Thesis Title A Study on the Effect of Low Blood Lead Levels on the Developing Rat Brain.

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ABSTRACT

Inorganic lead compounds are very toxic to the developing nervous system. Exposure to even a very low level of lead during the early postnatal period in rats could produce cognitive dysfunctions, hyperactive behaviors and learning and memory impairments. The aim of this study was to investigate the effects of very low blood lead levels (below 30 μg/dl) in postnatal rats on the "open-field" behavior test and on morphological changes of neurons in the cerebellum, especially the Purkinje cells and neurons of the dentate nucleus. The LD_{50} value for i.p. injection of lead acetate in 14 day-old rats was determined to be 110 μg/g body weight (Bwt). It was also established that daily doses of 60 μg/gBwt were adequate for inducing the desired "low level" of 10-30 μg lead per dl of blood in 14-28 day

old rats. The motor activity of animals with blood lead levels of 10-30 μg/dl was tested in the open field apparatus. The number of entries into squares of the apparatus' grid and the defecation scores were recorded for each of the 5 minutes of each test for four consecutive days. The mean number of entries into outer grid squares in 5 minutes averaged over four days significantly increased ($p<0.001$) from 6.637 ± 1.266 in the control group to 16.381 ± 1.102 in the treated group. The average number of entries into outer grid squares in the first, second, third, fourth and fifth minutes were significantly higher in the lead-treated group than in the control group. Cerebella of the lead-treated rats were fixed with fixative solution and stained with cresyl violet. Analysis under the light microscope showed that the average number of dentate nucleus cells was significantly reduced ($p<0.001$) from 23.061 ± 0.491 per ocular grid area in the control group to 15.448 ± 0.460 in the treated group. Conversely, Purkinje cells did not reveal conspicuous morphological or numerical changes. These observations suggest that low lead exposure in the early postnatal period could produces hyperactive behavior in the open field test and a preferential decrease in the number of cells in the dentate nucleus, but did not alter Purkinje cell morphology or numbers in rat cerebellum.