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Research Paper

THERAPEUTIC EFFICACY OF MEDICINAL PLANTS TO MITIGATE FLUOROSIS

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Abstract

Fluoride is toxic to all the system and causes oxidative stress in various tissues. When fluoride is ingested, approximately 93% is absorbed into the bloodstream. A good part of the material is excreted, but the rest is deposited in the bones and teeth, and is capable of causing a crippling skeletal fluorosis, non- skeletal fluorosis and dental fluorosis. In the present study Amla (*Emblica officinalis*), lemon (*Citrus lemon*) and Tomato (*Lycopersicum esculentum*) were given to fluorotic subjects for 6 months. The blood and urine sample were collected from non-fluorotic and fluorotic subjects before and after the respective treatment. The sample were analysed for fluoride concentration using Ion-Selective Electrode Method using ORION Model 94-09 Ion meter. Amla, lemon and tomato are good source of vitamin C. The serum fluoride level was significantly ($p<0.001$) high in fluorosed subjects and the same was declined significantly ($p<0.001$) following *E. officinalis* and *Emblica officinalis* + *Citrus limon* + *Lycopersicon esculentum* for 180 days as compared to 0 day treatment. On the other hand urine fluoride level was increased significantly ($p<0.001$) after ingestion of *E. officinalis* and *Emblica officinalis* + *Citrus limon* + *Lycopersicon esculentum* for 180 days.Vitamin C is an excellent source of electrons, therefore, it can donate electron to free radicals formed due to fluoride toxicity, and quench their reactivity and mitigate the harmful effects of fluoride water by increasing its urinary excretion and decreasing its retention in the body.

Key words: Fluorosis, Antioxidant, Free radicals, Medicinal plants, *Emblica officinalis*, *Citrus lemon*, *Lycopersicum esculentum.*

INTRODUCTION

Fluoride is a serious health hazard across several nations, and chronic intake of fluoride deranges the carbohydrate, lipid and antioxidant metabolism in general. It is well established that ingestion of higher amounts of fluoride causes metabolic disorders, by interacting with various cellular processes such as gene expression, cell cycle,

respiration, metabolism, ion transport, secretion, endocytosis, apoptosis, necrosis, oxidative stress, and disrupts the antioxidant defence system in the body.

Fluoride in the groundwater is also a long standing and worldwide problem.The crippling and painful disease caused by excess ingestion of fluoride is termed as **"Fluorosis"**. Fluoride is often present in the environment and enters the body through edibles such as toothpastes, oral rinses, drugs, cosmetics and most swiftly through drinking water. Small and regulated amount of fluoride in drinking water lead to definite and substantial growth of teeth and bones. High Concentration of fluoride interrupts with mineralization process of bones as well as teeth and alters the normal functioning of various soft tissue viz. liver, kidney, adrenal gland, lungs, heart, brain and gastro-intestinal system.

Medicinal plants can play important role in amelioration of fluoride toxicity. Nutritional interventions like high intake of vitamin C, vitamin D and calcium helps to reduce the problem of fluorosis. The medicinal plants like Amla (*Emblica officinalis*), lemon (*Citrus lemon*) and Tomato (*Lycopersicon esculentum*) are good source of antioxidants and play an important role in fluorosed subjects to ameliorate the harmful effects of fluoride water.

MATERIALS AND METHODS

Kherla Khurd and urban Dausa of Dausa district were selected as study area on the ground of fluoride content in potable water. The fluoride content in potable water was 1.00 ppm in urban area of Dausa districts, whereas it was found to be higher i.e. 12.5 ppm F in Kherla khurd village of Dausa district.

The human health survey along with trained medical staff was carried out in each selected village of study area and fluorosed subjects were identified (Teotia et al. 1985, Susheela, 2001). At least twenty adult persons were identified for each treatment group. The age of the subjects was ranging between 30-66 years. The *Emblica officinalis, Citrus limon and Lycopersicon esculentum* were used as test materials in fluorosed subjects.

Group I was untreated control subjects where fluoride level was 1 ppm in drinking water. Group II, subjects were treated with *Emblica officinalis* (Amla murabba, 80gm/day/subject) along with fluoride water (12.5 ppm F) for 180 days and Group III was given *Emblica officinalis* (Amla murabba 20 gm) + *Citrus limon* (30 gm) *Lycopersicon esculentum* (100gm) per day per subject for 180 days along with 12.5 ppm F contaminated drinking water.

The blood and urine samples were collected under the surveillance of medical staff from each group before and after completion of treatment. The collected samples were brought to the laboratory and analysed for serum and urine fluoride content.

Serum/ urine fluoride was determined by Ion-Selective Electrode Method using ORION Model 94-09 Ion meter.

RESULTS

The results revealed that the level of serum fluoride (Fig. 1) was highly significantly ($p<0.001$) amplified in fluorosed subjects residing in fluoride endemic area as compare to control group. The fluorosed subjects treated with *E. officinalis* for 180 days resulted in highly significant ($p<0.001$) decrease in serum fluoride level as compared to 0 days treatment. Further , the fluorosed subjects treated with *Emblica officinalis, Citrus limon and Lycopersicon esculentum* (Fig. 1) for 180 days also resulted in decreased serum fluoride as compare to 0 day treatment indicating beneficial role of test substances to

fluorosed subjects. The data indicate that *E. officinalis* showed better results in decreasing serum fluoride than combined treatment.

The fluoride concentration in urine (Fig. 2) was increased highly significantly ($p<0.001$) after 180 days in fluorosed subjects as compared to control group with *E. officinalis* treatment The fluorosed subjects treated with *E.officinalis+ C. limon +L.esculentum* (Fig. 2) for 180 days resulted in increased urine fluoride concentration as compared to 0 day treatment but low in comparison to Group II.

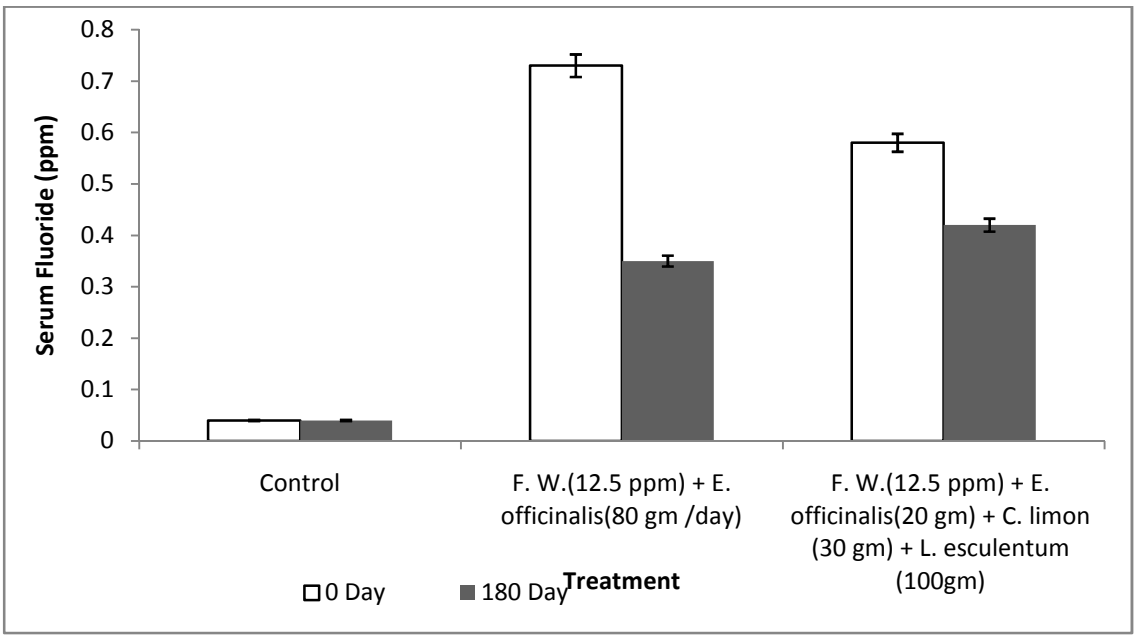

Fig. 1: Effect of test substance on Serum Fluoride (ppm)

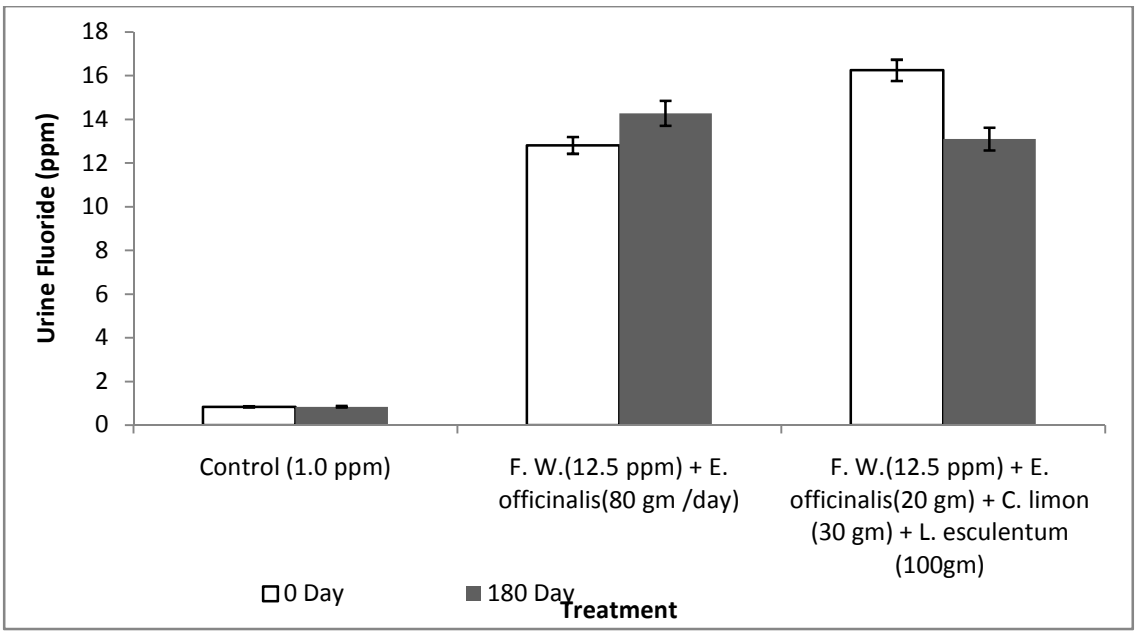

Fig.2: Effect of test substance on Urine Fluoride (ppm)

DISCUSSION

In the present study the serum fluoride content was significantly high in fluorosed subjects of endemic area. **Chinoy and Patel (1996)** found an enhancement in the levels of fluoride in the serum. The retained fluoride in the serum, thus would affect the general body metabolism probably by altering soft tissue functions. **Kurland *et al.* (2006)** also observed increased serum fluoride levels in 52-year-old man exposed to high fluoride in drinking water. The highly increase serum fluoride concentration has been reported by **Sharma and Sharma (2006)** in subjects of fluoride endemic area of Dausa district, Rajasthan, India.

Free radicals are highly reactive species that have an unpaired electron causing cellular damage. However supplementation of *E.officinalis, E.officinalis+ C. limon +L.esculentum* to fluorosed subjects for 180 days showed highly significant recovery in serum fluoride concentration.

Urinary fluoride is regarded as the best sign of exposure to fluoride compounds and usually it correlates with the level of fluoride in drinking water. According to **Czarnowski and Krechniak (2002)**, and **Singh *et al.* (2007)** the higher fluoride levels in the urine of children may be associated with higher fluoride levels in drinking water. Usually adults show significantly high fluoride in urine as compared to children, which may be due to long time exposure of fluoride. The increased urine fluoride level in children of fluoride endemic area has been reported by **Sharma *et al.* (2007).**

After the treatment of *E.officinalis,*for 180 days the urine fluoride level increased highly significantly as compared to *E.officinalis, C. limon and L. Esculentum* (significantly) used in combination to fluorotic subjects for 180 days. As we observed from the figure 1 and 2 as the serum fluoride level decreaseses the urinary fluoride excreation increases revealing reversal of toxic substance through natural fruits and thus playing beneficial role in removing toxic impact of fluoride in fluorosed subjects.

Vitamin C act as an antioxidant and its primary role is to neutralize free radicals. Since ascorbic acid is water soluble, it can work both inside and outside of the cell to combat free radical damage. Free radical will seek out an electron to regain their stability.

Nutritional interventions like intake of vitamin C, vitamin D and calcium can help to reduce the problem of fluorosis. The medicinal plants like Amla *(Emblica officinalis)*, Lemon *(Citrus limon)* and Tomato *(Lycopersicum esculentum)* are good source of antioxidants and play an important role in fluorosed subjects to ameliorate the harmful effects of fluoride water. *E. officinalis* has the ability to stimulate our natural antioxidant enzyme systems including catalase, superoxide dismutase and glutathione peroxidase. C. Limon is also rich in vitamin C, which strengthens the immune system and acting as an antioxidant, protects cells from radical damage. *L. esculentum* contain not only vitamin C but calcium as well.

CONCLUSION

The data revealed that the people residing in fluoride endemic area were suffering from various grades of dental fluorosis, skeletal fluorosis and non-skeletal fluorosis. However feeding of Amla *(Emblica officinalis)*, Lemon *(Citrus limon)*, Tomato *(Lycopersicum esculentum)* to fluorosed subjects along with fluoride water were significantly effective in mitigating fluorosis, through antioxidant properties of fruits. *E. officinalis* supplementation to fluorosed persons was found to be more beneficial than *C. limon, L. esculentum* which may be attributed to the presence of high amount of ascorbic acid in amla fruit. The dried powder increases its urinary excretion and decreasing fluoride

retention in the body. Thus medicinal plants can play important role in amelioration of fluoride poisoning.

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REFERENCES

1. **Agha, F.E., El-Badry, M.O., Hassan, D.A.A. and Elraouf, A.Abd. (2012):** Role of vitamin E in combination with methionine and L-carnosine against sodium fluoride-induced haematological, biochemical, DNA damage, histological and immunohistochemical changes in pancreas of albino rats. *Life Sci. J.*; 9 (2): 1260-1275.
2. **Chaudhary, S., Singh, P.K., Gupta, A.K. and Singh, A.P. (2010):** combined effect of *Tamarindus indica* and *Emblica officinalis* on enzyme profile and lipid profile after fluoride intoxicantion in albino rats. *J Ecophysiol occup health*; 10: 77-83.
3. **Chinoy, N.J. and Patel, D. (1996):** Amelioration role of amino acids on fluoride induced alterations in uterine carbohydrate metabolism in mice. *Fluoride*; 29(4): 217-226.
4. **Czarnowski, W. and Krechiak, J. (2002):** Urinary flurode of school children in Gdansk. *Fluoride*; 35(4): 239-243.
5. **Dey, S., Swarup, D., Saxena, A. and Dan, A. (2011):** in vivo efficacy of tamarind (Tamarindus *indica*) fruit extract on experimental fluoride exposure in rats. *Res. in Vet. Sci.;* 91: 422-425.
6. **Ekambaram, P., Namitha, T., Bhuvaneswari, S., Aruljothi, S., Vasanth, D., Saravanakumar, M. (2010):** Therapeutic efficacy of *Tamarindus Indica (L)* to protect against fluoride- induced oxidative stress in the liver of female rats. J. Fluoride; 43(2): 134-140.
7. **Gupta, A.R., Dey, S., Swarup, D. and Saini, M. (2013):** Effects of excessive fluoride ingestion on collagen protein and expression on type I collagen gene in skeletal muscles of rats. *Fluoride;* 46: 149-155.
8. **Gupta, A.R., Dey, S., Swarup, D., Saini, M., Saxena, A. and Dan, A. (2013):** Ameliorative effect of *Tamarindus indica L.* on biochemical parameters of serum and urine in cattle from fluoride endemic area. *Veterinarski Arhiv;* 83: 487-496.
9. **Khan K.H (2009):** Roles of *Emblica officinalis* in medicine- a review. *Bot Res Int.*; 2(4): 218-228.
10. **Khan, A.M., Dubey, N., Raina, R., Singh, G. and Beigh, S.A. (2013):** Toxic effects of deltamethrin and fluoride on haematological parameters in rats. *Fluoride*; 46(1): 34-38.
11. **Kurland, E.S., Schulman, R.C., Joseph, E.Z., William, R.R., David, W.D. and Michael, P.W. (2006):** Recovery from skeletal fluorosis (an Enigmatic, American case). *J. of Bone and Mineral Research*; 22(1), doi: 10.1359/JBMR.060912.
12. **Liang, Z., Niu, R., Wang, J., Wang, H., Sun, Z. and Wang, J. (2012):** Ameliorative effect of protein and calcium on fluoride-induced hepatotoxicity in rabbits. *African J. of Biotech.;* 11: 13801-13808.
13. **Nabavi, S.F., Moghaddam, A.H., Eslami, S. and Nabavi S.M. (2012a):** Protective Effects of Cucumin against Sodium Fluoride-Induced Toxicity in Rat Kidneys. *Biol. Trace Ele. Res.;* 145: 369-374.

14. **Naresh, K., Sushma, S., Manjeet, S., Beena, Kumar, G.M. and Sakshi (2011):** Effects of sodium fluoride on some of the haematological parameters of male rabbits. *J. of Adv. Res. in Biol. Sci.;* 3(1): 58-60.
15. **Ravichandran, B., Chattopadhyay, S., Gangopadhyay, P.K. and Saiyed, H.N. (2012):** Evaluation of haematological changes in population exposed to fluoride. *Toxicol. and Environ. Chem.*; 94(10): 2052-2056.
16. **Rupal, A.V. and Narasimhacharya A.V.R.L. (2012):** Alleviatory effects of *Emblica Officinalis G.* As a food supplement in fluoride induced hyperlipemia and oxidative stress. *Int. J. pharma pharma sci;* 4: 404-407.
17. **Sharma P.K. and sharma J.D. (2006):** Amelioration of fluoride toxicity through *Emblica officinalis* in subjects residing in fluoride endemic area of Dausa district. *International conference on toxicology, Toxicogenomics and Occupational Health*; "ICTTOH" 9-11Oct. 2006, Gwalior.
18. **Sharma, J.D. and Sharma, P.K. (2007):** Beneficial role of Citrus lemon on blood and urine physiology of villagers residing in fluoride endemic area of Dausa district. *Fluoride*; 40(4): 261.
19. **Singh, B., Gaur, S. And Garg, V.K. (2007):** fluoride in drinking water and human urine in southern Haryana, India. *J. Haz. Met.*; 144(1-2): 147-151.
20. **Stawiarska-Pieta, B., Bielec, B., Birkner, K. and Birkner, E. (2012):** The influence of Vitamin E and Methionine on the Activity of Enzymes and the Morphological Picture of Liver of Rats Intoxicated with Sodium Fluoride. *Food and Chem. Toxicol.;* 50: 972-978.
21. **Susheela, A.K. (2001):** *A treatise on fluorosis*. 1st edn, F.R.R.D.F.,New Delhi.
22. **Teotia, S.P.S., Teotia, M. And Singh, D.P. (1985):** Bone static and dynamic histomorphometry in endemic fluorosis. In: *Fluoride Res. Stu. in Environ. Sci.:* Elsevier Science publishers, Amsterdam; 27: 347-355.