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# Comparative Assessment of *In Vitro* Effects on the Human Lymphocytes in Tuberculosis Patients of the Zinc Oxide Nanoparticles Biofunctionalized by Sulfated Polysaccharides from Spirulina

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## Abstract

The *in vitro* study of the influence of the zinc oxide nanoparticles biofunctionalized by sulfated polysaccharides compared with sulfated polysaccharides used the peripheral blood lymphocytes collected form 65 patients, new cases with pulmonary tuberculosis (TB). The patients were distributed in the main study group, which included 34 cases with multidrug-resistant TB (MDR-TB), divided in the 1st study group with 12 cases with primary drug-resistance and the 2nd study group with 22 patients with acquired drug-resistance during the anti-tuberculosis treatment, and the control group composed by 31 patients with drug susceptible TB The immunological indices were assessed through the lymphocyte's blast transformation reaction at phytohaemagglutinin and immune modulating index. The experiments demonstrated that the exposure of the lymphocytes to the biologically active compounds - zinc oxide nanoparticles biofunctionalized by sulfated polysaccharides exerted a higher immune stimulating effect compared with the purified sulfated polysaccharides. The biological activity was more pronounced on lymphocytes collected from the patients with primary drug resistance compared with those who acquired the drug-resistance during the anti-tuberculosis treatment and the effect was more pronounced in patients with drug susceptible TB compared with those with drug-resistant TB. The biochemical indicators of the glucose metabolism, identified a low glucose consumption, low activity of the aldolase and lactate dehydrogenase during the lymphocyte's proliferation test at phytohaemagglutinin, which was increased significantly




at the exposure of the lymphocytes to the zinc oxide nanoparticles biofunctionalized by sulfated polysaccharides, and higher in the group of patients with drug-susceptible tuberculosis.

*Keywords: zinc oxide nanoparticles, sulfated polysaccharides, spirulina, tuberculosis, lymphocytes*

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