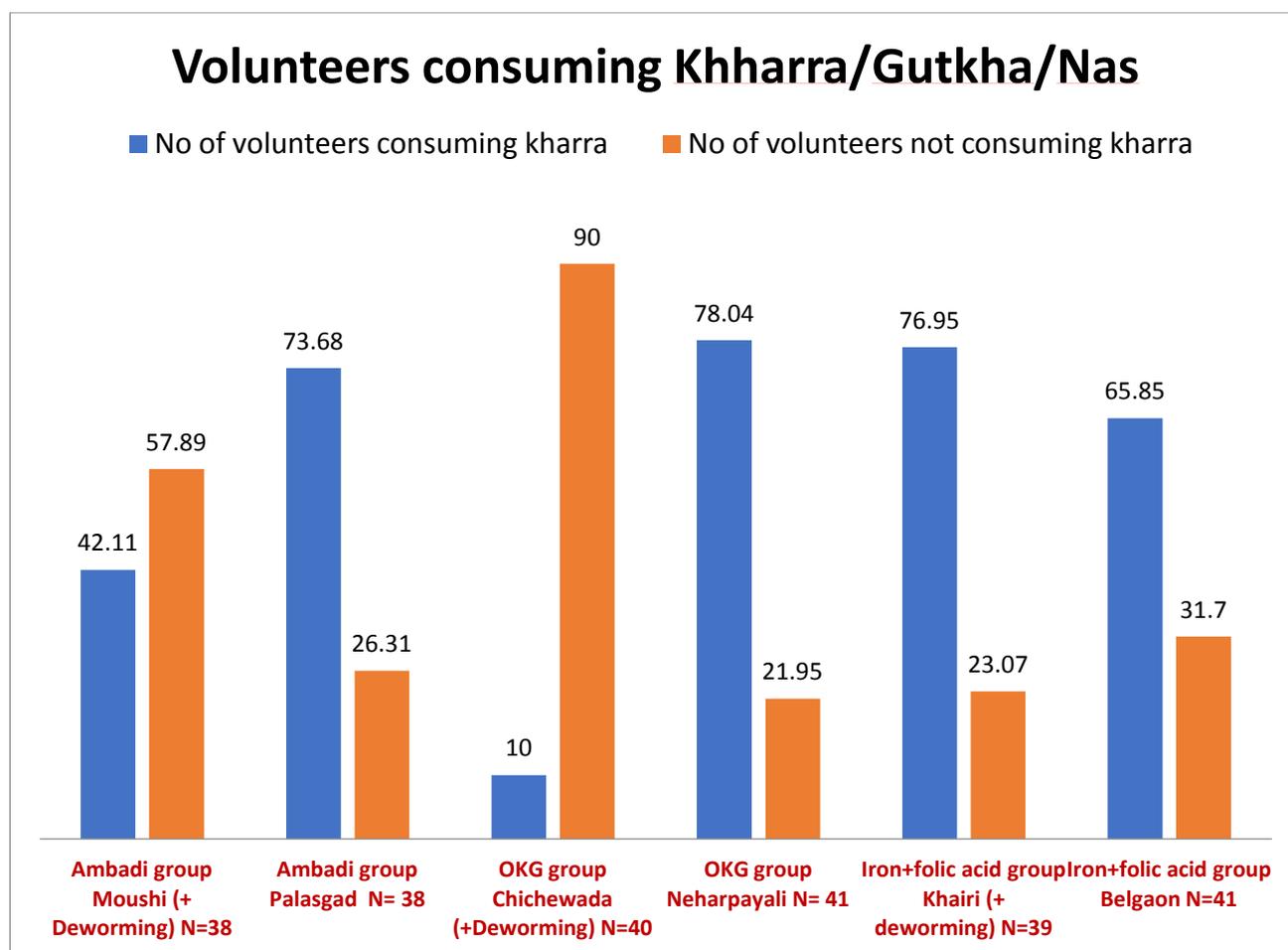


Table 9 shows that chewing Kharra/ gutkha is common habit in study participants. The percentage of Kharra consumption is highest in Neharpyali group (78.04%) while it is lowest in Chinchewada group (only 10%)

Table 10: Effect of Kharra/Gutkha/nas on Hb levels

Ave Hb g %	Moushi N=38	Palasgad N= 38	Chichewada N=40	Neharpyali N= 41	Khairi N=39	Belgaon N=41
Kharra group(Initial)	10.4	10.87	8.3	10	10	9.7
Kharra group(3 months)	10	0	0	10.7	10	9.5
Kharra group(after 1 yr.)	10.66	10.4	9.75	10.7	10.7	10.2
No Kharra group(Initial)	10.79		9.9	9.7	10.1	10.1
No Kharra group(3 months)	10.8		11.17*	11.07*	10.2	9.7
Non Kharra group (1 yr.)	11.46		11.48*	11.07*	10.8*	10.5*

Table 10 show correlation of eating Kharra/Gutkha /nas daily on Hb levels

It was observed that most of the village women have the habit of daily consuming Kharra/Gutkha/nas etc. it's a combination of betelnut, tobacco and chuna (lime). All of these inhibit absorption of iron from diet. The Hb % is found to be increased in non Kharra group by more than 1% in groups 1 and 2 as compared to group 3 which received Iron folic acid capsules as standard treatment. It is clearly indicating the inhibition of iron absorption due to Kharra contents and not showing the favourable effect of standard treatment.

Table 9 shows correlation of eating kharra/gutka /nas daily on Hb levels. It was observed that most of the village women have the habit of daily consuming kharra/gutkha/nas etc. it's a combination of betelnut, tobacco and chuna (lime). All of these inhibit absorption of iron from diet. The graph shows no of women consuming kharra as compared to number of women not consuming it. It shows clearly that from Moushi (42%) and Chichewada only 10 % women consume kharra as compared to all the rest, where it ranges from 65 to 77 %. Rise in Hb levels in non kharra group are more than Hb levels in kharra group.

Symptomatic relief

Participants were asked if they suffer from common symptoms of anemia like fatigability, paleness, breathlessness, weakness, headaches, short breath, faster heartbeats etc. and how much they spend on medical bills due to illness monthly. Almost all participants reported that they feel more energetic, good appetite, and their medical expenses were reduced drastically.

Table 11: Monthly medical expenses

Group	Initial Medical expenses in Rs	Medical expenses after 1 year
Moushi	702	307.8
Palasgad	351	Not available
Chichewada	672	125
Neharpyali	450	73.17
Khairi	933	341
Belgaon	1024	437
Average expenses in Rs	756	256.6 

During second follow up focus was on their symptoms and medical expenses to monitor their awareness about Hb and diet. The table shows significant reduction by almost 50% reported in medical bills in all groups, with the highest drop in medical expenses reported by the organic kitchen garden group participants. This is very encouraging though we could not quite achieve the objective of 2 g% rise in Hb, it shows definite symptomatic relief.

Table 12 Correlation of diet and Hb levels

Vegetables in Diet and Hb

Vegetable Types	1A Moushi	2B Palasgad	2A Chichewada	2B Neharpyali	3A Khairi	3B Belgaon
1-5	-				24.00	
6-10	15.00	13.00	23.00	7.00	21.00	10.00
11-15	11.00	13.00	17.00	7.00		28.00
16-20	-		6.00	2.00		1.00
Hb ↑	-0.26	0.32	1.46	1.25	0.11	0.09
Ave no vegetables consumed	10.00	11.00	12.00	12.00	6.00	11.00

Table 12 shows vegetables consumed routinely by participants

In Chichewada most of the women consumed a variety of vegetables, ranging from 6-20 types, and their rise in Hb is also 1.46 % which is highest, while in Khairi more number of women consumed less than 5 types of vegetables with slight rise in Hb of 0.11%.

Table 13: Cereals in Diet and Hb

Cereal Types	1A Moushi	2B Palasgad	2A Chichewada	2B Neharpyali	3A Khairi	3B Belgaon
1-5	29.00	34.00	17.00	11.00	24.00	15.00
6-10	4.00	4.00	21.00	12.00	8.00	25.00
Hb ↑	-0.26	0.32	1.46	1.25	0.11	0.09

Table 13: Average Iron content of Cereals was 4.3mg% In Chichewada and most of the women consumed a variety of cereals ranging from 6-10 types and their rise in Hb is 1.46 %

Table 14: Grains in Diet and Hb

Most of the women consumed grains like rice and wheat as their staple diet. Average iron content of grains was 0.82 to 8.45 mg % and being a staple food, all participants ate grains daily.

Grain Types	1A Moushi	2B Palasgad	2A Chichewada	2B Neharpyali	3A Khairi	3B Belgaon
2.00	36.00	38.00	27.00	9.00	27.00	40.00
3.00		1.00	12.00	7.00	10.00	
Hb ↑	-0.26	0.32	1.46	1.25	0.11	0.09

Table 15 Iron intake through daily diet

Daily Diet and iron content

Components of daily diet	Iron mg per 100 g
Green leafy vegetables	2.5 to 6.4 mg %
Legumes e.g Green peas, Lentils, Peanuts , Beans etc	1.5 to 5.1mg %
Grains e.g rice, wheat, corn, barley , jawar	0.82 to 8.45 mg %
Consumption of three varieties per meal	4.42 to 19.95mg %

Table 15 show average iron intake is not as per recommended dietary intake of 18mg per day as absorption from nonheme source like vegetables is only 5 % of intake.

Table 16-Daily Diet and iron content

Recommended Iron Intake for females 19-50 years is 18 mg daily. One complete meal of 300 g with green leafy vegetables + Cereals + Grains can provide 20 to 100 % Recommended Dietary allowance (RDA). Three such daily meals can provide 60 to 300% RDA.

Note: Only 5 % of dietary iron from vegetarian diet to 20% of dietary iron from non vegetarian diet is absorbed in healthy person.

Discussion and conclusion

❖ **Initial survey of some villagers leads us to conduct a planned study to find out causes of iron deficiency anemia and whether it can be treated by creating its correlation with diet by promoting organic kitchen gardens for nutrition.**

The common causes of iron deficiency anemia in females are iron deficient diet, blood loss due to heavy menstruation, worm infestation, malaria, tuberculosis, bacterial infections etc. Adult women in the age group of 30-50 years having regular menstruation and who were willing to participate were screened for Hb levels. They were enrolled in this study based on their Hb levels of 8-11 g % i.e. suffering from mild anemia and most of them had symptoms like weakness and fatigue, short breath, increased heart rate, dizziness etc.

The diet analysis revealed that most of them consumed seasonal vegetables, grains and cereals that provide iron content in the range of 4.42 to 19.95mg %, with average of iron content being 12.185 mg %. The recommended daily requirement in healthy adult females, in age group of 19-50 years, is 18 mg per day. Though the average content of iron looks within recommended daily intake one must remember that only 5 to 20% of elementary iron from diet is absorbed from digestive system. The daily diet was insufficient to fulfil the daily needs of iron which clearly indicated a need for improvisation in diet.

The iron required by body is in ferrous form (Fe^{2+}) and dietary iron is in ferric form i.e. Fe^{3+} . When ferric form from diet reaches to lumen of small intestine, with the help of Vitamin C ferro reductase enzyme it gets converted into ferrous form Fe^{2+} and is absorbed by intestine. It is stored into bone marrow up to 75% for formation of new haemoglobin in RBCs. However, levels of iron in blood are also monitored by another substance hepcidin which blocks transport of iron to prevent iron overload. Selection of diet rich in absorbable iron becomes essential. Similarly dietary substances rich in tannins like tea coffee, phytates, other heavy metals, calcium, tobacco, betelnut and similar substances interfere with iron absorption.

In this study various groups were compared for different parameters as shown in results.

❖ **A group was selected to create awareness about iron rich diet through developing an organic kitchen garden for nutrition that can supply good quality green leafy vegetables throughout the year. This group was also supplemented with deworming to rule out possibility of worm infestation and its interference in iron absorption. Second group was control group, without deworming but with awareness about diet and anaemia.**

Another two groups were selected as standard groups with supplementation of iron folic capsules, one with deworming and the other without deworming.

There are various herbal products in the market for treatment of anemia. Two groups were selected for supplementation of ambadi flower powder capsules, with and without deworming. There were in all six groups from six villages each consisting of 38-41 females.

The study revealed the following major factors that affect Hb levels

❖ **Awareness about diet and nutritional deficiency anaemia.**

- Diet consumed by participants contained vegetables, cereals and grains in sufficient quantities, still they suffered from nutritional deficiency anemia.
- After intervention of treatment period of three months i.e. after first follow up of Hb testing, all participants from all six groups were made aware of nutritional deficiency anemia and were encouraged to eat green leafy vegetables daily, and to grow them organically in kitchen gardens. At the time of 1st Hb testing women from all groups were made aware about Hb and that their symptoms like fatiguability, body pain, paleness of face and nails is due to anemia. If they consume more vegetables daily, their Hb can be increased. They will not need tablets. Similarly, they should drink ambadi or other sarbat (which they do) twice daily, particularly in summer season. Usually women think sarbat is for guests. Women were paying lots of money on medical treatment for these symptoms monthly.
- During second follow up after 12 months it was noted that women were more aware about their diet, particularly green vegetables grown organically in kitchen gardens and their consumption, they also consumed sarbat of ambadi as it was summer season, that awareness was reflected in symptomatic relief of symptoms of anemia and lesser medical expenses.

❖ Worm infestation

- Due to open air defecation and unhygienic environment, worm infestation is very common in Indian population. It is an established fact that it is one of the major causes for anemia as worms in intestine affect overall nutritional status. During the study one subgroup in each main group was treated initially with deworming agent albendazole. Hb levels were elevated in deworming groups as comparing to without deworming groups.

❖ Habits like Kharra that inhibit absorption of iron from diet or medication.

- It was surprising when it was observed that participants receiving iron folic acid capsules did not show expected elevation in Hb levels. When consumption of Kharra is correlated with Hb status, a clear picture is evident. Women who were not eating Kharra showed a significant increase in Hb as compared to those eating Kharra. In Chichewada 90% of women do not consume Kharra and the highest rise of Hb was observed in this group, though they did not receive any medication apart from deworming. The level of literacy was also more in this group. While in the Khairi and Belgaon group receiving iron tablets, 76 % and 65% of women respectively consumed Kharra. It clearly shows that inhibition of iron absorption is the reason for no change in Hb even after treatment.

➤ Conclusion

- **Chichewada group, where all the positive factors are combined, showed maximum elevation of Hb within three months and this was maintained when the 1 year second follow up was done.**
- Awareness of OKG and daily consumption of vegetables was more in this group.
- They received deworming tablets
- 90% of women did not consume Kharra may be because of literacy
- They have less no of deliveries as compared to all the other groups may they were more educated also.
- Though vegetables grains and cereals consumed by all these volunteers provided daily recommended iron, the habit of Kharra and worm infestation significantly decreased their iron absorption to less than 5% leading to nutritional deficiency anemia over a period of time and deterioration in overall health leading to health and financial problems.

Recommendations

Rich Iron containing Local and wild vegetables

(©Analysed by Amhi Amchya Arogyasathi)

Vegetable	Iron mg %	Vegetable	Iron mg %	Vegetable	Iron mg %
Lal math	106*	Latari bhaji	85*	Chavli Bhaji	90
Kuda Ful	34*	Moha ful	22.4*	Mungana leaves	29*
Bahava Ful	31**	Ghol bhaji	27	Aliv	19
Aratfari	26.29	Lal bhaji	56.57	Ambadi leaves	47.40*
Tarota bhaji	44.66	Kheda bhaji	23.14*	Khanda bhaji	23.14*
Legada bhaji	54.08	Ful cobí	16	Heti Shenga	10

- Awareness of daily consumption of iron rich food :
Diet should be rich in iron containing vegetables such as lal math, chavali, shevga, ambadi which are easily available throughout the year, less expensive and grown easily in kitchen gardens.
- For daily availability of fresh, cheap vegetables, the promotion of organic kitchen garden development is desirable
- At least once a year administration of albendazole or mebendazole for the whole family for prevention of worm infestation is desirable
- Use of kharra, gutkha, nas or other addictions suppress iron absorption from diet and such addiction is one of the major causes of anemia and should be avoided.