

IN VIVO TOXICITY AND TERATOGENICITY EVALUATION OF PLANT VIRUS NANOPARTICLES

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Purpose. Plant virus nanoparticles are showing great potential as delivery system for diagnostics and therapeutics [1]. The aim of the study was to evaluate the toxicity and teratogenicity of Potato Virus X (PVX) and Tomato Bushy Stunt Virus (TBSV) by direct yolk sac injection in early chick embryos.

Methods. Five different concentrations of PVX and TBSV nanoparticle (NP) suspensions were injected in the yolk sac 16h after incubation and chick embryos were sacrificed 26h later. Toxicity was evaluated both by comparing dead embryos and somite number with negative controls. Teratogenicity was evaluated by analyzing somites, vascular area, and neural tube deformities. Black carbon NPs and retinoic acid were used as positive controls for toxicity and teratogenicity.

Results. Negative controls (i.e. untreated embryos and vehicle) showed a somite number (14.06 ± 1.12 and 15.6 ± 2.7) compatible with that reported by Hamburger and Hamilton at the same stage [2] and dead embryos were lower than 5%. At concentrations ranging from 1 ng/embryo to 10 µg/embryo, the 2 toxicity indicators revealed no significant differences ($p > 0.05$) between PVX and TBSV treated embryos and the negative control. The same concentrations did not grant signs of teratogenicity. On the contrary, positive controls resulted appropriate since 50% and 25% of deaths as well as 100% and 51% of malformations were recorded for black carbon NPs and retinoic acid, respectively.

Conclusions. Even though additional results and tests in other animal models are mandatory to have conclusive opinion on the safety of these NPs, the reported results evidenced their safety in chick embryo model.

[1] Grasso S., Santi L., *Viral Nanoparticles as macromolecular devices for new therapeutic and pharmaceutical approaches*, Int. J. Physiol. Pathophysiol. Pharmacol., 2:161-178 (2010).

[2] Hamburger V., Hamilton H.L., *A series of normal stages in the development of the chick embryo*, J. Morphol., 88:195:49-92 (1951).