

Cumulative Effect of Fluoride on Hematological Indices of Mice, *Mus norvegicus albinus*

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Abstract: Mice were exposed to fluoride. Hematological indices (WBC, Hb, PCV, MCV, MCH and MCHC) were measured. The results suggested a clear relation between presence of fluoride in drinking water and blood of mice. Fluoride could cause hypo chromic microcytic anemia. The effect is dependent on the levels of bioaccumulation of fluoride ions in the blood of mice.

Key words: Anemia • Bioaccumulation • Blood • Fluoride and Mice

INTRODUCTION

There is a close correlation exists between the distribution of fluoride bearing minerals and prevalence of endemic fluorosis [1]. Number of changes in blood parameters was reported in fluoride exposed mice [2] and camels [3, 4]. However, WBC, MCV, MCH and MCHC were not affected in rats [5]. However, the work on hematological parameters with bioaccumulation of fluoride levels in blood and the impact of fluoride accumulation levels is not available.

MATERIALS AND METHODS

Male Wister strain albino mice *Mus norvegicus albinus* of five weeks old with average weight of 25g were obtained from CFTRI, Mysore, India. The mice were acclimatized in the laboratory for a period of fifteen days. All animals were fed *ad libitum* with a standard diet in the form of pellets obtained from Hindustan Lever Ltd., Mumbai. The animals were divided into six groups of eight each. The first and second group served as controls (C₁ and C₂), the third group was dosed orally with 10 mg/Kg b.w. fluoride (F₁). Fourth with 5 mg/Kg b.w. fluoride (F₂) once a day for a period of 30 days. In the remaining two groups F₃ and F₄ were given the same dosage of fluoride as in the case of previous groups, but were maintained for a period of 60 days The dosage was administered every day at 9 A.M. using a gastric intubation tube. These doses were 1/5 and 1/10 LD₅₀ of fluoride of lethal dose LD₅₀/24 hours 50.56 mg/kg body wt. [6]. After the treatment to the said period of exposure, the

animals were sacrificed by decapitation. Whole blood was collected from the aorta for fluoride accumulation and hematological studies. Blood fluoride concentration was estimated using the fluoride ion electrode and calomel reference electrodes as described by [7]. The hemoglobin concentration was estimated by acid haematin method [8], mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were estimated as per [9]. Duncan's multiple range test [10] was applied to check the difference between treated groups and controls and the significance was calculated at 5% level (P).

RESULTS AND DISCUSSION

The results presented in the Table 1 that a significant decrease in RBC, hemoglobin, PCV, MCH relative to the respective controls and with no change in WBC and MCHC. The decrease in the above parameters was dose and time dependent (thus it was greater in groups F₁ and F₃ than F₂ and F₄). Changes of these values in mice have been attributed to rate of bioaccumulation of fluoride in blood. On the whole mice exhibited hypo chromic microcytic anemia and severity was more at the day 30 than at the day 60.

The decreased hematocrit levels may be attributed to a decrease in size of erythrocytes due to stressful conditions [11]. A significant decrease in hemoglobin concentration was observed which was reflective of the decrease in hematocrit and RBC counts and agrees with the results reported by [5].

Table 1: Alterations in RBC, WBC, Hb, PCV, MCV, Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin concentration (MCHC) and Fluoride accumulation in the mouse, on exposure to different doses and periods of fluoride.

S.No.	Group	R.B.C. (Millions/cumm)	WBC (x 10 ³ /μl)	Hb (g/100ml)	PCV (%)	MCV (g/dl)	MCH (pg)	MCHC (%)	Fluoride accumulation (μg/ml)
1	30 days C ₁	5.68b	6.81a	13.64c	28.59c	50.33c	24.01b	47.7a	0.0036a
2	30 days F ₁	4.76 a (16.1)	7.05a (3.5)	7.82a (-42.6)	16.49a (-42.3)	34.97a (-31.7)	16.42a (-31.6)	47.42a (-0.58)	0.0155c (+ 330.5)
3	30 days F ₂	4.82 a (-15.1)	7.14a (4.8)	9.29b (-31.8)	19.54b (-31.6)	40.53b (-19.4)	19.27a (-19.7)	47.54a (-0.33)	0.0134b (+ 272.2)
4	60 days C ₂	5.72 c	6.42a	13.72a	28.57b	50.12c	23.98c	47.85a	0.0016a
5	30 days F ₃	4.42 a (-22.7)	6.54a (1.8)	6.54c (-52.3)	13.74a (-52.0)	31.08a (-37.9)	14.79a (-38.3)	47.59a (-6.54)	0.803b (+ 4918.7)
6	60 days F ₄	4.96 b (-14.3)	6.60a (2.8)	8.34b (-37.2)	17.63b (-38.5)	35.97b (-28.2)	17.02b (-29.0)	47.3a (-1.14)	0.0095a (+ 493.7)

* Each value is a mean of eight estimations.

** Percentage decrease/increase over control is given in parenthesis.

Means within column followed by the same letter are not significantly different (P > 0.05) from each other according to Duncan's multiple range test.

The decrease of severity at the 60 day can be attributed to the recovery of animal from fluoride stress. It is known that fluoride intoxication depressed bone marrow activity in cattle [12]. Reports also have shown that fluoride induced disorders in hematopoietic organs in mice [13] and in human hematopoietic progenitor cells [14]. In our study the mice, on exposure to sub-lethal doses of fluoride, showed a significant positive correlation between blood fluoride level and erythrocyte indices. Hence it is possible to assume that a relation between presence of fluoride and decrease of hematocrit exists. The results coincide with the reports of [15], who reported that sodium fluoride at 50 mg/L, in drinking water caused significant depletion in blood α -aminolevulinic and dehydratase (ALAD) activity, platelet counts (PLT) and glutathione (GSH) level and also a decrease in white blood cell (WBC). On the whole it could be concluded that the concentration of fluoride ions in blood is directly related to the fluoride in the drinking water and has adverse impact on the hematological indices.

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