

## COENZYME Q<sub>10</sub> EFFECTS IN MIGRAINE, PARKINSON'S DISEASE AND ALZHEIMER'S DISEASE

El Assri Abdeladim

Scientific supervisor: Seniuk I.V.

National University of Pharmacy, Kharkiv, Ukraine

citochrom@gmail.com

**Introduction.** Coenzyme Q (CoQ), a highly hydrophobic molecule, is known from 1957 when it was isolated from beef heart mitochondria by Professor Frederick Crane on Madison University. CoQ is composed of a benzoquinone ring and a polyisoprenoid lipid tail containing varying chain length depending on the species. Human isoform contains ten isoprene units (CoQ<sub>10</sub>) but rodents have mainly nine units (CoQ<sub>9</sub>) besides some amount of CoQ<sub>10</sub>. Briefly, the benzoquinone ring is derived from the essential amino acid phenylalanine, which is converted into tyrosine and then 4-hydroxybenzoate. The polyisoprenoid lipid tail subunits are generated from acetyl-CoA (and through joint intermediate of cholesterol – farnesyl-pyrophosphate) by the mevalonate pathway.

CoQ is present in most aerobic organisms, all animal and plant organs. It is endogenously produced in every cell and its intracellular synthesis is its major source, although a small proportion is acquired through the diet. Meat, fish, nuts, and some oils are the richest nutritional sources of CoQ, while much lower levels can be found in most dairy products, vegetables, fruits, and cereals. Interestingly, the daily intake in different countries is very similar and represents around 3-5 mg.

A large cohort of 860 European adults aged 18-82 years shows a decrease of CoQ<sub>10</sub> blood concentrations with a shift in redox status in favour of the oxidized fraction in old people of both sexes. The recent study on Japanese centenarians compared to 76-year-old controls confirms decreased serum total levels of CoQ<sub>10</sub> significantly shifted to the oxidized form. Thus, exogenous CoQ<sub>10</sub> supplementation may show benefits as an antiaging agent during aging process.

**Aim.** The aims to summarize clinical and experimental effects of CoQ<sub>10</sub> supplementations in some neurological diseases such as Migraine, Parkinson's disease, Alzheimer's disease.

**Materials and methods.** A number of search engines such as Google Scholar, PubMed and Web of Science were utilised to explore the established CoQ<sub>10</sub>-based literature.

**Research results.** Migraine is a debilitating condition characterized by headaches and nausea with a usual onset around puberty. Associated symptoms may be sensitivity to light, sound or smell and vomiting. Migraine affects 10 % people worldwide and it is approximately three times more common in women than in men. Deficiency of CoQ<sub>10</sub> may be quite common in pediatric and adolescent migraine. CoQ<sub>10</sub> is comparable with placebo in respect to migraine attacks/month and migraine severity/day.

Parkinson's disease (PD) is one of the most common neurodegenerative diseases with still unknown primary cause. Many scientists found some benefit of CoQ<sub>10</sub> supplementation in the above-mentioned experimental animal models of PD. Cleren et al. showed significant neuroprotective effects of CoQ<sub>10</sub> against acute treatment with MPTP, which produced severe dopamine depletion in 5-month-old male mice. Transgenic mice with DJ-1 (Parkinson disease protein 7) deficiency with the hypersensitivity to MPTP showed a clear neuroprotection by a prophylactic use of Ubisol-Q<sub>10</sub>, water-soluble nanomicellar formulation of CoQ<sub>10</sub>. Attia and Maklad indicated that CoQ<sub>10</sub> supplement caused a remarkable improvement in most of the behavioral tests and decreased protein carbonyl content in the brain in mouse PQ model, particularly when treatment of CoQ<sub>10</sub> started prior rather than after PQ induction of PD. Ubisol-Q<sub>10</sub> given in drinking solution was effective in blocking the progression of neurodegeneration in PQ rat model when administered therapeutically (after PQ injection). However, Ubisol-Q<sub>10</sub> must be given continuously and cannot be withdrawn in order to

continue neuroprotection. The withdrawal led to further neurodegeneration. The authors suppose that Ubisol-Q<sub>10</sub> halts neurodegeneration by supporting of remaining neurons.

The most common, progressive, irreversible and fatal brain disease is Alzheimer's disease (AD), which disturbs cognition and memory functions. AD is strongly associated with increasing age with usual onset over 65 years old. Globally, the greatest contributors to AD risk are smoking following by diabetes, mid-life hypertension, mid-life obesity, depression and physical inactivity. Study focused on prevention of AD development described the improvement of cognitive decline, oxidative stress,  $\beta$ -amyloid accumulation, astrogliosis, synaptic loss and caspase activation in young triple transgenic mice given MitoQ in the drinking water at two months of age and continued for 5 months, i.e. the period during which the first AD-like pathologies become manifest. MitoQ-treated mice showed improved memory retention compared to untreated triple transgenic AD mice as well as reduced brain oxidative stress, synapse loss, astrogliosis, microglial cell proliferation, amyloid- $\beta$  accumulation, caspase activation, and tau hyperphosphorylation. These findings support the involvement of mitochondria-derived oxidative stress in the etiology of AD and suggest that MitoQ may lessen symptoms in AD patients.

**Conclusions.** From the first pioneering clinical administration of CoQ<sub>10</sub> to patients with heart failure in Japan in the 60s of the last century the number of CoQ<sub>10</sub> applications keeps increasing. In the context of mitochondrial dysfunction and oxidative stress in the above-mentioned serious neurological diseases the most prominent and relevant functions are the energetic role and antioxidant capacity of CoQ<sub>10</sub>. New promising formulations improve bioavailability and could make possible the more efficient administration. CoQ<sub>10</sub> administration can serve only as a corroborative substance. It is important to note that numerous clinical and experimental studies repeatedly provide the evidence that CoQ<sub>10</sub> is highly safe and good tolerated with negligible side effects or drug interactions.

## **$\Omega$ -3 FATTY ACIDS AND THE TREATMENT OF DEPRESSION**

El Hajjami Nada

Scientific supervisor: Seniuk I.V.

National University of Pharmacy, Kharkiv, Ukraine

citochrom@gmail.com

**Introduction.** Depression is a condition in which an individual feels lethargic, irritable, and guilty, has difficulty and trouble, no enjoyment in life, mood swings, sometimes suicidal ideation and thoughts, and loss of pleasure in activities. There are hundreds of millions of individuals suffering from major depression disorder all over the world. This leads to a considerable portion of the economy going for treatment as large amounts of money are spent on drugs every year. Pharmaceutical drugs are not very effective and they also have side effects that compound the problem. There are number of studies which shows that  $\omega$ -3 fatty acids are proving to be very effective against the treatment of major depression disorder and other psychiatric disorders.

**Aim.** To study the effect of  $\omega$ -3 fatty acids on the chains of formation of depressive states.

**Materials and methods.** A number of search engines such as Google Scholar, PubMed and Web of Science were used to study the literature on  $\omega$ -3 fatty acids on the chains of formation of depressive states.

**Research results.**  $\Omega$ -3 fatty acids are known to be important for normal metabolism. Most mammals are unable to synthesize  $\omega$ -3 fatty acids on their own. However, through diet they are able to obtain the shorter chain  $\omega$ -3 fatty acids such as  $\alpha$ -linolenic acid consisting of 18 carbon and three double bonds and later on use them to produce eicosapentaenoic acid (EPA) which is considered to