Effect of alendronate, hop-extract and their combination on the number and average surface of astrocytes in the brain of ovariectomised female Wistar rats

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INTRODUCTION

Reduced production of estrogen during menopause is related to development of osteoporosis. Recent research shows it might also be connected to higher risk of degenerative diseases of central nervous system, and researchers believe estrogen has a neuroprotective effect. One of the most frequently used medicinal products for treatment of osteoporosis is alendronate, which passes the blood-brain barrier. Hop extract contains phytoestrogens, especially xanthohumol and 8-prenylnaringenin. Phytoestrogens are sometimes used to alleviate the symptoms of menopause. It is unclear if and how alendronate, phytoestrogens and their combination affect the cells involved in inflammation and neuroprotection in the brain.

MATERIALS & METHODS

The study was performed on brain tissue of 50 female Wistar rats. Animals were divided into 5 groups: a control group (underwent sham operation), and 4 ovariectomized groups (untreated, treated with alendronate, hop extract or their combination). Animals were treated daily for 2 weeks with 2 mg/kg of alendronate and/or 60 mg/kg of hop extract. Expression of GFAP was evaluated using LSAB immunohistochemical staining and subsequent analysis with the help of ImageJ software package, which was used to determine astrocyte number and average surface.

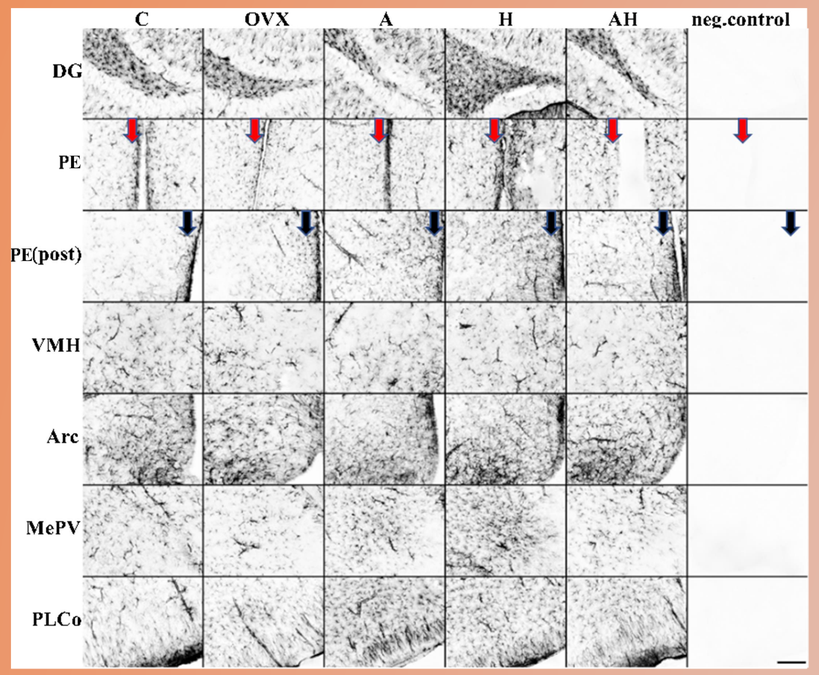

Figure 1. Samples IHC stained with GFAP antibody, objective 20×. Scalebar in lower right corner is 200µm. DG – dentate gyrus, PE – periventricular nucleus, PE(post) – posterior periventricular nucleus, VHM – ventromedial hypothalamic nucleus, Arc – arcuate nucleus, MePV -medial post central amygdaloid nucleus, PLCo – post lateral cortical amygdaloid nucleus, C – "sham" control, OVX – untreated, A – alendronate, H – hop extract, AH – alendronate and hops extract. Arrows show the direction of PE.

Authors would like to thank Croatian Microscopy Society for supporting this presentation.

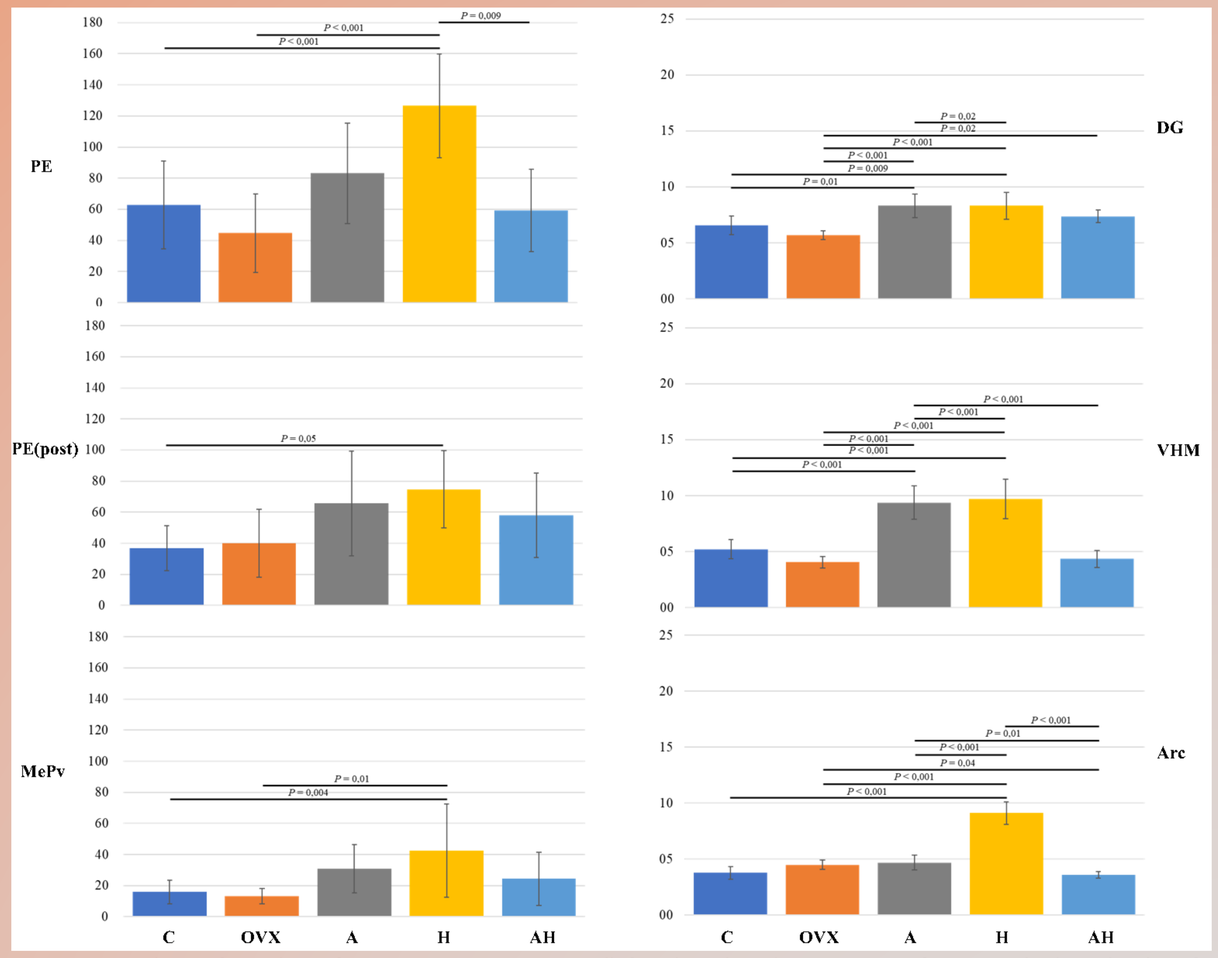

Figure 2. Analysis of number of GFAP positive astrocites (left column) and astrocyte surface area (right colum). Left colum y axis – number of astrocites. Right column y axis – astrocyte surface in µm^2

RESULTS

In most of the examined brain areas, treatment affected astrocyte number or their average surface. Group treated with hop extract had significantly larger astrocyte number in periventricular nucleus, periventricular posterior nucleus and medial posteroventral amygdaloid nucleus. Average astrocyte surface was significantly larger in several examined areas of brain in hop extract group and in alendronate group. Groups receiving combination of alendronate and hop extract had average astrocyte surface comparable to control or untreated group in most of the examined areas.

CONCLUSION

Treatment with alendronate, hop extract or a combination of the two affect the modulation of inflammation and neuroplasticity of brain tissue by changing the number of astrocytes and their surface.