Microbial Pathogenesis
Volume 141, April 2020, 103989

Benefits of nanotechnology: Dietary supplementation with nerolidol-loaded nanospheres increases survival rates, reduces bacterial loads and prevents oxidative damage in brains of Nile tilapia experimentally infected by *Streptococcus agalactiae*

Matheus D. Baldissera [a], Carine F. Souza [a], Aleksandro S. da Silva [b], Maiara C. Velho [c], Aline F. Ourique [c], Bernardo Baldisserotto [a]

https://doi.org/10.1016/j.micpath.2020.103989

Highlights

- *Streptococcus agalactiae*-induced brain damage and fish mortality.
- Nerolidol loaded nanospheres reduced brain bacterial load.
- Nerolidol loaded nanospheres reduced fish mortality.
- Nerolidol loaded nanospheres (1.0 mL/kg diet) prevented ROS formation and lipid damage.

abstract

Rampant and uncontrolled use of antibiotics is a major concern for aquaculture; the practice foments the emergence of resistant strains of *Streptococcus agalactiae*, among other negative impacts. Constituents of plant essential oils such as nerolidol are being considered as replacements for synthetic drugs to support fish

nutrition and health. There is evidence to suggest that nanotechnology may enhance the efficacy of natural bioactive compounds; this is a substantial advance for the development and sustainability of aquaculture. Against the backdrop of this evidence, we aimed determine whether dietary supplementation with free nerolidol and nerolidol-loaded nanospheres would exert bactericidal effects against *S. agalactiae,* as well as prevent *S. agalactiae*-induced brain oxidative damage. In Experiment I, we measured the antimicrobial properties of dietary supplementation of nerolidol and nerolidol nanosphere in terms of mortality, longevity and relative percent survival. Fish infected with *S. agalactiae* fed 0.5 and 1.0 mL nerolidol nanospheres kg/diet demonstrated lower mortality and higher relative percent survival than the control group, while longevity was higher in all infected plus supplementation groups. Experiment II showed significantly lower microbial loads in brains of fish infected with *S. agalactiae* that were fed 1.0 mL nerolidol nanospheres kg/diet than in the control group. Brain nerolidol levels were significantly higher in uninfected as well as infected fish supplemented with nerolidol nanospheres than in fish supplemented with free nerolidol. Finally, brain reactive oxygen species and lipid peroxidation levels were higher in infected fish supplemented with basal diet compared to uninfected fish and supplemented with basal diet, and the supplementation with 1.0 mL/kg nerolidol nanospheres prevented this augmentation caused by infection. These data suggest that dietary supplementation with nerolidol nanospheres (1.0 mL/kg diet) has potent bactericidal effects in terms of augmentation of fish longevity and survival, and reduction of brain microbial loads. Also, *S. agalactiae*-induced brain oxidative damage that contributed to disease pathogenesis, and the dietary supplementation with nerolidol nanospheres (1.0 mL/kg diet) prevented this alteration. In summary, nanotechnology is a compelling approach to enhancing the efficacy of nerolidol, giving rise to reduction of *S. agalactiae* loads in fish brains.

Previous

Next

Keywords

Nanoscience; Fish mortality; Streptococcosis; Disease pathogenesis; Lipid damage

Cited by (3)

Nanotechnology in aquaculture: Applications, perspectives and regulatory challenges

2022, Aquaculture and Fisheries

Show abstract

Advances in Research on Cholesterol-Lowering Functional Foods

2022, Shipin Kexue/Food Science

Curcumin, curcumin nanoparticles and curcumin nanospheres: A review on their pharmacodynamics based on monogastric farm animal, poultry and fish nutrition

2020, Pharmaceutics

View full text