**Effects of musical interventions on brain and behavior in healthy elderly people**

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**BACKGROUND**

Cognitive decline: a main threat among negative effects of aging
- Impacts quality of life, social behavior, functioning & autonomy
- Working memory (WM) is particularly affected: holding & manipulating information for further processing [1]
- But also, episodic memory (past/recent experiences) and fine motor skills

Hypothesis: musical practice may counteract age-related decline
- Older adults can learn new skills: behavioral and brain plasticity [2]
- Piano practice may improve cognition particularly WM in elderly [3, 4]

**AIM & HYPOTHESES**

**Aim**
- Investigating the potential benefits of piano practice versus sensitization to music on cognitive, sensorimotor and brain structural and functional plasticity in healthy elderly in a 1.5-year
  - Piano practice (PP) vs. musical culture (MC, control = active listening)

**Hypotheses**
- Outcome 1: PP > MC for brain plasticity effects
- Outcome 2: brain plasticity will relate to cognitive benefits/stability following the same gradient (PP > MC)

**METHODS**

A Swiss-German randomized control trial in healthy older adults [5]
- 150 healthy older adults, 62-78 years old & musically naïve
- Randomization: age, gender, education and COGTEL score (general cognition)
- Teaching by professional musicians: 1-hour/week for 12 months
- Homework: 30 minutes 5 days a week for 12 months
- MRI: MP2RAGE, diffusion, task/resting-state fMRI, ASL
- Psychometric testing: 15 instruments

**6-MONTH GREY MATTER VOLUME INCREASE & WORKING MEMORY (SUBMITTED)**

Voxel-based morphometry (MP2RAGE)
- 132 individuals (PP & MC)
- No significant group differences
- Both group combined

Tonal working memory (WM) task
- All participants (no group differences)
  - T1 = 80.6 ± 17 %, T0 = 74.9 ± 19 %
  - 6% increase in accuracy (p = 0.001)

Near transfer effect of musical training
17% (R²) of the progress variance explained by the combination of grey matter volume increase, training intensity & sleep duration

**6-MONTH STRUCTURAL CONNECTIVITY & EPISODIC MEMORY (SUBMITTED)**

Fixel-based analysis [7] (diffusion)
- 121 individuals
  - PP > MC group difference in the fornix, output tract of the hippocampus

Fiber density relates to
- Training intensity (PP)
- Episodic memory (30-min delayed recall of a word list, RAVL Test [8])

**12-MONTH FC & BIMANUAL FINE DEXTERITY (SUBMITTED)**

Seed-based functional connectivity (FC) analysis (resting-state data)
- 109 individuals
  - R motor hand area seed (controlling the left hand)
  - FC increase with bilateral motor areas in the PP group only
  - Bimanual motor skill progress
  - PP group: FC change positively associated with bimanual motor skill progress (purdue pegboard [9] assembly test: assembling pins, washers and collars in a defined order for 60 seconds)

**CONCLUSION**

✔ Music, a promising intervention associated with structural and functional plasticity mediating age-related cognitive decline
✔ Music making > listening to foster healthy aging, support functional abilities, independence and well-being


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