Fluoride Toxicity Manifestations in Pregnant women and Children in India and the way forward

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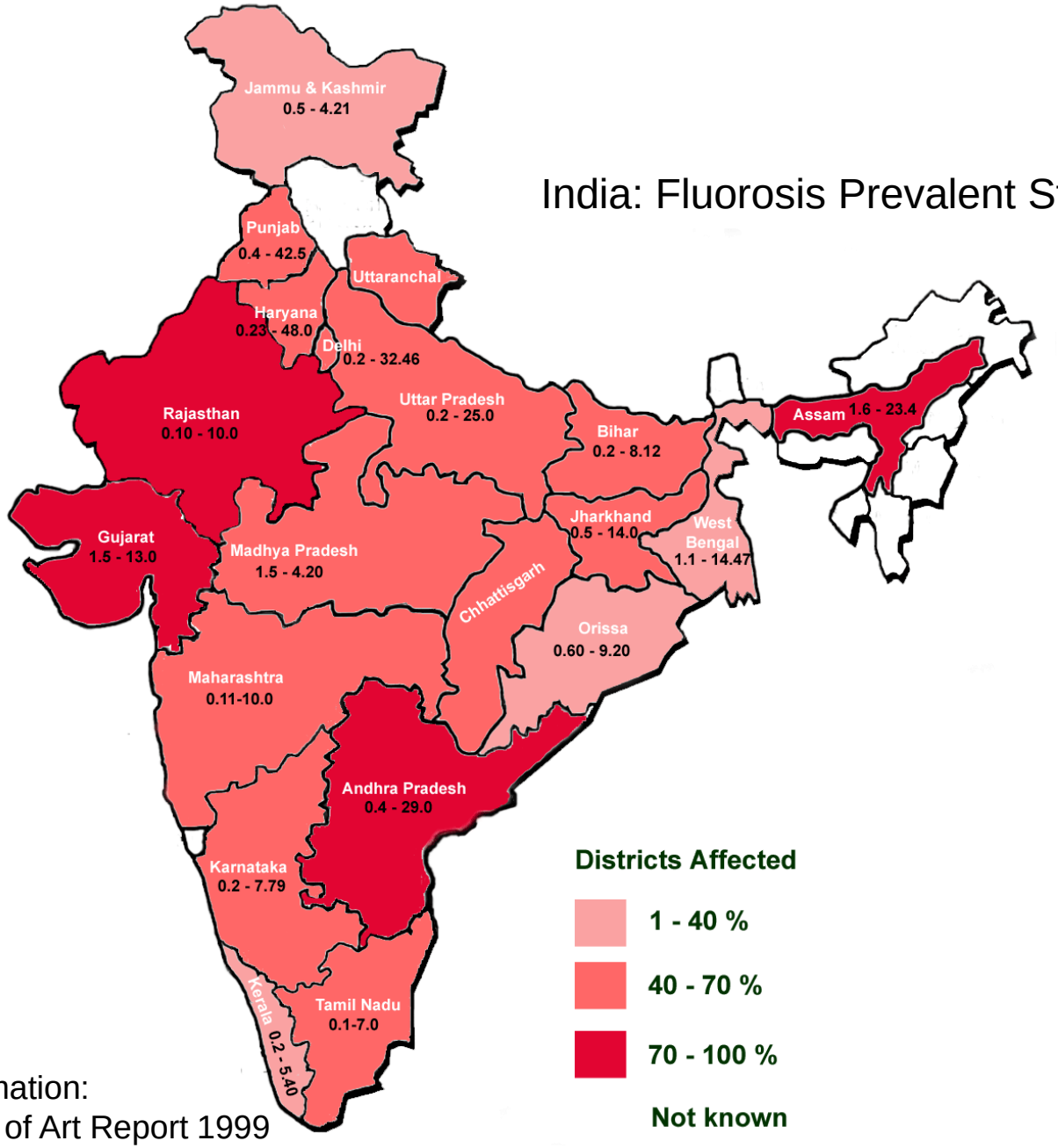
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Indo-Global Healthcare, Rohini 5-6th October 2015

India: Fluorosis Prevalent States



Source of Information:

- UNICEF State of Art Report 1999
- FR & RDF Data Bank

Black Rock Salt

- Sandha namak
- Vrat ka namak
- Lahori namak
- Pakistani namak

- **Has a tangy taste and Aroma**
- **Used extensively as spice to make the food snacks, pickles, salads, fruit juices etc.**
- **In African Nations "Magadi" has the same volcanic origin as Black Rock Salt = 157 ppm**

Markets flooded with F^- laced products



Black Rock Salt (Sandha Namak) = 157 ppm F^-

To avoid popular street food items and water lavishly smeared with black rock salt (CaF_2)







Black Rock Salt



Fluoridated Dental Products











Indian Scenario

- **Anemia in Pregnancy**
  (Ranges from 30 – 98%) in different states.
- **Low birth weight (< 2.5 kg) babies**
  (Ranges from 40 – 80%)
- **Major Public Health problem facing India**
- **India unable to achieve Millennium Development Goals 5 &4 by 2015.**

Maternal Mortality rate

Presently 139 per 100,000 births

⇩

By 2015 109 per 100,000 births

Infant Mortality rate

Presently 43 per 1000 live births

⇩

By 2015 27 per 1000 live births

India shall not achieve the Millennium Development Goals by 2015

A National Programme for Iron (100 mg) & Folic acid (500 µg) supplementation to pregnant women in India

"ON"

Since 1980 with little success

The failure is attributed to Pregnant women for non-compliance by Policy makers / Government

Have a peep into the children living in Fluoride endemic villages in India

Jharkhand * F^- = 7.0 – 14.0 mg/L



Assam *F^- = 2.5 – 12.00 mg/L



Madhya Pradesh * F^- = 2.0 – 10.3 mg/L



- Short stature (cretinism)
- Deaf mutism
- Low IQ (mental retardation)
- Knock-knee
- Bow-legs

Uttar Pradesh (Agra)



Our Protocol for Pregnant Women

(Additional steps, other than the routine investigations an Obstetrician normally carries out)



Step 1: **To Test Haemoglobin**

show the result to the pregnant women.

(Explain implications)

– Haemoglobinometer preferred (HemoQ).

Step 2: **To Test Urine Fluoride**

(Collect urine sample in plastic bottle;
30 ml only)

- test in the laboratory using Ion Meter.



Protocol (contd.)

Step 3: **To Test Drinking Water Fluoride**

If Urine Fluoride is more than 1.0 mg/l, Drinking water collected (in plastic bottle; 30ml) and test for Fluoride in the laboratory

Step 4: **Anaemic pregnant women having**

Hb < 12.0g/dl,
High Urine Fluoride > 1.0 mg/l
High Drinking water Fluoride > 1.0 mg/l

To introduce :

(1) **Diet Editing** : to withdraw consumption of Fluoride sources, including use of fluoridated toothpaste.

(1) **Diet Counselling** : to impart information on importance of consuming vegetables, fruits and dairy products Through : Breakfast / Lunch /Dinner

Step 5: **During visits to ANC, to check UFL & Hb until delivery. Maximum contact 120 days**

ANC – will continue to provide Iron (100 mg) and Folic acid (500µg) as per hospital guidelines

Monitoring Details

Date	Duration between visits	Hb (g/dl)	Urinary F^- (mg/l)	Overall Change	
				Hb (g/dl)	Urinary F^- level (mg/l)
(21/4/05) Ist Visit		7.7	1.082	+ 4.1	- 0.828
(27/6/05) 2nd Visit	67 Days	6.7	1.738		
(25/7/05) 3rd Visit	28 Days	8.1	0.467		
(22/8/05) 4th Visit	28 Days	10.2	0.903		
(12/9/05) 5th visit	28 Days	12.1	0.303		
(26/9/05) 6th Visit	17 Days	11.8	0.254		

Mother's age: 23, Literate (Monthly income US $ 250/Month)

Date of Delivery: 18/10/05 (Delivered at 39 weeks 2 days)
Time of Delivery: 12:50 A.M

Birth weight of the Male Baby: 3.28 kg

RAW DATA: Results of the Investigations of Control Population (Hospital Protocol)

S.No	Id. No.	Hb Level (g/dl)	Hb Level (g/dl)	Urinary Fluoride Level (mg/l)	Urinary Fluoride Level (mg/l)	Birth weight (kg)
		Initial	Prior to delivery	Initial	Prior to delivery	
1.	004	5.9	8.2	3.520	3.002	1.70
2.	006	7.0	6.4	3.380	✓ 6.430	1.75
3.	007	8.9	9.5	4.850	4.778	2.00
4.	032	8.7	9.8	1.553	1.759	1.75
5.	1658	8.9	✓ 10.4	1.163	2.561	IUD
6.	570	8.0	7.6	1.316	1.936	2.30
7.	508	7.0	10.2	1.761	1.230	1.35/1.40 ✓
8.	610	✓ 5.5	✓ 5.9	1.811	2.285	2.10
9.	869	✓ 9.0	9.3	2.101	2.251	2.20
10.	1203	8.7	8.1	1.507	✓ 1.030	2.19
11.	559	8.2	8.3	✓ 0.472	1.911	2.10
12.	1638	6.0	6.8	0.862	2.781	IUD
13.	1043	8.4	8.9	0.671	1.340	2.23
14.	1048	7.5	6.3	0.976	2.203	2.25 ✓
15	1001	8.0	7.7	0.669	1.187	2.10

IUD — Intrauterine Death

Normal range of fluoride level in urine is 0.1—1.0 mg/l

(15 Nos from 43%)

RAW DATA: Results of the Investigations of Sample Population (Interventions I & II Introduced)

S. No	Id. No.	Hb Level (g/dl)	Hb Level (g/dl)	Urinary F^- Level (mg/l)	Urinary F^- Level (mg/l)	Birth weight (>2.5 kg)
		Initial	Prior to delivery	Initial	Prior to delivery	
1.	016	7.7 →	11.8	1.082 →	0.254 ✓	3.28
2.	247	8.9 →	12.9 ✓	1.983 →	0.557	3.40
3.	287	8.4 →	11.2	1.262 →	0.639	3.35
4.	641	8.7 →	11.9	1.824 →	0.616	3.05
5.	162	9.0 →	11.7	2.930 →	0.840	3.40
6.	516	9.0 →	12.2	1.174 →	0.386	2.85 ✓
7.	216	7.2 →	10.5	✓ 1.060 →	0.961	3.20
8.	111	7.8 →	10.4	5.464 →	1.957 ✓	3.30
9.	480	8.5 →	10.2	1.166 →	0.834	2.85
10.	1265	8.8 →	11.3	1.837 →	0.674	3.50
11.	602	6.5 →	11.9	1.204 →	0.638	2.95
12.	426	8.5 →	10.9	✓ 6.256 →	0.946	2.87
13.	083	✓ 6.2 →	10.7	1.943 →	0.684	3.08
14.	713	9.0 →	12.8	1.166 →	0.834	3.45 ✓
15.	1893	9.0 →	11.9	2.183 →	0.801	3.08

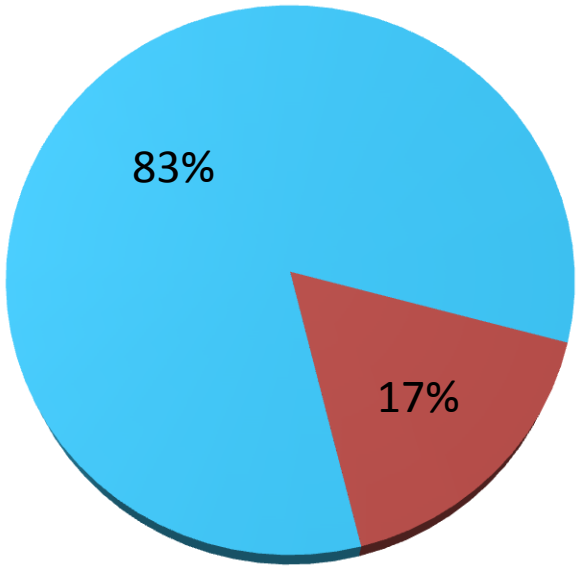
Normal range of fluoride level in urine is 0.1—1.0 mg/l

(15 Nos from 83%)

Pregnancy outcome

[Iron + Folic acid supplementation unsuccessful; due to non-absorption of nutrients ; in our protocol F^{-} is eliminated & therefore malnutrition / undernutrition corrected]

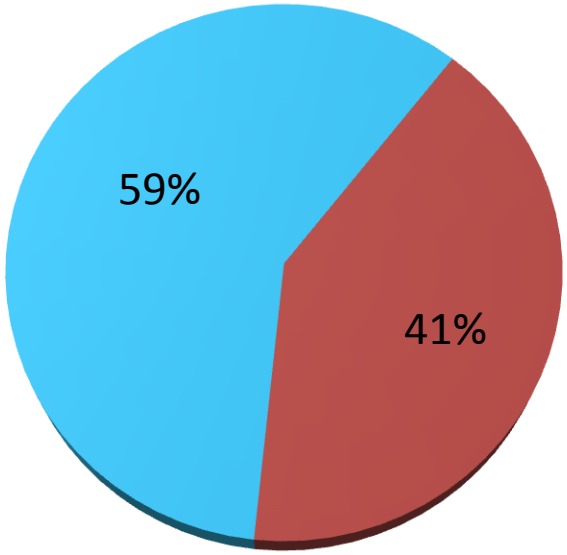
Sample



Diet Editing +
Diet Counseling + Iron & Folic acid supplementation

NBW
LBW

Control



Diet Counseling +
Iron & Folic acid supplementation

MAJOR ACHIEVEMENTS

- **Urine F^- Reduced to <1.0 mg / L =**

  1.0 - 0.254 mg/L = (65% pregnant women).

- **Healthy Mother with Hb > 12.0 – 14.0 g/dL (77% pregnant women)**

- **Healthy Baby with Birth Weight**

  > 2.5 – 3.89 Kg (82.5% babies born).

Achieved In India Only

(2005 – 2010)

Role of F^- in causing Anemia

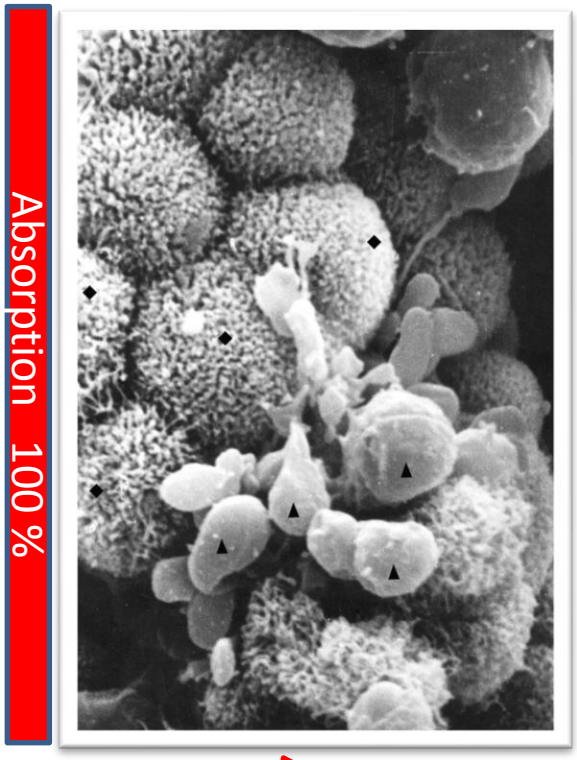
Cause	Effect
(1) Gastro Intestinal mucosa deranged	• Non-absorption of Nutrients and orally administered supplements. Hb ↓
(2) Destroys Probiotics (Good Bacteria in the Gut)	• Vitamin B_{12} production ↓ Hb ↓
(3) Destroys Red Blood Cells. Erythrocyte membrane looses calcium	• Abnormal RBC i.e. Echinocyte formed. Short-lived • Low RBC → Low Hb → Anemia
(4) Thyroid hormone production reduced	• Adequate normal stimuli for bone marrow + other Erythropoetic tissues lacking → RBC production less ↓ Hb ↓

1 -4 causes low hemoglobin biosynthesis → Anemia

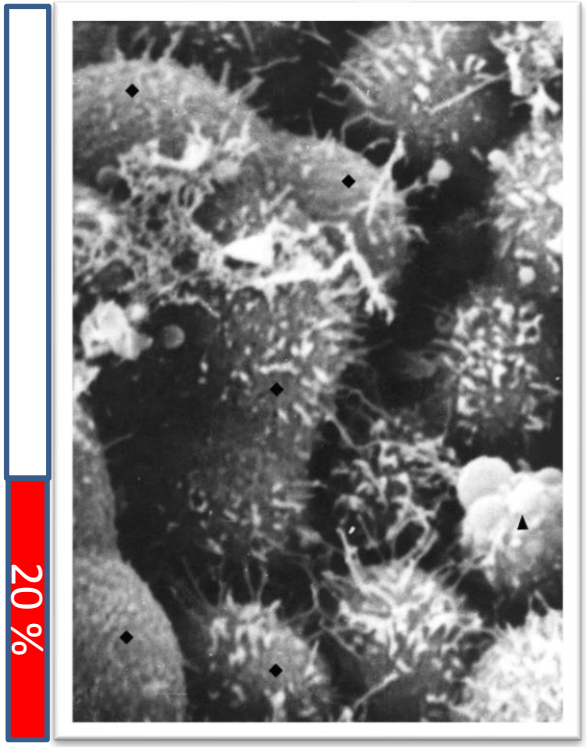
Withdrawal of Fluoride → 1-4 reversed → Hemoglobin ↑ → Anemia Rectified

Showing Scanning Electronmicrographs of the Intestinal lining (Duodenal region) of a normal volunteer and those consuming fluoride contaminated ground water

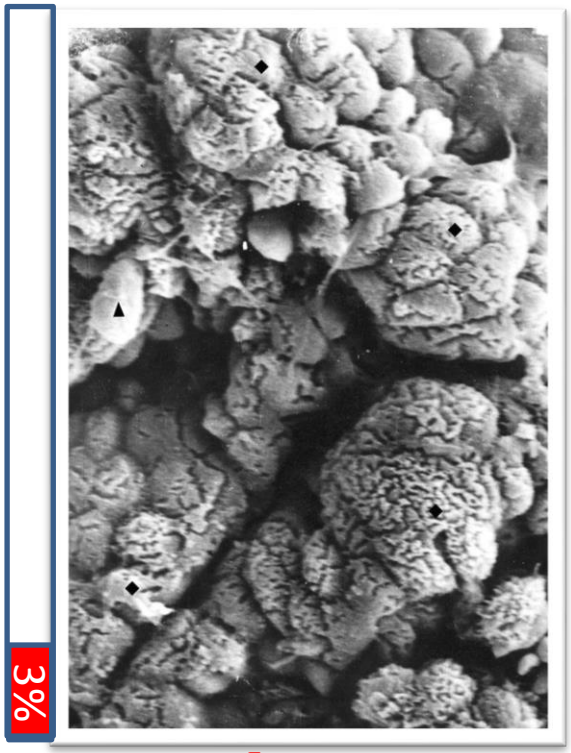
Normal Mucosa



F^- 1.2 mg/l



F^- 3.2 mg/l



Regeneration

Occurs upon withdrawal of F^-

100% Absorption of nutrients

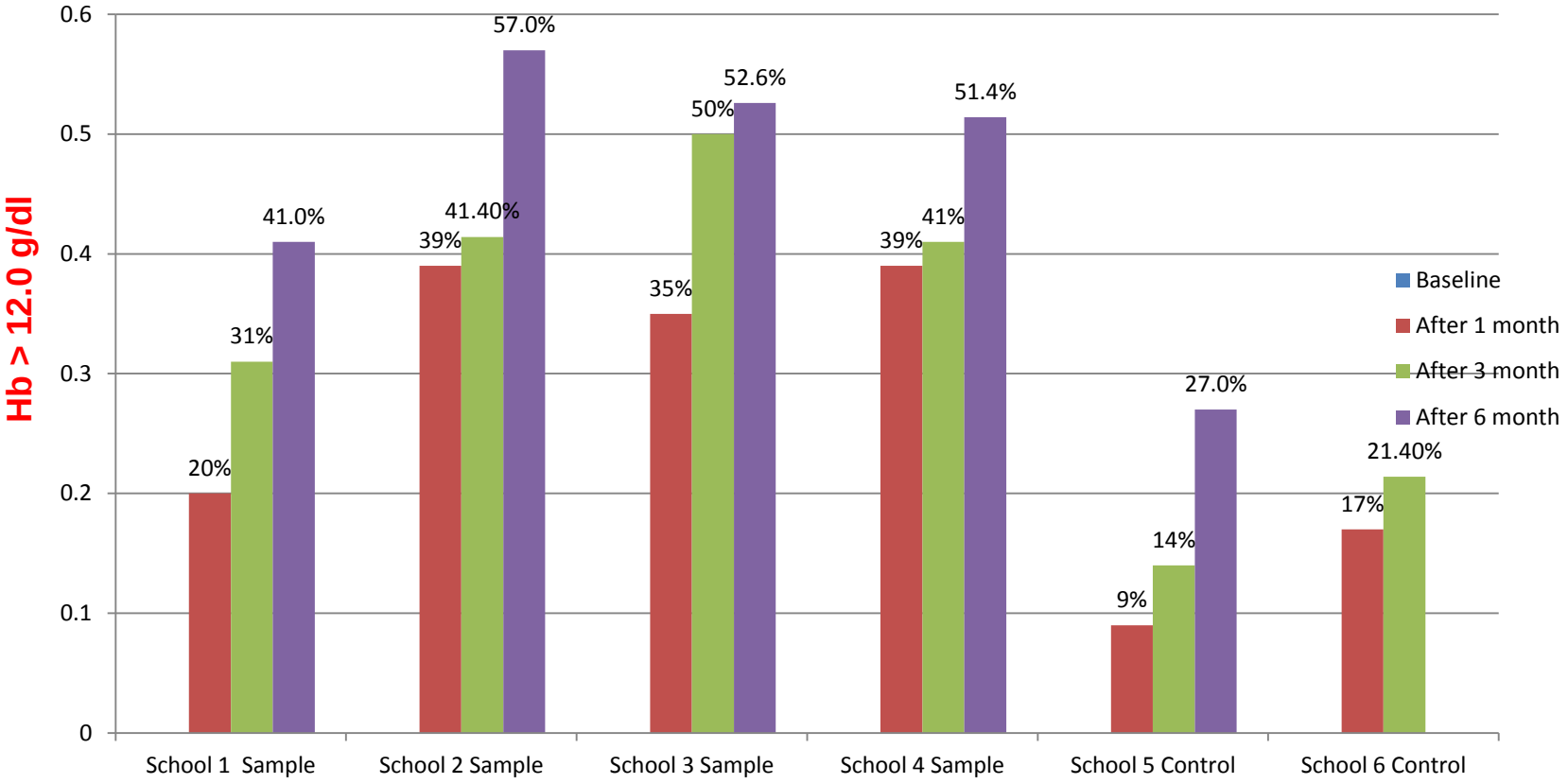
↓

Hemoglobin enhanced

Hypothesis Re-tested

Improved Hb in school children without Iron tablet (in Delhi State)

Baseline data vs after nutrition education to parents; monitored at intervals of 1, 3 and 6 months)



Our Babies

ID No. 067	
Birth weight	3.5 Kg
Date of Delivery	26/2/2008 (Delivered at 40 weeks and 2 day)
Mother's Hb	12.0 g/dl





ID No. 174	
Birth weight	3.5 Kg
Date of Delivery	8/8/2008 (Delivered at 37 weeks and 5 day)
Mother's Hb	11.6 g/dl





ID No. 372	
Birth weight	3.7 Kg
Date of Delivery	8/9/2008 (Delivered at 39 weeks and 3 day)
Mother's Hb	12.2 g/dl





Last→

Concluding Messages



FLUORIDE WALL



Say **NO** to



SUPARI & TOBACCO

BLACK TEA



Non Potable Water

Say **Yes** to













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Thank You