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Research Note

Estimation of Fluoride Content in the Edible Vegetables of an Industrial Area in Orissa

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Abstract: The excessive fluoride intake through food and water is harmful to human as well as animals. The present paper is an attempt to analyze the fluoride content in the vegetables of a polluted area where endemic and industrial fluorosis co-exist. The common vegetables consumed in the local area were selected and analysed. The results showed that the fluoride content in the vegetables of the study area were higher than the samples from control area.

Key words: Fluoride, vegetables, Orissa, industry.

Introduction

Fluoride consumption more than the permissible levels through contaminated foodstuffs and water is harmful to the human beings as well as grazing animals. Plants growing near fluoride emitting sources can accumulate high levels of fluoride in leaves.

Aims and Objectives

In the present study the fluoride contents in a variety of vegetables ordinarily consumed by the people living in the polluted area (MoEF, GOI, 1994; CGWB, 1993) were estimated. The area selected was a known industrial zone (Angul-Talcher) in Orissa state having a number of major industries.

Material and Methods

Common staple vegetables have been selected for the estimation of fluoride content in both the study and control area. The species selected are *Solanum melongena* (Brinjal), *Lycopersicum esculentum mill* (Tomato), *Phaseolus vulgaris* (French Beans), *Brassica oleracea* L (Cabbage), *Papaver somniferum* L (Leafy), and *Solanum tuberosum* L (Potato). The fluoride content was estimated following the standard addition method prescribed by A.E. Villa (1979) using Orion micro processing ionalyzer (1984).

Results and Discussion

As it could be seen from Table 1, the average fluoride concentration levels in different types of vegetable samples with an average of 30.74 mg/l and a range of 15.96-45.5 mg/l, were very high. A review article by Dinesh Chand published in 1998 reports mean fluoride content in leafy amranthus samples as 0.58 ppm (Sengupta and Pal, 1971) and another study by

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Table 1: Fluoride concentration (mean) levels of different types of vegetable samples

Sl No	*Vegetable*	*Study F^- in mg/l*	*Control F^- in mg/l*
1	Leafy (n=5)	30.74 (15.96-45.6)	7.68 (6.24-10)
2	Potato (n=4)	12.79 (8.00-16.4)	5.34 (2.80-6.0)
3	Beans (n=3)	5.39 (4.56-6.08)	0.95 (0.6-1.26)
4	Brinjal (n=4)	5.29 (3.14-7.03)	1.29 (0.89-2.0)
5	Tomato (n=4)	5.21 (1.52-10.64)	0.95 (0.48-1.22)
6	Cabbage (n=4)	4.88 (1.36-7.03)	1.02 (0.50-1.8)

Figures in brackets indicate range.

Lakadwala and Punekar conducted in 1973 presents a range fluoride value of 4.91-7.17 ppm of fluoride content in the leafy amranthus samples. These values remain far lower when compared to the mean and range values with study area of leafy vegetable analysis carried out in the present study.

Tuberous vegetables such as potato appear to accumulate relatively higher degree of fluoride. A mean value of 12.79 mg/l with a range value of 8.00-16.4 mg/l has been noted from the potato samples collected from study area. French bean samples had a mean fluoride content of 5.39 mg/l (range 4.56-6.08 mg/l) in the present investigation from the study area. However, Lakadwala and Punekar reported the fluoride content ranging from 1.07 to 1.96 ppm in non-industrial areas in French bean samples. A study presenting fluoride estimation in the samples collected from endemic areas of Nalagonda, Andhra Pradesh, India, reports a mean fluoride content of 2.3 mg/kg in brinjal and 0.2 mg/kg in tomato and 41.6 mg/kg in jawar (Rajyalakshmi and Rao, 1985). However, in the present study, in the brinjal samples grown at the fluoride-exposed area, analysis showed the mean fluoride value of 5.29 with a range from 3.14 to 7.03 mg/l, which are comparatively higher fluoride concentrations.

The fluoride content in the tomato showed an average of 5.21 mg/l with a range of 1.52-10.64 mg/l. An Indian study presenting values of fluoride analysis from tomato samples reported a range of value from 1.00 to 2.08 ppm (Lakadwala and Punekar, 1973). As regards the cabbage samples and fluoride content, a mean value of 4.88 mg/l with a range of 1.36-7.03 mg/l was noted from the samples collected from the study area in the present investigation. However the corresponding cabbage fluoride concentration reported by Watanabe in 1994 were 0.16 ppm as mean value of fluoride and 0.10-0.19 ppm as the range value fluoride.

The fluoride content of vegetation is indicative of the degree of atmospheric contamination. It has been shown that in an area contaminated by industries fluoride content increases abnormally in vegetation (Carlson, 1972; Pillai and Mane, 1985). Rippel (1972) found that the fluoride content of corn and vegetables grown near aluminium smelter is directly related to the distance from the emission source. Vegetables grown in regions of other industrial emissions showed higher fluoride content than in control (Alary, 1970; Fedorowski, 1978; Oelschlager, 1970). It can be concluded that plants tend to accumulate fluorides as observed in the present study. The populations specially consuming vegetables do have a risk of fluoride exposure through consumption of food and vegetable in these areas.

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Calendar of Events

Water Contamination Emergencies: Collective Responsibility (International Conference)
7 and 8 April 2008
London, United Kingdom
Website: http://www.soci.org/SCI/events details.jsp?eventID=EV1035
Contact name: Mrs Maggi Churchouse
Organized by: RSC, SCI, IWO

Water Down Under
15 to 17 April 2008
Adelaide, South Australia, Australia
Website: http://www.waterdownunder2008.com/welcome.htm
Organized by: Engineers Australia and The International Centre of Excellence in Water Resources Management (ICE WaRM)

WaterTech 2008
16 to 18 April 2008
Lake Louise, Alberta, Canada
Website: http://www.esaa-events.com/watertech
Contact name: Joe Chowaniec
Organized by: ESAA

The 9th China International Water Supply & Drainage and Water Treatment Exhibition (WSDWTF 2008)
27 April 2008
Shanghai, China
Website: http://www.wsdwtf.com
Contact name: Helen Zhu
Organized by: Shangai ZM Exhibition Service Co., Ltd

International Conference on Waste Engineering and Management
28 to 30 May 2008
Hong Kong, China
Website: http://www.hkie.org.hk/icwem/index.htm
Contact name: Conference Secretariat
Organized by: The Hong Kong Institution of Engineers & the Canadian Society for Civil Engineering

International Conference on Water Resource Systems Management under Extreme Conditions
4 and 5 June 2008
Moscow, Russian Federation
Website: http://waterextreme.sibico.com
Contact name: Sergey Malygin
Organized by: SIBICO International, Ltd.

Summer Institute in Advanced Coastal Management
9 to 27 June 2008
Narragansett, Rhode Island, United States
Website: http://www.crc.uri.edu
Contact name: Kimberly Kaine
Organized by: Coastal Resources Center

Water Pollution 2008
9 to 11 June 2008
Alicante, Spain
Website: http://www.wessex.ac.uk/conferences/2008 water08/index.html
Contact name: Alice Jones
Organized by: Wessex Institute of Technology

Sustainable Irrigation 2008
11 to 13 June 2008
Alicante, Spain
Website: http://www.wessex.ac.uk/conferences/2008/irrigation08/index.html
Contact name: Alice Jones
Organized by: Wessex Institute of Technology

4th European Centre for River Restoration International Conference
16 to 21 June 2008
Venezia, Italy
Website: http://www.ecrr.org
Contact name: Francesco Pra Levis
Organized by: European Centre for River Restoration – ECRR

International Groundwater Symposium
18 to 20 June 2008
Istanbul, Turkey
Website: http://www.iahr-gw2008.net
Contact name: Nadim Copty
Organized by: IAHR

Singapore International Water Week 2008
23 to 27 June 2008
Singapore
Website: http://www.siww.com.sg
Contact name: Daphne Yeo
Organized by: Singapore International Water Week Pte Ltd.