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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, 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] and Eren *et al.,* [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 (C_1 and C_2), the third group was dosed orally with 10 mg/Kg b.w. fluoride (F_1). Fourth with 5 mg/Kg b.w. fluoride (F_2) once a day for a period of 30 days. In the remaining two groups F_3 and F_4 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 LD_{50} of fluoride of lethal dose LD_{50}/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 Singer and Armstrong [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 Barbara A. Brown [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 F_1 and F_3 than F_2 and F_4). 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 Banupriya *et al.,* [12].

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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 [13]. Reports also have shown that fluoride induced disorders in hematopoetic organs in mice [14] and in human hematopoetic proginator 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 Megha and Flora [16], who reported that sodium fluoride at 50 mg/L, in drinking water caused significant depletion in blood ∂-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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