Impact of separated fiber fractions from lingonberries on the synaptic plasticity of the hippocampus in ApoE-/- mice

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ApoE-/- mouse model is widely used to study atherosclerosis but it has been reported that ApoE-/- mice also show signs of cognitive deficiency with age. High-fat (HF) diet has been shown to alter gut microbiota composition, associated with increase brain markers of inflammation, that may result in neural alterations and contribute to impairment in learning and memory in mice. We have previously observed beneficial effects of lingonberries (LB) on the gut microbiota. In the present study, we aimed to explore whether LB and their two separated fiber fractions could affect memory functions and neuroinflammation. Eight weeks-old male ApoE-/- mice fed HF diet (38% kcal) supplemented totally with 60 g/kg of fiber contained either only cellulose (control), soluble (solLB) or insoluble (insLB) fiber fractions of LB or whole LB (wLB) respectively. Behavioral tests, enzyme immunoassay, immunohistochemical and ultrastructural studies of the hippocampus involved in the formation of memory and learning, were analyzed. The number of astrocytes and microglial cells, synaptic and mitochondrial density in the hippocampal CA1 zone were estimated. The wLB and insLB significantly increased the density of synaptic terminals in the hippocampal CA1 zone (15%) with a simultaneous increase of mitochondria in this area (12.8%). The glial reaction to the wLB diet was expressed by an increase of the number of astrocytes (12.4%) and microglial (17.4%) cells. Obtained morphological data was supported by enzyme immunoassay. Spontanous T-maze test showed trend to increase in the rate of alternation and shortened time for making the decision in a wLB and insLB groups compared to the HF control.
Results from this study suggests that intake of wLB as well as the insLB fiber fraction can prevent the negative effect of HF diet on the hippocampus in ApoE-/- mice and activate the synaptic plasticity in the hippocampus.