Progressive Increase of Alzheimer's Disease Pathology in 5xFAD Transgenic Mice

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BACKGROUND

Today, Alzheimer's disease (AD) is one of the most devastating neurodegenerative diseases worldwide. Pathologically increased β-amyloid in the brain of AD patients is thought to be one of the main causes for the observed progressive cognitive decline in affected people. The development of new drugs against AD is therefore a main research focus. To be able to test these new drugs, appropriate animal models are needed. The 5xFAD transgenic mouse model mimics the most crucial phenotypic symptoms of amyloidogenic neurodegeneration and is therefore among the best transgenic AD animals available.

MATERIALS and METHODS

5xFAD mice bear 5 mutations, 3 in the APP695 gene as well as 2 mutations in the presenilin 1 gene. The expression of the 5xFAD transgene is driven by the neuron-specific Thy1 promoter. Here, we analyzed the soluble and insoluble fraction of whole brain lysate from 5xFAD mice over age for aggregated Aβ by A4 assay and for Aβ and Aβ aggregates as well as neuroinflammation as indicated by astrogliosis and activated microglia by immunofluorescent labeling followed by quantification.

RESULTS

Our results show a progressive increase of Aβ40 and Aβ42 aggregates as well as neuroinflammation in the cortex and hippocampus of 3 to 9 months old 5xFAD mice.

Aggregated Aβ by A4 assay

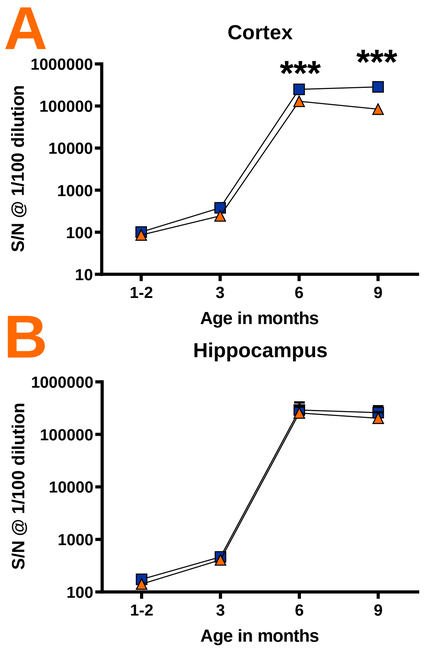

Figure 1: Aggregated Aβ species of 1- to 9-month old 5xFAD transgenic mice. A: cortex; B: hippocampus. Tissue was analyzed by A4 assay. S/N mean ± SEM of 3-5 female or male animals per group; S/N = signal to noise ratio. Two-way ANOVA and Bonferroni *posthoc* test; *** p<0.001.

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RESULTS

Aβ and Aβ aggregates

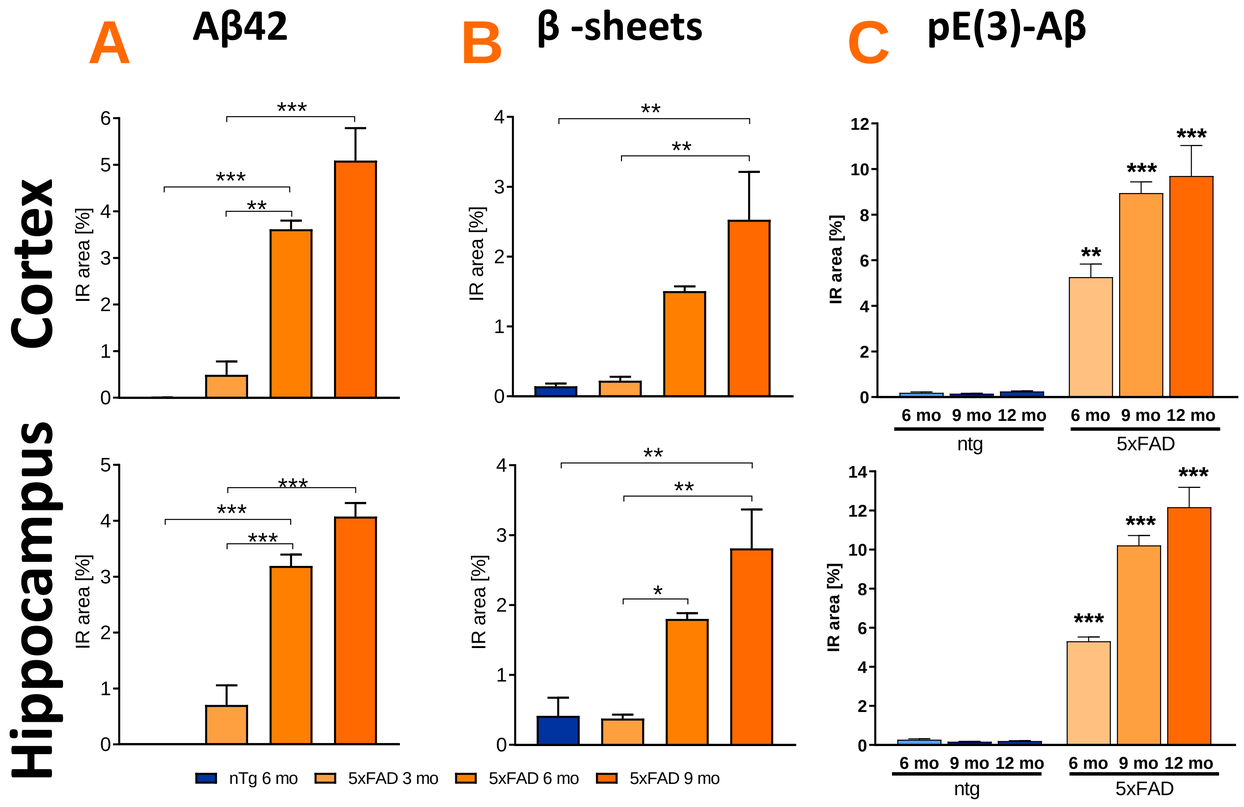

Figure 2: Quantification of Aβ42, β-sheets (Thioflavin S) and pE(3)-Aβ load in the cortex and hippocampus of 6-, 9- and 12-month old 5xFAD transgenic mice. Immunoreactive area in percent in the cortex and hippocampus. Values in ntg mice represent background. n = 5. Mean + SEM. Two way ANOVA followed by Bonferroni's *posthoc* test. *p<0.05; **p<0.01; ***p<0.001.

Neuroinflammation

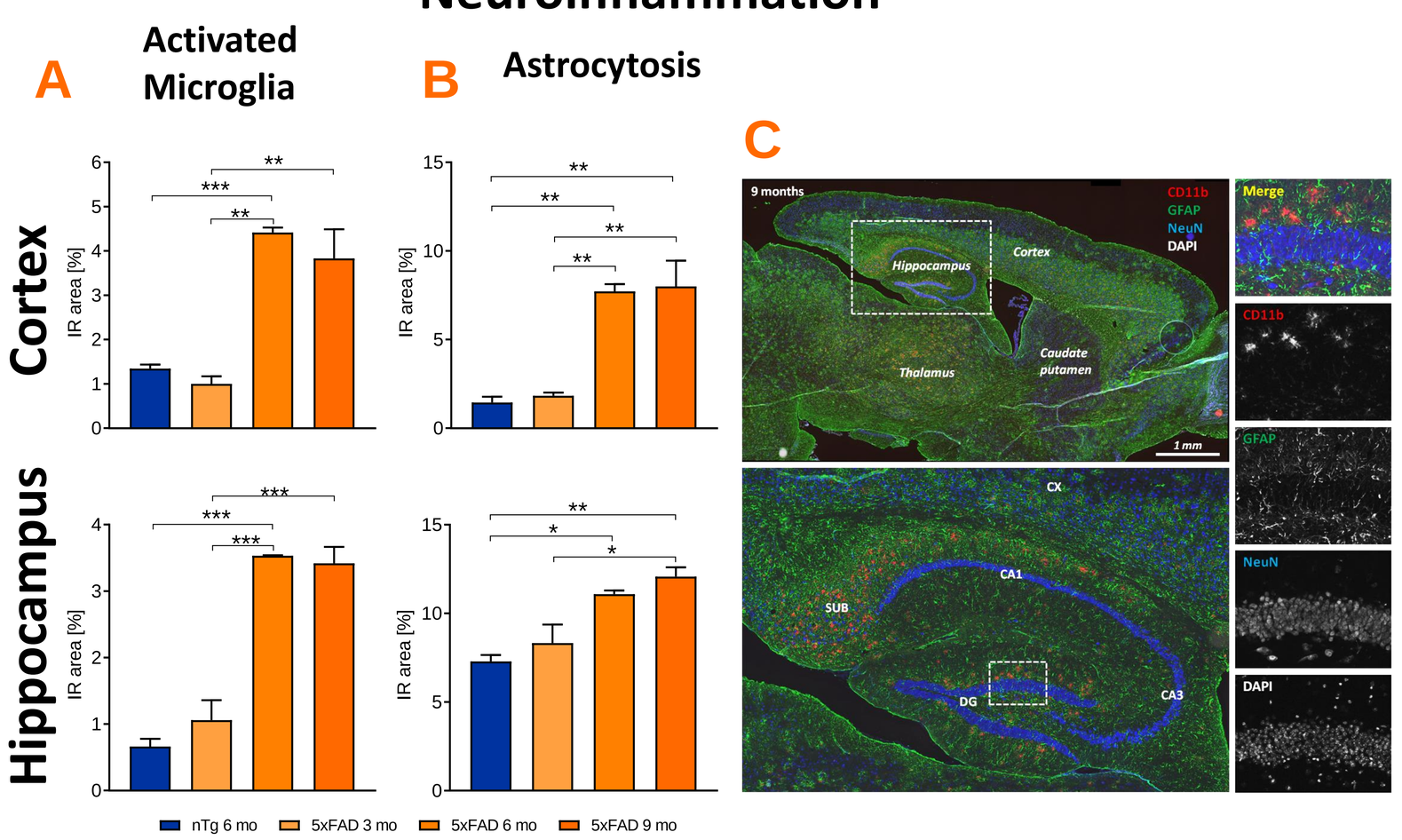

Figure 3: Neuroinflammation in 5xFAD transgenic mice. Quantification of activated microglia (**A**; CD11b labeling) and astrocytosis (**B**; GFAP labeling) in the cortex and hippocampus of 3-, 6- and 9-month old 5xFAD transgenic mice. Immunoreactive area in percent. n = 5. Data are shown as mean + SEM. One Way ANOVA followed by Bonferroni's *posthoc* test.*p<0.05; **p<0.01; ***p<0.001. **C**: Representative images of CD11b, GFAP, NeuN and DAPI labeling in 9 months old 5xFAD transgenic mice.

SUMMARY and CONCLUSION

These results suggest that 5xFAD mice are not only a well-suited model for Aβ research but also to analyze Alzheimer's disease - related neuroinflammation.

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