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Fluorosis Mitigation through Nutrition supplementation and food diversification and safe drinking water in Madhya Pradesh

Dr.Tapas Chakma, Scientist 'G'

Introduction:

Fluorosis has emerged as an important public health problem in India. It affects multiple body organs and systems. It has widespread clinical manifestations starting with damaged and discoloured teeth and potentially ending in crippling conditions. Dental fluorosis is characterised by permanent hypo-mineralisation. It is estimated that in India, over 18 million people are affected by dental fluorosis while nearly 8 million people are affected by skeletal fluorosis. In the central state of Madhya Pradesh (M. P.), one of the largest states with a population of over 72 million (Government of India, 2012), the eastern, western and southern regions are mostly affected by dental fluorosis due to the high fluoride content present in groundwater. The majority of these fluoride-affected areas are heavily inhabited with local tribal population. These tribal groups are traditionally backward in both economic and social aspects as compared to other social groups in India. Madhya Pradesh's tribal groups constitute over 20 % of the state's population. There are 46 schedule tribes in 51 districts of M.P., out of which Gonds reside in almost all the state districts with other major inhabitant tribes like Baiga, Bhil, Bhilala and Bharia.

Rationale of Selecting the Problem:

This study was initiated in 1995 in Mandla district of M.P. on the request of Chief Medical and Health Officer (CMHO), Joint Director and Collector of Mandla to investigate the mysterious disease characterized by pain and deformity in lower limbs. This mystery disease was initially reported first in Tilaipani village and then later in Hirapur village. Hence, a project was carried out to identify the disease and suggest appropriate remedial measures.

Methodology:

Door-to-door surveys were carried out by a team of researchers from Regional Medical Research Centre for Tribals (RMRCT) (now called National Institute for Research in Tribal Health), Jabalpur. Information from both villages regarding socio-cultural and demographic data was collected via personal interviews while medical officers carried out detail clinical examinations. Food consumption pattern and nutritional uptake was evaluated every 24 hr by interviewing the female population involved in cooking activities. Blood samples were collected for biochemical analysis such as alkaline Phosphatase, serum calcium and serum inorganic phosphorus. Sickle cell test determining sickle cell disease was performed to rule out sickle cell osteopathy. Drinking water samples were collected in plastic bottles for fluoride estimation.

After detailed examination and tests conducted, it was confirmed that drinking water in the above mentioned areas contained fluoride levels much higher than the permissible levels. Clinical and radiological evidence also showed that deformities were due to fluorosis complicated with multiple nutritional deficiencies.

Intervention:

Intervention consists of two components; a) Water intervention and b) Nutritional intervention

a. Water Intervention:

The main aim of water intervention is access to safe drinking water (water safety planning) devoid of any harmful compounds and toxic ions like fluoride.This was achieved by renovation of the old wells and water pipes which were the primary source of ground water contamination by fluoride. Dilution of fluoride-contaminated water with the rain water was also adopted in ashram schools (residential schools) of Dhar and Jhabua.

b. Nutritional intervention:

During the initial survey, severe deficiencies of micronutrients were observed in the diet of tribals diagnosed with Fluorosis. Hence, supplementation of calcium, vitamin C and iron in the diet was undertaken for a period of 3 to 6 months as all these three micronutrients are required for bone mineralization. Dietary intake of a locally available herb Chakoda Bhaji (Cassia Tora) belonging to the legume family, on a regular basis was recommended to the villagers as it contains all the 3 micronutrients.

Process of Intervention:

a. Water Intervention:

Since, the supply of safe drinking water is undertaken by the Public Health Engineering Department (PHED), consultations and meetings with officers of PHED, Mandla, were initiated to chalk out plans for providing fluoride-free water to the villages. Water treatment and filtration method was devised by PHED and subsequently approved with financial assistance from RGNDWM, Ministry of Rural Development, GOI.

B. Nutrition Intervention:

Therapeutic supplementation of Calcium, vitamin C and iron was undertaken by district health authorities for a period of 3 to 6 months depending upon the severity of the deficiency present, which varies from person to person. Analysis of a locally available green plant called Chakoda Bhaji by the National Institute of Nutrition revealed that its fresh green leaves had high amounts of calcium, vitamin C and iron, whereas the dry leaves were rich in calcium. The task for dissemination and propagation about the regular uptake of Chakoda Bhaji was handled by NIRTH. For this, periodical group meetings were conducted with the village women with the help of Anganwadi workers and Female Health Workers for a period of three years to recommend the increase in its consumption from once in a week to atleast five times in a week. Myths such as occurrence of diarrhoea due to consumption of this plant were discredited.These women were also asked to change the cooking process by discontinuing the boiling of leaves and subsequent disposal of the boiled water. It was noted that daily uptake of 12-20g of dry Chakoda leaves or 80-100 g of fresh leaves could fulfil the daily dietary calcium requirement of 400 mg/day,while considering other sources of calcium available in the normal diet.

Evaluation of Impact of Intervention:

After 5 years of intervention, evaluation studies revealed that there was a reduction in the prevalence (<20 years) of Genuvalgum from 51% at base line to 2.6% after intervention. Similarly, there was also a slight reduction in the prevalence of dental fluorosis from 74% to 70 % in the same age group. This reduction is not true reduction as this is due to a change of cohort. Reduction in excretion of fluoride in urine was also observed where in percentage of children who were excreting more than 2ppm fluoride in urine reduced from 41 % to 10% after intervention.

Similar intervention was carried out in Seoni district of Madhya Pradesh with larger population (>5000). After 2 years of intervention there has been significant reduction in the prevalence of Genuvalgum (33%), skeletal fluorosis (34%), non-skeletal fluorosis (66%) and other symptoms (80%). The impact of intervention was also evaluated case wise. It is worthwhile to note that cases with mild fluorosis showed complete reversal of bone deformity, whereas partial reversal was observed in severe cases after intervention. This correction in the deformity was also detected radiologically.

Scale up of the Study:

The same intervention model was adopted by UNICEF Bhopal and implemented in Dhar and Jhabua districts through two different NGO's with technical guidance from NIRTH Jabalpur. After 1 year of intervention, independent evaluation revealed about 30% reduction in skeletal and non-skeletal fluorosis. (Detail report is available at UNICEF Bhopal office). INREM Foundation (TATA Trust) also implemented the same module in Jhabua and reported similar results. Their work in Jhabua is still being carried out.

The concept of nutrition supplementation is adopted by the National Programme for Prevention and Control of Fluorosis. However, the programme needs to be strengthened.

Limitation:

Fluorosis mitigation requires a multi-disciplinary approach. Initial therapeutic supplementation of micronutrients requires intervention from the Health Department. Supply of safe drinking water requires intervention from PHED. Nutrition supplementation through dietary modification will require intervention from Women and Child welfare groups. All three departments need to work in coordination. There is a lack of knowledge about fluorosis in all sections of the society, including the medical fraternity. There is an urgent need to fill this void, propagate and educate people about fluorosis and its harmful effects as well as focus on its prevention. Cassia tora (Chakoda Bhaji) leaves are available only during monsoon and for one to two months in the post-monsoon period. Hence, supplementation during summer is largely dependent on the storage done during monsoon. Moreover, it is not available commercially and hence cannot be purchased from market.

A fluorosis diagnostic facility (fluoride estimation in urine or blood) is not available in most of the district hospitals or even in medical colleges. Hence, confirmation and diagnosis pose a big challenge for the patient as well as for the physicians.

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- Chaturvedi N, Bharti PK, Tiwari A , Singh N. Strategies and recent development of transmission-blocking vaccines against Plasmodium falciparum. Indian Journal of Medical Research. Manuscript no. (2015-0634(574-15)(Accepted 2016).

Conferences/Meetings attended

Dr. Neeru Singh, Director

- Meeting at NRHM Bhopal and delivered presentation on screening of sickle cell anaemia on 13th January 2016.
- Third review meeting for the progress of establishment of MRHRU on 19th January 2016, at Department of Health Research, New Delhi.
- Vector Science Forum meeting on 2ndFebruary 2016 at ICMR HQ, New Delhi.
- Meeting on Malaria Elimination on 10th and11th February 2016 at NVBDCP, New Delhi. Presentation was made on “Malaria in Tribal and other special population groups for malaria elimination”.
- Expert consultation on adoption and operationalization of WHO Global Policies, Guidance and Strategies in Malaria in SEAR and the Greater Mekong sub-region on 15th and16th February 2016 at WHO SEARO.
- DNDI clinical expert meeting on Lymhatic Filariasis on 22nd and 23rd February 2016 at ICMR HQ, New Delhi.
- Meeting with Secretary, Ministry of Tribal Affairs, Govt. of India on 24th February 2016 at MOTA, New Delhi.
- Expert Group meeting regarding field station at Keylong in Lahaul&Spiti area of Himachal Pradesh on 2nd March 2016 at ICMR HQ, New Delhi.
- The fourth meeting of the collaborative project entitled “Molecular Epidemiology of Malaria in India & Qatar with an Emphasis on Parasite Diversity, Drug Resistance and Immune Response” from 22nd to 24th March, 2016 at Weill Cornell Medical College, Qatar.





- A meeting of Expert Committee on Tribal Health was held on 5th and 6thApril, 2016 at NHSRC, NIHFW Campus, New Delhi under the chairmanship of Dr. Abhay Bang, Director, SEARCH, Gadchiroli, Maharashtra and Shri Manoj Jhalani, Joint Secretary (Policy), Ministry of Health & Family Welfare, Govt. of India.



- A Stakeholders consultation meeting on Tribal Health was held on 11th April, 2016 at ICMR, Hqrts., New Delhi under the chairmanship of Dr. Soumya Swaminathan, Secretary, DHR & DG, ICMR and Dr. Shyam S. Agarwal, Secretary, Ministry of Tribal Affairs, Govt. of India.



- Meeting on the occasion of World Malaria Day, 25th April 2016 in which a Memorandum of Understanding (MOU) was signed between ICMR and Sun Pharmaceuticals. An Announcement was made to demonstrate Malaria Elimination project in Mandla district, Madhya Pradesh in presence of Shri J. P. Nadda, Hon'ble Union Minister of Health & Family Welfare, Govt. of India, Shri Jual Oram, Hon'ble Union Minister for Tribal Affairs, Govt. of India, Dr. Narottam Mishra, Hon'ble Minister for Health and Family Welfare, Ayush; Bhopal Gas Rehabilitation; Medical Education and Legislative Affairs, Govt of Madhya Pradesh and dignitaries representing government organizations, NGOs and National and International bodies such as WHO, Bill and Melinda Gates Foundation etc.









- Scientific Advisory Group (SAG) meeting on 26th - 27th April 2016 at ICMR Delhi.
- Director's meeting on 27th April 2016 at ICMR Delhi.

Dr. V. G. Rao, Scientist G

- 70th National Conference of Tuberculosis and Chest Diseases (NATCON 2015) at Lucknow during 20th-21stFebruary 2016.
- Workshop on Guidance for Nutritional Support in TB patients in India at Yenepoya Medical College, Mangalore on 24th and 25thFebruary, 2016.

Dr.Tapas Chakma, Scientist G

- Meeting for Review of MRHRU at New Delhi on 19th January 2016.
- Meeting with MD, CGMSC at Raipur on 30th January 2016 regarding construction of MRHRU.

Dr. A.K.Mishra, Scientist E

- Attended a meeting with CMHO and DMO Dindori on 24thFebruary regarding the current status of malaria in Dindori district.

Dr. Kalyan B. Saha, Scientist E

- Visited Mitra-Christian hospital, Bissam, Cuttack, Raygada, Odisha on 12- 17 January 2016 to evaluate the best practices to control malaria among children under 5.
- Visited SEARCH, Gadchiroli, Maharastra on 6th-11th March 2016 regarding formulation of malaria control strategy and visited tribal villages to have first-hand idea of terrain housing pattern and vector composition of the area.
- Delivered a lecture on Research methodology to Research scholars on 13th March 2016 at the ICSSR sponsored workshop by Department of Political Sciences, RDVV, Jabalpur.
- Delivered a special lecture on 29th March 2016, on establishing a communication strategy to generate awareness on malaria in Baiga dominated area in Dindori district of Madhya Pradesh in National Seminar on Horizon of Tribal Development, organized by Department of Anthropology, Dr. Hari Singh Gaur University, Sagar, Madhya Pradesh.



- Co-chaired a session of Socio-cultural, Economic & Environmental aspects on Tribal Development in National Seminar on Horizon of Tribal Development, organized by Department of Anthropology, Dr. Hari Singh Gaur University, Sagar, Madhya Pradesh.

Dr. GyanChand, Scientist E

- Visited SEARCH, Gadchiroli, Maharastra on 6th-11th March 2016 regarding formulation of malaria control strategy and visited tribal villages to have first-hand idea of terrain housing pattern and vector composition of the area.

Dr. Jyothi T. Bhatt, Scientist E

- Presented paper titled 'Efficacy of Gene XPert MTB/RIF in diagnosing tuberculosis from extrapulmonary specimens' in 'National Conference on Tuberculosis and Chest Diseases' held during 20th& 21st February 2016 at KGMC, Lucknow.

Dr. S. Rajasubramaniam, Scientist E

- Participated in Stakeholders consultation meeting on Tribal Health on 11th April, 2016 at ICMR, New Delhi under the chairmanship of Dr. Soumya Swaminathan, Secretary, DHR & DG, ICMR and Dr. Shyam S. Agarwal, Secretary, Ministry of Tribal Affairs, Govt. of India.

Dr. Praveen K.Bharti, Scientist D

- Attended the meeting of collaborative project entitled “Molecular Epidemiology of Malaria in India and Qatar with an emphasis on parasite diversity, drug resistance and immune response” from 22nd- 24thMarch 2016 at Weill Cornell Medical College, Qatar Foundation, Doha, Qatar.



Dr. Praddep V. Barde, Scientist D

- Attended the meeting of vector science forum at ICMR Headquarter on 2nd Feb 2016.

Dr. Surendra Kumar, Scientist D

- Attended Public Information Campaign (PIC) at Panna and Sehore districts on 27th-31st December 2015 and 23rd-27th February 2016 and delivered speech in the camp.

Workshops/Trainings/Meeting conducted

- Two training workshops were conducted by Dr. Pradeep V. Barde, Scientist D on Dengue and Chikungunya ELISA diagnosis for pathologists and technicians of state government in December 2015 at NIRTH Jabalpur. A total of about 34 participants attended the workshop.
- NIRTH, Jabalpur has established a field station at Keylong, Lahaul & Spiti districts of Himachal Pradesh for health research. In this connection, the recruited project staff of the field station Ms. Manjeeta Negi, Lab Technician and Mr. Ashwani Senpa, Data Entry Operator were trained at NIRTH, Jabalpur in the month of January 2016.





- Expert group meeting on establishment of Infectious Disease Laboratory at NIRTH, Jabalpur was organized on 17th February, 2016.Experts reviewed the designs of lab, location site and gave their valuable suggestions.
- The 28th Scientific Advisory Committee of NIRTH, Jabalpur was organized on 18th and 19th February 2016 under the chairmanship of Lt. Gen. D. Raghunath (Retd.). Dr. P.L. Joshi, Former Director, NVBDCP, New Delhi, Dr. D.T. Mourya, Director, NIV, Pune, Dr. Roshan Colah, Former Scientist 'F', NIIH, Mumbai, Dr. Sher Singh Kashyotia, Dy. Director, NVBDCP, New Delhi, Dr. Manju Rahi, Scientist 'E', Division of ECD, ICMR, New Delhi, Dr. S.C. Dubey, Former Joint Director, HSADL, Bhopal, Dr. P.B. Sengupta, Prof.& Head, Dept of Sociology & Social Work Post Graduate Studies and Research, RDVV Jabalpur and Dr. Pawan Ghanghoriya, Asst. Professor, Dept of Pediatrics, NSCB Medical College Jabalpur were subject experts. Scientists of the institute presented the proposed new, ongoing and completed research projects.





- Training on HIV testing was conducted at NIRTH Jabalpur for laboratory technicians of ICTC in 2 batches during 7th to 11th March and 14th to 18th March 2016. A total of 45 LTs were trained.

Events



- The Institute celebrated 68th Republic day on 26th January 2016 with great enthusiasm. Dr Neeru Singh, Director of the institute hoisted the National Flag at NIRTH main building.



- The committee constituted by the Secretary, DHR and Director General, ICMR New Delhi for review of categorization of ICMR library at NIRTH, Jabalpur. The committee comprises of Dr. V. K. Shrivastava (Chairman), Scientist G and Head, Division of Publication and Information, ICMR, Shri Kumar Sanjay, Chief Librarian-cum-Documentation Office, NITI Aayog Library, New Delhi and Shri Amiruddin, Section Officer, ICMR, New Delhi evaluated the Library facility at NIRTH during 24th 25th February, 2016.





- National Science day was celebrated at NIRTH, Jabalpur on 28th-29th February, 2016. The student of local Colleges, University visited the institute on 29th February 2016. Scientists of the Institute had interactive session with them. The research scholars working in the institute displayed the posters and explained those to the visiting students. The students also visited the laboratories and had first-hand observation on various modern equipments and techniques used for biomedical research.







- The 33rd Foundation Day of NIRTH, Jabalpur was celebrated on 1st March 2016.The Chief Guest, Prof. Kapil Deo Mishra, Vice-Chancellor, Rani Durgavati Vishwavidyalaya, Jabalpur, expressed the good work done by the institute for the welfare of the tribal people, which was hitherto less touched. He emphasized on education, research, extension and training being the four pillars of development. Prof. Vijay K. Chaudhary of Dept. of Biochemistry, University of Delhi gave the foundation day lecture "Magic of Antibodies".

Award



- Dr. V.G.Rao, Scientist G of this institute received ICMR award for Biomedical Research conducted in under-developed areas for the year 2012 at the hands of Hon. Union Health Minister, Shri J.P.Nadda, during the award ceremony held in the auditorium, All India Institute of Medical Sciences, New Delhi on 19th January, 2016.

Promotion/Transfer/Superannuation

- Dr. T. Chakma Promoted to Scientist G under ICMR assessment scheme.
- Dr. S. Rajasubramaniam promoted as Scientist E.
- Dr. Rajiv Yadav promoted as Scientist D.
- Dr. Vidhan Jain promoted as Scientist C.
- Dr. M.M. Shukla, Scientist F and Dr. A.K. Mishra, Scientist E joined NIRTH, Jabalpur on transfer from NIMR.
- Mr. M.K.Jain, Technician B, Mr.Shanker Lal Jha, Attendant Services and Mr. Kamta Prasad Jaiswal, Attendant Services joined NIRTH, Jabalpur on transfer from NIMR.
- Mr. KV.K. Rao, retired on 29th February 2016 from the post of ALIO after 30 years of his successful service period.
- Dr. J. Roy retired on 30th April 2016 from the post of Technical Officer-A after 29 years of his successful service period.