DESCRIPTION FOR THE GENERAL PUBLIC

Norharman and harman are plant origin alkaloids, isolated for the first time from *Peganum harmala*. These compounds are derivatives of indole. They are naturally found in mammalian tissues, the central nervous system, the liver, blood platelets and plasma as well as urine [Celikyurt et al., 2013]. Moreover, they are endogenously synthesized in the human organism at 50-100 ng/kg b.w. norharman and 20 ng/kg b.w. harman.

The role of β-carbolines in the human organism is not completely clarified. According to Alves et al. [2010] and Celikyurt et al. [2013], harman and norharman may reduce the incidence rate of Parkinson's disease by reversible blocking of the enzyme monoamine oxidase (MAO), which in diseased individuals is more active than in healthy people. The authors stated that it caused the decomposition of dopamine, which is responsible for the motor system, coordination and muscle tone. However, Louiz and co-workers [2014] observed in their studies a very high affinity of harman to the toxin causing Parkinson's disease: 1-methyl-4-phenyl-1,2,3,6-tetrahydropiridine (MPTP). These two compounds differ only in the presence of a nitrogen bridge in the indole ring. They also showed a higher concentration of harman in the blood of patients with essential tremor and Parkinson's disease patients in relation to the control. In turn, Herraiz and Chapparo [2006] showed a negative correlation between the consumption of coffee and incidence of Parkinson's disease, indicating a high (30%) reduction of its frequency. β-carbolines are capable of binding with benzodiazepine, imidazoline, serotonin and opiates increasing their neuroactivity [Alves et al., 2010]. All these studies do not fully explain the role of harman or norharman in the development or prevention of neurological disorders.

β-carbolines may be found in meat (chicken, beef, pork and fish) subjected to thermal processing, as well as certain foodstuffs not exposed to high temperatures, e.g. in cow milk (0.4 ng/ml) [Pfau and Skog, 2004]. These compounds are found in particularly high amounts in roasted coffee (1-10 μg/g norharman and up to 2.5 μg/g harman) [Alves et al., 2010]. Alves and co-workers [2010] also determined the amounts of β-carboline compounds in roasted chicory, in which it was 2 μg/g for norharman and 1.3 μg/g for harman. Chicory is the primary component of cereal coffee.

High contents of β-carbolines in coffee and particularly in cereal coffee [Wojtowicz et al., 2015], the latter recommendable for all consumers, in contrast to coffee, leads us to the question whether an adequate incorporation of cereal coffee in the diet may have a positive effect on neurological activity in humans, providing some protection against civilization-related diseases such as Parkinson's. Studies proposed within this project should provide an answer to this question. Basic studies will comprise chemical analyses concerning the determination of β-carboline levels in the diet, but also in the human organism after their consumption. Thus it was necessary to include *in vivo* experiments on experimental animals, such as also behavioral tests to evaluate the applied diet with increased β-carboline levels. In turn, the aim of studies on human cell lines (HaCaT and with Parkinson's disease) is to show the effect of these compounds on their viability (determination of IC50) and intracellular processes (flow cytometry); preliminary such studies do not show any toxic effect. Studies concerning nutritional prevention of neurodegenerative diseases are currently priority research and this project will contribute both to their development and to biology and food chemistry.

Literature

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