

ABSTRACT

Infertility currently affects around 9% of couples worldwide and in 30% of the cases, the male factor plays a role. It is clear that lifestyle and diet affect male fertility and sperm function and can affect the outcome of fertility treatments. One of the key aspects being affected by the diet is the sperm membrane which plays a central role in capacitation and fecundation. The aim of this project was to clarify the effect of diet in the sperm membrane and propose a groundbreaking way to manage membrane remodeling *in vitro*. Beginning with a validated animal model (boar), we demonstrated that graphene oxide (GO) can change the sperm's membrane composition, both in terms of fatty-acids and the sterols content, with a reduction of cholesterol consistent with capacitation. Furthermore, using innovative methods, we evidenced a change in the membrane's physical-chemical characteristics such as the phase-change temperature and the fluidity of the membrane. These results agree with previous finding that GO can improve sperm capacitation resulting in increased rates of IVF (Bernabò, Fontana et al. 2018). Then we changed the focus of our work to the clinic, evaluating the effect of GO in human semen samples. We verify that in the concentrations previously proposed as effective in boar GO does not induce damage to the sperm nor does it influence the traditional functional parameters such as motility, mitochondrial function, tyrosine phosphorylation and acrosome reaction. However, GO influences human spermatozoa in a concentration dependent manner.