

EFFECTS OF HIGH FLUORIDE AND LOW IODINE ON OXIDATIVE STRESS AND ANTIOXIDANT DEFENSE OF THE BRAIN IN OFFSPRING RATS

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SUMMARY: Thirty-two Wistar rats were divided randomly into four groups of eight rats each (female:male = 3:1). With one untreated group as a control group, the other three groups were administered, respectively, high fluoride in their drinking water (100 mg F/L from NaF), low iodine in their chow (0.0855 mg/kg), or both the high fluoride and low iodine together, in order to assess the effects of the three treatments on oxidative stress in the brain of offspring rats. After the animal model was established, the rats were allowed to breed, and 36 offspring rats in each group (female:male = 1:1) were randomly selected for the experiment. These rats were given the same treatment for the next 90 days as their parents. Superoxide dismutase (SOD) activity and the malondialdehyde (MDA) content in the brain of the combined high fluoride and low iodine group were significantly higher during and at the end of the 90-day period than in the control group, but the SOD/MDA ratio in this high fluoride and low iodine group was consistently lower than in the control group. These results suggest that brain stress from high fluoride and low iodine is one of the causes of reduction in learning and memory in offspring rats.

Keywords: Antioxidant defense; Biochemical indexes; High fluoride; Iodine deficiency; Offspring rats; Oxidative stress; Rat brain.

INTRODUCTION

In recent years, reports dealing with the biochemistry of fluoride indicate that superoxide free radicals and lipid peroxidation play an important role in fluoride intoxication.¹⁻⁴ Although some findings differ,⁵ various epidemiological investigations in China have reported a relationship between fluoride and intelligence showing an intelligence quotient (IQ) lowering of 8 to 10 points in children living in villages with high fluoride in food or drinking water.⁶⁻⁹ Thus, it is important to study oxidative processes in brain stress and antioxidant brain defense in experimental offspring rats to explore the mechanism of lower IQ in high fluoride areas.

It is well known that lower IQ is strongly linked to iodine deficiency. The mechanism of lower IQ associated with iodine deficiency is related to certain neurotransmitters, enzymes, growth metabolism, and the development of the central nervous system.¹⁰⁻¹³ There appear to be few reports indicating that low iodine is directly related to oxidative stress. The present study, therefore, aimed to examine oxidative stress and antioxidant defense in the brain as they might relate to our recent investigation showing reduction of learning-memory in offspring rats of mothers administered high fluoride or low iodine or a combination of high fluoride and low iodine.¹⁴

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