Iron oxide nanoparticles (Fe₃O₄ NPs) are probably the NPs that have received the most increasing attention in nanomedicine. These NPs have been found to possess some properties related with their superparamagnetic behaviour. In fact, this characteristic offers them a great potential to develop a variety of applications in medicine, including the treatment of iron deficiency, thermo-therapy, drug delivery and so on. However, many safety concerns are rising, mostly regarding their interactions with innate immune cells. For example, their capacity to induce inflammation, which is one of the most undesired side effects associated with NP exposures, needs to be studied more in depth. The aim of this project is to understand the effects of Fe₃O₄ NPs on the biology of human neutrophils, key player cells in inflammation and the most important leukocyte population present in the circulation.

Iron oxide nanoparticles (Fe₃O₄ NPs) were purchased from Sigma. According to the manufacturer, the particle size is 9–11 nm as assessed by transmission electron microscopy (TEM). The solution is at 5 mg/ml in de-ionized water and a fraction was further diluted to obtain a stock solution at 1000 X to work with and was used as is. The endotoxin level of the NPs suspension was determined by the classical Limulus amebocyte lysate (LAL) assay using the ToxinSensor™ Chromogenic LAL Endotoxin Assay Kit and were under the detection limit of 0.01 EU/ml.

Before performing any experiments, we previously determined that Fe₃O₄ NPs do not induce cell necrosis in our experimental conditions used as assessed by the trypan blue exclusion assay.

Neutrophils were treated with buffer (Ctrl) or the indicated concentration of Fe₃O₄ NPs. Results are expressed as means ± SEM, n=4). *, p<0.05 vs Ctrl.

This study indicates that Fe₃O₄ NPs can alter the biology of human neutrophils, an issue that has not been previously investigated. Indeed, these NPs were found to delay spontaneous apoptosis by a mechanism requiring de novo protein synthesis. Although Fe₃O₄ NPs were found to induce the production of IL-1β, TNF-α, IL-6 and IL-8 using commercially available ELISA kits. Results are expressed as means ± SEM, n=4). *, p<0.05 vs Ctrl.

REFERENCES

