

## Differential toxicity of dietary Al(III) forms or/with amyloid peptide on cell viability and synaptogenesis

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### Abstract

An abundance of studies on the discrete risk factors A $\beta$  amyloid peptide and aluminum have been reported over the years, inquiring into their toxicity in the brains of Alzheimer's disease patients.<sup>1,2</sup>

**Keywords:** Alzheimer, aluminum, Amyloid peptide, neurons, glia

### 1. Introduction

Among a plethora of environmental factors responsible for cellular toxicity are metalloneurotoxins.<sup>3</sup> Habitual and often involuntary exposure of humans to such toxins emerging from dietary sources, aquatic environments, industrial and atmospheric sources influence normal cellular physiology, which in combination with the underlying human genetic disposition, like Amyloid peptide mutations, lead to unknown to-date pathways linked to neurodegenerative events.<sup>4</sup>

The investigation of the potential biological activity of wellcharacterized Al(III) forms in combination with Amyloid peptide in neuronal and glial cellular environment constitutes a challenge, because of the neurotoxic potentiality of the metal and the evidence linking the two aforementioned factors to Alzheimer's disease. In the current in vitro study, the toxicity of A $\beta$ (1-40) and its potential correlation with well-defined aluminum compounds was investigated in primary rat hippocampal cultures following long-term incubations.

### 2. Experimental Section

In the context of this research, the experimental approach targeted initially the effect of soluble well-defined forms of aluminium, such as  $K[Al(C_7H_{11}O_6)_3] \cdot (OH) \cdot 4H_2O$ , on hippocampal cell viability in comparison to that of a purely inorganic aluminium compound ( $AlCl_3$ ). Concurrently, the toxicity potential of A $\beta$  on hippocampal cells was probed in an attempt to establish the prototypical behavior of that known risk factor in AD, and the synergistic or non-synergistic effects of the A $\beta$  peptide and Al(III) compounds (quinate and nascent inorganic) investigated by assessing neuronal dendritic shrinkage in addition to survival rate of glial and neuronal cells as a function of their exposure to a hybrid (inorganic-organic) mix of neurotoxins. To implement the experiment, cultures of neonate rat Sprague-Dawley were utilized.

### 3. Results

Statistical analysis of the experimental results (1) unravel the diverse reactivity of that metal ion as that is formulated by the

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bound ligands in aqueous media, and portray the effects brought on by the neurotoxic Al(III) forms, (2) suggest that glial cells were less vulnerable than neuronal cells. Synaptogenesis and cell loss are involved in potential mechanisms whereby both AD factors aluminum and Amyloid peptide induce neurotoxicity, with the specific ligand bound to Aluminium influencing metal neurotoxicity, and (3) project synergistic toxic effects on the viability of hippocampal cell cultures. Such effects were observed when aluminum forms were applied in combination with Amyloid peptide. Also observed was a greater -shrinkage of neuronal cells due to degeneration of dendrites that was more pronounced when A $\beta$  was applied alone

and in the presence of AlCl<sub>3</sub> than when A $\beta$  was applied with Al-quininate.

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