Cytogenetic Study of Fluoric Individuals of Chandrapur District, Maharashtra

Varsha T. Dhurvey
Department of Zoology, RTM Nagpur University, Nagpur, India

Firdos A. Karim
Department of Zoology, RTM Nagpur University, Nagpur, India

Prema M. Dixit
Department of Zoology, RTM Nagpur University, Nagpur, India

ABSTRACT

Cytogenetic toxicity induced by fluoride has been observed in subjects residing in the Warora tehsil of Chandrapur district of Maharashtra. A total 60 blood samples from 10 males and 10 females (age ranging from 13-60 years) were collected from each of Dongargaon, Pijdura villages and Warora town respectively and to assess chromosomal abnormalities. In the present study, the higher concentration of fluoride (5 ppm) showed the abnormal cells and chromosomal abnormalities showing ring chromatid, acentric fragmentation, chromatid deletion, chromosome fragmentations, metacentric fragmentation, chromatid breakage, gapping between centromere and chromatid gaps were mainly observed. The gross abnormalities were increased by the individual type with high concentration of fluoride consumed by the subjects. The abnormal cells and chromosomal abnormalities were increased with the increased concentration of dose. We have also capturedphotographs of chromosomal abnormalities using scanning electron microscope (SEM) detecting the morphological variations correlated with light microscopy techniques. The study concluded the deformities in the colchicine arrested metaphase spreads to assess the sensitivity of the residents living in an endemic fluoride area to chromosome aberrations.

Keywords: Cytogenotoxicity, fluoride, chromosomal abnormalities, SEM, Warora tehsil.

1. INTRODUCTION

In Waroratehsil,Chandrapur district the post monsoon ground water fluoride concentration contains in the range of 0.6-5.0ppm and the people suffer from dental and skeletal fluorosis [1], prevalence and severity of dental fluorosis among school students [2], fluoride distribution and dental fluorosis in children [3],skeletal fluorosis in relation distribution to nutritional status and living habits[4],and pre-monsoon assessment of groundwater quality [5].
As we know, no study has been reported on chromosome aberrations in resident of an endemic fluoride area of Chandrapur district of Maharashtra. Therefore the present study was designed to investigate cytogenotoxic effects on the individuals residing in the villages.

2. MATERIALS AND METHODS

A total 40 samples from 10 males and 10 females (ages ranging from 13-60 years) were collected from each of two villages Dongargaon and Pijdura respectively. For control, 20 blood samples (10 males and 10 females) were collected from Warora town, which is 4 km away from these two endemic villages. The collected blood samples were processed by colchicine-hypotonic-aceto-alcohol-flame drying-Giemsa staining technique [6]. 360 well spread slides were prepared and 10 slides were randomly selectedand metaphase plates per slide were observed to study chromosomal abnormalities. The observation data was studied and recorded.

3. RESULTS

The blood collection from subjects residing in endemic and non-endemic villages of Warora tehsil of Chandrapur district of Maharashtra is shown in (table 1). The villages having high concentration of fluoride in water showed higher frequencies of chromosomal abnormalities.as compared to control. In the present study the higher concentration of fluoride (5 ppm)

showedthe abnormal cells and chromosomal abnormalities in metaphase plate showing ring chromatid(**R**), acentric fragmentation (**AF**), chromatid deletion (**CD**), fragmentations (**F**), metacentricfragmentation (**MC**), chromatid breakage (**CB**), gapping between centromere (**G**) and chromatidgaps were mainly observed. As well as in the low fluoride concentration (2.26 ppm) showed lessabnormal cell in metaphase plate showing chromatid deletion (**CD**), fragmentations (**F**), ringchromatid (**R**), acentric fragmentation (**AF**) (Figure. 1) The gross abnormalities were increased bythe individual type with high concentration of fluoride consumed by the subjects. The abnormalcells and chromosomal abnormalities were increased with the increased concentration of dose.

Human chromosomes abnormalities were studied by SEM those can showing variation withinthe abnormal cells, ring chromatid (**R**), acentric fragmentation (**AF**), chromatid deletion (**CD**),fragmentations (**F**) (Figure. 2).

Sr. No.	Villages	Ground water fluoride concentration range	No.of samples	Male*	Female *
1	Warora	0.5-0.8 ppm	20	10	10
2	Dongargaon	0.6-5.0ppm	20	10	10
3	Pijdura	1.06-2.26ppm	20	10	10

Table No.1: Collection of blood samples of residents of control and endemic fluoride area

FIGURE 1

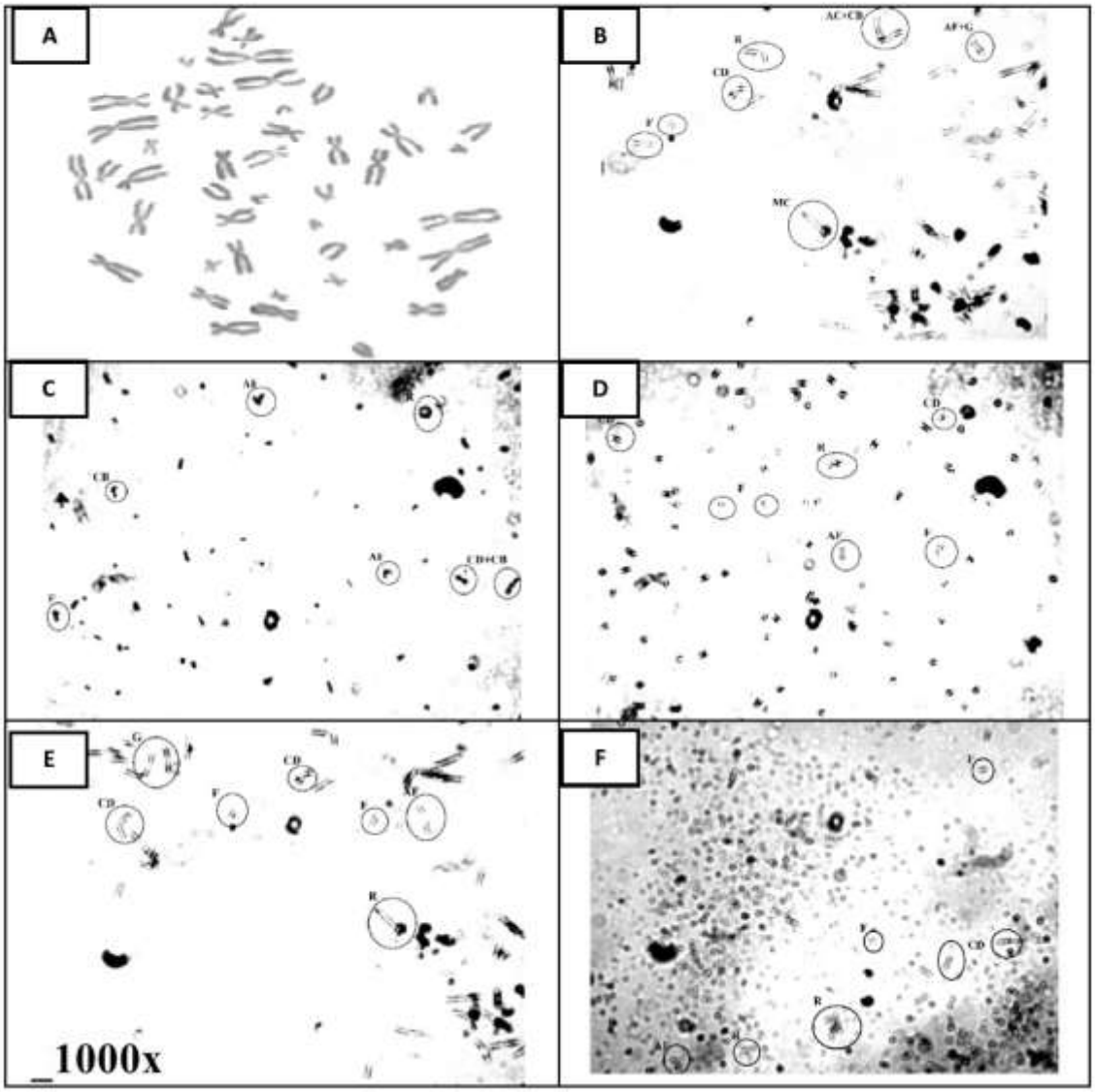

Figure 1. A: - The metaphase plates showing normal chromosomes. B - F :- The metaphase plate showing the abnormal chromosomes of individual from endemic villages ring chromatid (R), acentric fragmentation (AF), chromatid deletion (CD), fragmentations (F), metacentric fragmentation (MC), chromatid breakage (CB), gapping between centromere (G).

Note: - Fig. A belongs to Warora, Fig. B & C belongs to Dongargaon, Fig. D, E, F belongs to Pijdura.

FIGURE 2

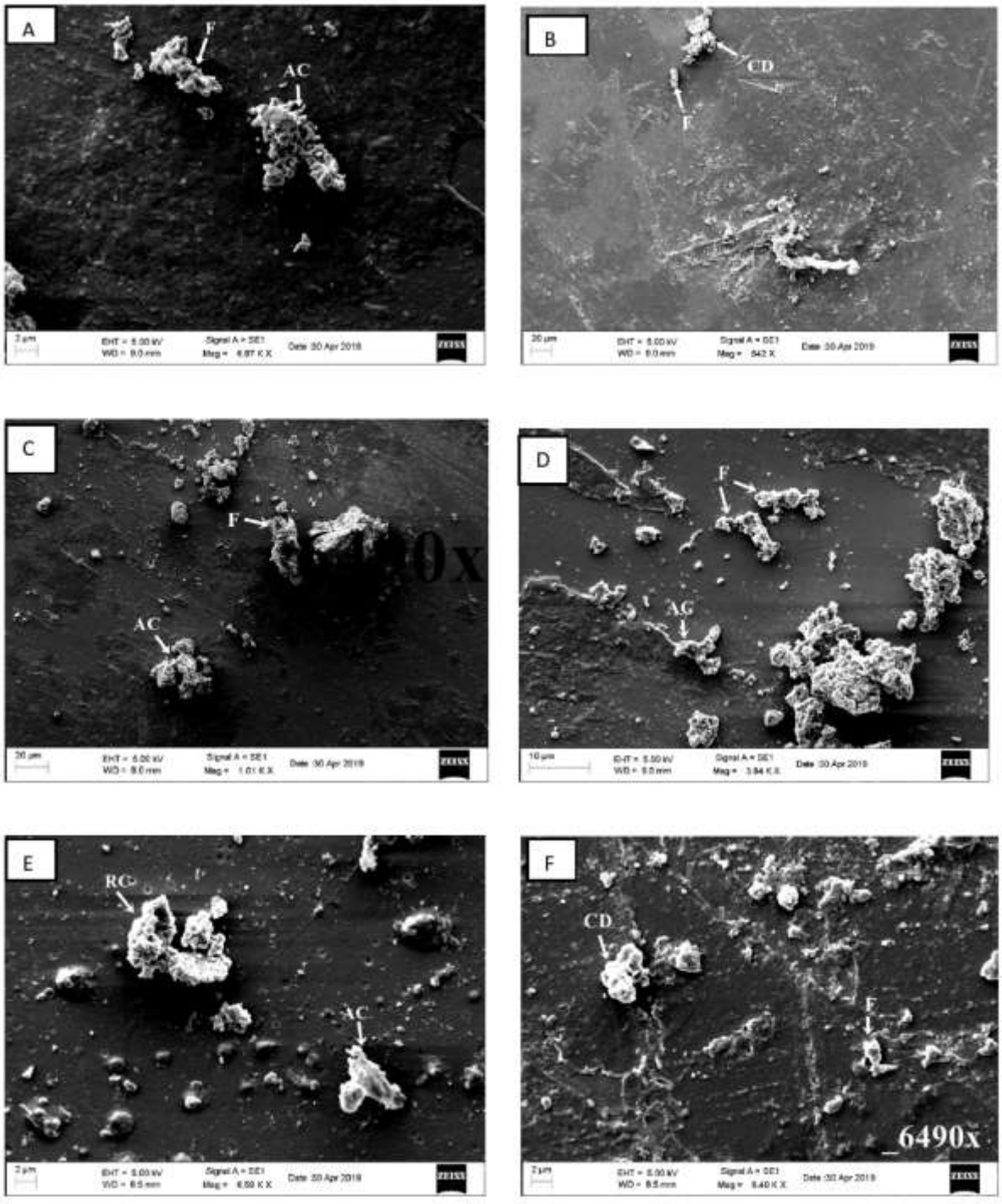

Figure 2. A-F : SEM photomicrograph showing acentric chromosome (AC), chromosome fragment (F), chromatid deletion (CD) and ring chromatid (RC).

4. DISCUSSION

In regard to chromosomal aberrations, our observations in the present study revealed chromatid breakage, chromosome breaks, chromatid deletions, fragmentation, acentric fragmentation and ring chromosomes. An increase in chromatid break,iso-chromatid

breakage and chromosomal exchange has been reported by [7, 8] in bone marrow cells of Swiss mice and in human lymphocyte after exposure to fluoride [9].

In the present study abnormal cells and chromosomal abnormalities were increased with increasing concentration dose. The chromosomal abnormality was due to significant increase of individual type. The chromatid breakage, chromatid deletion and chromatid fragmentation were most common among gross type, while chromatid ring, acentric chromatid were most common among individual. The frequency of acentric and minute fragmentation was increased drastically. This might occur due to the deletion of telomeric end of chromosomes [7].

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The present results it becomes clear that groundwater fluoride concentration induces chromosomal damage by dose-dependent manner. The exact mechanism cannot be pinpointed because concentration of fluoride interfere a number of physiological processes. However, it interferes the phagocytosis and induce to produce super oxide free reactive radicals and ions that attack the nucleophilicsites if DNA leading to break in chromosome. It may also interfere with DNA repair enzyme system [10, 11].

In our investigation, the observation it incidents the acentric and minute fragmentation was very high. The deletion of such important telomeric gene segments, might be resulted to induce cancer/tumors and ageing [11].The study concluded the deformities in the colchicine arrested metaphase spreads to assess the sensitivity of the residents living in an endemic fluoride area to chromosome aberrations.

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