Zinc

Zinc is a chemical element with symbol Zn and atomic number 30. It is the first element in group 12 of the periodic table. In some respects zinc is chemically similar to magnesium: the ion is of similar size and the only common oxidation state is +2. Zinc is the 24th most abundant element in Earth's crust and has five stable isotopes. The most common zinc ore is sphalerite (zinc blende), a zinc sulfide mineral. The largest workable lodes are in Australia, Asia, and the United States. Zinc is refined by froth flotation of the ore, roasting, and final extraction using electricity (electrowinning).

The aim of a study of Dou et al., was to observe the influence of combined zinc and folic acid administration on depression and to explore its mechanism of action. Male Sprague Dawley rats were randomly divided into five groups: control, model, paroxetine (P), zinc + folic acid (ZnY), and zinc + folic acid + paroxetine (ZnYP) groups. Rat models of depression were established by chronic mild unpredictable stress for three weeks. These rats were then treated with different interventions for four weeks and the sucrose preference test was then performed to observe changes in rats' behavior. An HPLC-electrochemical method was used to detect the levels of 5-hydroxytryptamine (5-HT), dopamine (DA) and norepinephrine (NE) in the frontal cortex. qRT-PCR was employed to detect the mRNA levels of Tropomyosin receptor kinase B (Trk B) and N-methyl-D-aspartate acid (NMDA) in the frontal cortex; Western blotting was used to detect the protein levels of brain derived neurotrophic factor (BDNF) in the frontal cortex. The results showed that compared with the model group, sucrose consumption, 5-HT, NE and DA levels were significantly increased in the ZnY group ($P < 0.05$). Also the mRNA levels of Trk B and NMDA were significantly increased in the ZnY group compared with the model group ($P < 0.001$). No significant up-regulation of BDNF was observed in the ZnY group.

They conclude that combined administration of zinc and folic acid can improve the symptoms of depression-model rats, and its mechanism is related to increased levels of 5-HT, DA and NE in the brain, and to the up-regulation of Trk B and NMDA [1)].

A observational analytical retrospective research (« Case control study » type) of zinc exchange status in 60 patients was conducted. Study group included 40 patients of neurosurgical profile who needed intensive care. Control group consisted of 20 conventionally healthy volunteers. Presence of clinical and laboratory signs of zinc deficiency, presence or absence of gastrointestinal failure, level of consciousness, need for mechanical ventilation, and severity of patient's condition were assessed. Statistical analysis of the results was performed using the methods of descriptive statistics, nonparametric comparison of two groups in terms of qualitative and quantitative indicators, establishing correlation relationships.

in neurosurgical patients requiring intensive care, on the third day of treatment reduction in plasma zinc was observed, causing the clinical signs of zinc deficiency, even without achieving the minimum diagnostically significant threshold of its content in blood of 13 mcM/l. Zinc deficiency contributes to gastrointestinal, cerebral and immune insufficiency, increases the need for artificial lung ventilation and aggravates the severity of patient's condition. At the same time, high mortality of neurosurgical patients requiring intensive care is not directly related to the level of zinc in the blood plasma [2)].

It has been shown that zinc metal reestablishes chemosensitivity but this effect has not been tested with temozolomide TMZ. Using both in vitro and in vivo experimental approaches, we investigated whether addition of zinc to TMZ enhances its cytotoxicity against GBM. In vitro cell viability analysis showed that the cytotoxic activity of TMZ was substantially increased with addition of zinc and this response was accompanied by an elevation of p21, PUMA, BAX and Caspase-3 expression and a decrease in growth fraction as manifested by low ki67 and lower colony formation. Analysis of GBM as intracranial xenografts in athymic mice and administration of concurrent TMZ and zinc yielded results consistent with those of the in vitro analyses. The co-treatment resulted in significant reduction in tumor volume in TMZ/zinc treated mice relative to treatment with TMZ alone. Our results suggest that zinc may serve as a potentiator of TMZ therapy in GBM patients [3].

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