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# *Ex vivo* effects of nanoparticles on seabream spermatozoa

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### Abstract

The technological advantages obtained from the use of nanoparticles (NPs) have led to their widespread discharge into the environment. Based on their estimated releases and uses, $TiO_2$ NP and Ag NP are the most relevant NPs in terms of exposure to humans and the environment.

Despite NPs extensive use, the knowledge about its effects on marine organisms is still limited, especially concerning the potential toxic effects on reproduction. The available information on nanoreprotoxicity, mostly in humans, demonstrated that NPs cross through biological barriers into reproductive tissues, inducing hazardous effects in sperm functionality. Hence, this study aimed to evaluate the potential reprotoxicity of realistic concentrations of $TiO_2$ NP and Ag NP at the moment of fertilization in seabream (*Sparus aurata*).

Sperm was released by abdominal massage and was exposed for 1 h to realistic concentrations of $TiO_2$ NP and Ag NP. Several parameters were determined: sperm motility using CASA system, mitochondria functionality using flow cytometry, DNA integrity using comet assay, and antioxidants profile (CAT, GPx, and SOD) by spectrophotometry.

No alteration of sperm motility parameters, mitochondrial function, and DNA damage was found for both NPs. In contrast, the antioxidant responses were dependent on the NP. After exposure to $TiO_2$ NP, all antioxidants were depleted, while in the presence of Ag NP only SOD decreased.

Despite there was no alteration in the motility parameters, mitochondrial function, and DNA integrity, the depletion of the antioxidants suggests sperm susceptibility towards these NPs. The depletion of the antioxidants after short-term exposure is an ecologically relevant finding, demonstrating that at the moment of fertilization, realistic concentrations of these NPs challenge the antioxidant machinery. Sperm susceptibility towards these NPs, especially for $TiO_2$ NP, must be further evaluated as long-term exposures may affect gametogenesis.

### Keywords

Nanoparticles, Sperm, Marine fish, Ex vivo