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Poster Presentations

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Comparing the effect of reduced graphene and graphene-L-arginine on sperm fertilizing ability

Zare-Zardini H[1], Dehghanbaghi N[2], Soltaninejad H[3].
1. *Medical Nanotechnology and Tissue Engineering Research Center, Yazd Reproductive Sciences Institute, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.*
2. *Department of Biology, Faculty of Sciences, Science and Arts University, Yazd, Iran.*
3. *Department of Nanobiotechnology, Faculty of Biological Sciences, Tarbiat Modares University, Tehran, Iran.*

Email: hadizarezardini@gmail.com

Background: Sperm cell maturation occurs for fertility with longevity in the female reproductive system. Inducing and maintaining the ability of in vitro fertility of sperm is an important and effective factor in the success of pregnancy techniques and in vitro fertilization. So, various strategies such as addition of calcium or creatine phosphate, can be used for enhancement of the fertilizing capacity of sperm during in vitro fertilization. The change of chemical agents in sperm membrane can alter its fertility. Graphene, an allotrope of carbon, has interesting physical and chemical properties such as high electron mobility, high surface area, stiffness, strength and toughness. This nanostructure and their derivatives have been used in different fields of sciences, especially in biological and medical sciences.

Objective: The aim of this study was the comparison of the effect of reduced Graphene and Graphene-L-Arginine on sperm fertilizing ability.

Materials and Methods: In this study, we synthesized reduced and L-arginine-functionalized graphene by microwave method and characterized by transmission electron microscopy, scanning electron microscope, fourier-transform infrared spectroscopy, and raman spectroscopy. Acquired sperm samples from healthy volunteers were treated with different concentrations of reduced Graphene and Graphene-L-Arginine (1, 2, 3, 4, 5, 8, 10, 12, and 15 µg/ml).

Results: Results showed that water solubility of Graphene-Arginine was higher than reduced Graphene. This increase in solubility facilitates the use of functionalized graphene in chemical and physiological fluids. Between reduced Graphene and Graphene- L-Arginine, Graphene- L-Arginine had more significant effects on increase of sperm fertilizing ability in same concentrations. On the other hand, reduced Graphene has more toxicity than same concentrations. In concentrations of 1, 2, 3, 4, 5, 8, and 10 µg/ml of Graphene- L-Arginine and 1, 2, 3, and 4 µg/ml of reduced Graphene, significant increase of fertilizing ability for sperm was occurred. In concentrations of 12 and 15 µg/ml of Graphene- L-Arginine and 5, 8, 10, 12, and 15 µg/ml of reduced Graphene, cell death, reduction of sperm motility and viability as well as membrane lysis was significantly observed. The reason for the higher activity and effect of L-Arginine-functionalized graphene is the synergistic effect of graphene (cholesterol extraction and enhancement of fertilizing ability) and L-Arginine (enhancement of nitric oxide synthesis and prevention of membrane lipid peroxidation) on increase sperm fertility.

Conclusion: Based on this study, L-Arginine-functionalized graphene in low concentrations can be used in assisted reproductive technology for in vitro increase of sperm fertilizing ability.

Key words: *Assisted reproductive technology,Sperm fertilizing ability, Graphene, -Arginine, Nanostructure.*