The influence of magnetic field - driven Q-MNPs on behavioral parameters of rats

Butsiko Chkhartishvili[a], Tamar Khimeridze[b], Mmariam Kurasbediani[b], Nanuli Doreulee[b]

e-mail: butsiko.chkhartishvili@tsu.ge

[a, b] Biology Department, Faculty of Exact and Natural Science, Iv. Javakhishvili Tbilisi State University, University str. 2, 0143, Tbilisi, Georgia

In the recent years, nanoparticles are actively used for the target delivery of biologically active substances to various areas of the body. Loading drugs with nanoparticles increases their stability and the ability to deliver them to the target [1]. Due to the small size, nanoparticles are able to penetrate the membrane barriers and therefore there is a great interest in application of the nanoparticle-drug delivery systems in nanomedicine [1]. In recent years, flavonoids - an antioxidant of plant origin are widely used against disorders of various genesis. One of the best-described flavonoid of this group is Quercetin. Many of its pharmacological effects are known: anti-inflammatory, anti-bacterial, anti-cancer, but the use of Quercetin has been limited due to it poor bioavailability [2].

The aim of our study was to load the quercetin with the magnetic iron oxide nanoparticles (MNP) and to investigate the behavioral alterations after systemic administration of Quercetin-loaded magnetic nanoparticles (Q-MNP) into the rats.

Experiments were conducted on wild type white laboratory rats (180-200gr). Ketamine-anesthetized animals were fixed in a stereotaxic apparatus and Q-MNPs (Quercetin 4.5mg: 54µl DMSO + 34µl MNP (30 nm) +45µl DMSO) were injected in the tail vena under unilateral external magnetic field (1 tesla) exposure to the temporal lobe projection of the rat brain. After 2-3 days of Q-MNN injection in rats behavioral experiments were performed in the open field and T-maze tests. The animals have been divided into two groups based on the presence or absence of magnetic field. Each group combines 4 series of experiments: 1. control + physiological solution, 2. + MNP, 3. + Quercetin 4. + Q-MNP. The motor activity/emotional state and the number of correct reactions were monitoring in rats in open field (5days, 15min per day) and T-maze tests (11 days of training with 10 trials per day) respectively. For statistical analyses of obtained data software PRIZM was used.

The experiments demonstrated that magnetic field, as well as MNP itself, does not change the behavior of animals in the open field. However Quercetin and Q-MNN improves learning ability of the rats, which was reflected as a statistically significant increase of the number of correct reaction in T-maze test. There is no difference between the data of Quercetin and the Q-MNP series.

The work is supported by Rustaveli Foundation, grant FR17_629.

Reference

1. J.Wanigasekara, Ch. Witharana, Current Trends in Biotech. and Pharmacy, 2016; Vol. 10(1) 78-91
2. X. Cai, Z. Fang, J. Dou, A. Yu, G. Zhai. Curr Med Chem. 2013; 20(20):2572-82.