Effect of nanoparticles of noble metals on inflammatory status. Modulators. Model studies with chicken embryos.

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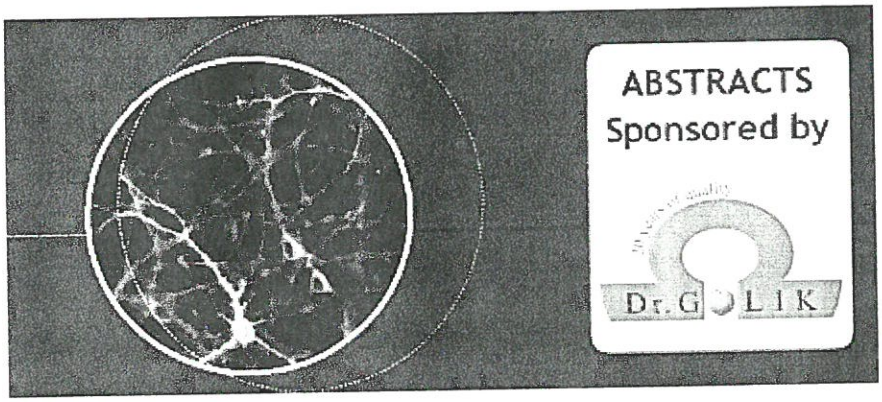

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ARE NANOPARTICLES OF NOBLE METALS TOXIC? MODEL STUDIES WITH CHICKEN EMBRYOS

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"Miraculous" therapeutic properties of noble metals have been known since ancient times; however, the discovery of antibiotics almost completely expelled their use in medicine. There is an almost complete lack of research work on the effect of nanoparticles of Ag, Au, Pd and Cu on the organism at cellular and whole body levels. Recently, in in vivo experiments with quails receiving water containing hydrocolloids of nano-Ag, we have demonstrated that nano-Ag might act as preprobiotic stimulating populating of LAB bacteria in the digestive tract. (Sawosz et al., 2007).The objective was to evaluate potential toxic effects of Ag and alloys of Ag/Cu and Ag/Pd nanoparticles, administrated in ovo to chicken embryos, at the whole body, tissue and DNA level.Fertilized chicken eggs (n=250) were divided into 5 groups: Control, Placebo, and hydrocolloids of Ag, Ag/Cu and Ag/Pd, produced by Nano-Tech Poland. The hydrocolloids (0.3 ml, concentration 50 ppm) were given in ovo by injection to albumen. After the injection the eggs were incubated for 48 h for the 1st examination (5 group x 25 eggs) and for 20 days for the 2nd (5 group x 25 eggs). After 48 h and 20 days of incubation there were no negative effects of nanoparticles on embryos' survival, growth and development, and morphology. The hydrocolloids did not affect activity of enzymes (asparagines transferase, alanine transferase and alkaline phosphatase), concentrations of glucose, triacylglyceride and cholesterol and also genotoxicity measured as a concentration of 8-oxo-2deoxyguanosine in the liver DNA.ReferencesSawosz E., M. Binek, M. Grodzik, M. Zielinska, P. Sysa, M. Szmidt, T. Niemiec and A. Chwalibog, 2007: **Influence of hydrocolloidal silver nanoparticles on gastrointestinal microflora and morphology of enterocytes of quails. Arch. Anim. Nutr. 61, 444-451.**

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EFFECT OF NANOPARTICLES OF NOBLE METALS ON INFLAMMATORY STATUS. MODULATORS. MODEL STUDIES WITH CHICKEN EMBRYOS

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Nuclear factor kB (NF-kB) is a transcriptional regulator, which plays a key role in inflammatory signaling in organism. NF-kB induces a wide spectrum of defence possibilities like cytokines, chemokines, effector molecules of immunity and pro-survival factors. However, many inflammatory diseases are associated with permanent nuclear synthesis and transcriptional activity of NF-kB, requiring anti inflammatory agents or drugs. Nanoparticles of noble metals are probably non toxic when used in very low doses. Moreover, some of these metals show anti microbial orland anti inflammatory properties.

The objective of the experiment was to evaluate expression of mRNA NF-kB in chicken embryos treated with hydrocolloids of nanoparticles of Ag, Au and Cu with and without inflammatory (LPS) stimulation.

Colloidal metal particles were obtained from Nano-Tech Poland. Colloids of Ag, Au and Cu were produced by non-explosive high voltage patented method from high purity metals and high purity demineralised water. The size of nanoparticles varied from 2 to 100 nm with the average size of 3.5 nm. Chicken embryos (20 per group) were injected with 200µl (50 ppm concentration) of Ag, Au and Cu nanoparticles. After 18 days of incubation, liver samples were collected and mRNA NF-kB p50 subunit was determined using Real Time - qPCR method.

Nanoparticles of Ag and Au had no effect on expression of mRNA NF-kB p50, however hydrocolloid of Cu showed tendency to increase this inflammatory agent. Embryos treated with LPS showed increased level of mRNA NF-kB, however, when LPS was administrated together with hydrocolloid of Ag nanoparticles the level decreased. Thus, hydrocolloids of silver nanoparticles can be considered as anti inflammatory agents.

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INFLUENCE OF SILVER NANOPARTICLES ON HSP70 EXPRESSION IN BURSA OF FABRICIUS AND SERUM IMMUNOGLOBULIN LEVELS IN CHICKEN EMBRYO

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Nanotechnology allows producing nanoparticles of silver with size lower than 1 x 10^{-9} m. Moreover, unusual biological activity of these particles is due to large area comparing to the volume, as well as to possibilities to store oxygen inside atom lattice. Ag nanoparticles may destroy individual procariota and eucariota cells, but, when use in small doses, they are probably not toxic for the whole intact organism. It has been suggested that nanoparticles of silver can increase activity of cell's immunity by stimulating heat shock protein (HSP) synthesis, without pro-inflammatory pathway activation.Fertilized eggs from Ross hens (120) were divided into 4 groups; control; nano-Ag; Gumboro vaccines; nano-Ag + Gumboro vaccines, and incubated under standard condition. Nanoparticles of Ag (from Nano-Tech Poland) at concentration of 50 ppm and amount 300µl were administered in ovo into albumin before incubation, while Gumboro vaccine was injected into air sac to 12 days old embryos. Administration of hydrocolloids of nanoparticles of Ag did not influence mortality, growth and development of embryos. The results from the present experiment together with our previous results, suggest that Ag nanoparticles used in a low quantity are not toxic to organism. Moreover, Ag nanoparticles administrated simultaneously with Gumboro vaccine increased expression of HSP-70 in bursa of Fabricius and increased the level of antibodies IgG in embryos' serum.

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