

Is neuronal oscillations a safe method to evaluate the nanotechnologic products in neuronal modulation

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Introduction

Undoubtedly, the greatest contribution of nanobiotechnology will be in neuroscience which still has a cloak of secrecy over millions of subjects waiting to be discovered and clarified. Nanobiotechnological developments in the fields of neuropharmacology and tissue engineering will provide the foundation stone in the development of neuroscience.

Most nutrients, dietary supplements, and many drugs do not cross the blood-brain barrier. The presence of this barrier restricts medical interventions in the treatment of neurodegenerative and psychiatric diseases. Besides preventing the treatment of several brain diseases and psychiatric conditions, blood-brain barrier also prevents the direct use of molecules that had been shown antioxidant properties and slowed down the aging brain.

The aim of our study is the production of novel molecules and agents that can pass through the blood-brain barrier at high rates to increase the success of the treatment of neural diseases. The first phase of our project, which intended to activate the cholinergic system using nanotechnology, has been completed.

The cholinergic system increases awareness by activating visual, audial, and almost all the senses. Besides, this system also plays an important role in cognitive processes such as selective attention and learning as well as in the pathology of some neurological diseases like Alzheimer's and schizophrenia.^{1,2}

In our study, useful molecules in *Rosmarinus officinalis* ve *Olea europaea* have been purified. *Rosmarinus officinalis* is a rich source of active antioxidants. One of the most important bioactive molecules of those is rosmarinic acid. Rosmarinic acid has healing property in allergic inflammatory processes, is antitumoral, as well as has neuroprotective properties in chemical neurotoxicity and different oxidative stress models.³⁻⁵ Antioxidant⁶ and neuroprotective^{7,8} properties of *Olea europaea* has been shown in many different studies.

In our study, our product that functions by inhibiting acetylcholinesterase has been installed into microparticles utilizing nanobiotechnological methods. Those microparticles cannot be affected by the acidity of the stomach and protect the bioactive molecules inside it from this harsh environment.

Study design

The effects of our product on the central nervous system have been studied in 100 volunteer subjects (Table 1) using 22 channels electroencephalogram recording software System Plus. For the analyses, ASA software was utilized. First, standard EEGs of the subjects were recorded, and frequency analyses have been conducted (Figure 1 & 2). Subjects received 20 mg/day pure rosmarinic acid and 5 mg/day pure *Olea europea* in microparticles in daily doses for three months.

Table 1 Age, gender and blood sugar levels of volunteers

Volunteer information	(n=100)
Age	23,43±8,33
Gender (W/M)	57/43
Fasting blood sugar	93 ± 5,27
Satiety blood sugar	129 ± 9,48

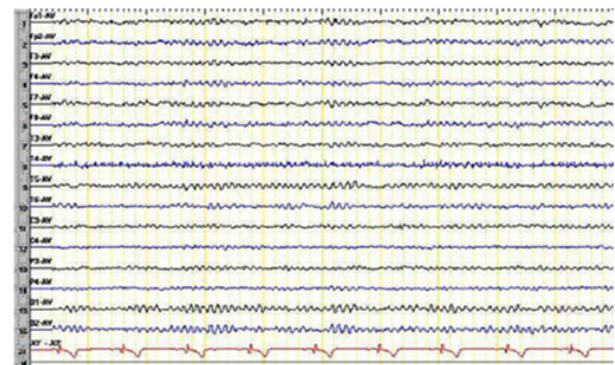


Figure 1 Standart EEG.

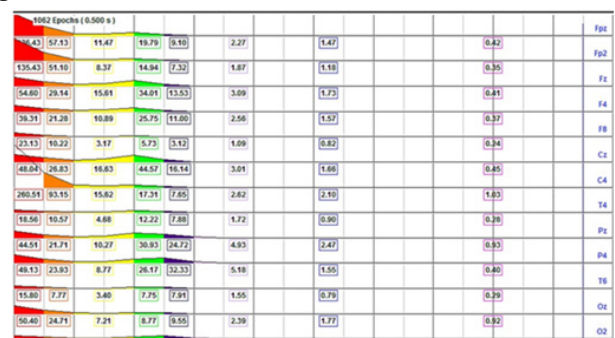


Figure 2 Frequency analyses before the product supplementation.

Our EEG results revealed that nanoparticle product caused an increase at beta and gamma frequencies in nearly all parts of the brain and especially in the frontotemporal region (Figure 2-4). Studies showed that cognitive functions increase with elevated gamma activity.⁹ Our EEG results indicate that our nanobiotechnological might pass the blood-brain barrier. The changes in the frequencies of the brain waves in frontal and temporal regions suggest that our product is effective in attention and concentration.¹⁰

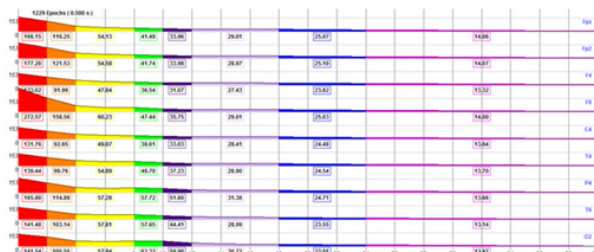


Figure 3 Frequency analyses after 3 months of daily supplement of the product.

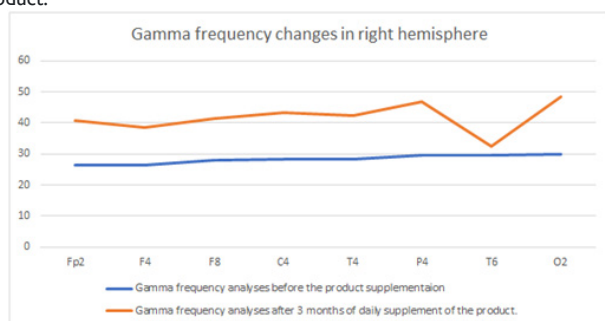


Figure 4 Gamma frequency changes in right hemisphere.

Since some volunteers could not use product regularly for 3 months, they were removed from the test setup. For this reason, the number of subjects we have requested so far has not yet been achieved. Here we present the initial report of our ongoing study. Our results suggest that neuronal oscillations might be utilized for evaluating the bio-availability of the nanotechnological products in the central nervous system.

Acknowledgments

None.

Conflicts of interest

None.

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