**Participant flow diagram:**

|  |
| --- |
|  |

**Baseline characteristics**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Exergame group**  | **Balance group**  |  |
| Sex (female/male) | 5/8 | 7/7 |  |
|  |  |  | **p (two-tailed)** |
| Age (years) | 80 (73; 83) | 80 (72.25; 81.75) | .685 |
| Mini mental status examination  | 29 (29; 30) | 28.5 (27; 29) | .259 |
| Geriatric depression scale  | 1 (0; 2) | 2.5 (1; 4.75) | .085 |
| Short-fear of efficacy scale international  | 7 (7; 8) | 8.5 (7; 10) | .076 |

**Outcome measures:**

**EEG during walking**

The analysis of this neuronal activity during gait performance was not possible due to non-standardized triggering modalities and the unconventional EEG device.

**EEG during cognitive testing**

**Table 1 Interaction effects (time × intervention) of repeated measures Puri & Sen-analyses of ranked data for relative power values**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Pillai’s trace***r2*  | **L***L = (N-1)\*r2* | **p** |
| **Auditory stimuli** |  |  |  |
| Delta | 0.218 | 3.052 | .079 |
| Theta | 0.445 | 6.230 | **.007\*\*** |
| Alpha low | 0.216 | 3.024 | .081 |
| Alpha high | 0.223 | 3.122 | .076 |
| Beta | 0.125 | 1.750 | .195 |
| **Visual stimuli**  |  |  |  |
| Delta | 0.020 | 0.280 | .618 |
| Theta | 0.215 | 3.010 | .082 |
| Alpha low | 0.260 | 3.640 | .052 |
| Alpha high | 0.174 | 2.436 | .122 |
| Beta | 0.240 | 3.360 | .064 |

*N=15; exergame group N=7 and balance group N=8. \*p ≤ 0.05, \* p ≤ 0.01, p-values are one-tailed and based on normalized data.*

**Table 2 Pre- vs. post-test of relative power for exergame and balance group**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | **z** | **p** | **r** |
| **Exergame group** | **Pre (N=8)** | **Post (N=9)** |  |  |  |
| **Auditory stimuli** |  |  |  |  |
| Delta | 1.79 (1.61; 2.07) | 1.59 (1.33; 1.95) | -1.52 | .156 | **-0.37a** |
| Theta | 1.86 (1.55; 2.42) | 1.70 (1.24; 1.86) | -2.37 | **.016\*** | **-0.57b** |
| Alpha low | 1.24 (1.16; 1.38) | 1.00 (0.80; 1.35) | -1.18 | .297 | -0.29 |
| Alpha high | 1.14 (0.67; 1.38) | 0.83 (0.55; 1.16) | -1.18 | .297 | -0.29 |
| Beta | -0.21(-0.6; 10.06) | -0.19 (-0.44; 0.14) | -1.18 | .297 | -0.29 |
| **Visual stimuli** |  |  |  |  |
| Delta | -0.08 (-0.63; 0.07) | -0.22 (-0.46; 0.14) | -1.01 | .375 | -0.25 |
| Theta | -0.82 (-1.29; -0.38) | -0.60 (-0.96; -0.28) | -1.18 | .297 | -0.29 |
| Alpha low | -0.57 (-1.23; -0.21) | -0.32 (-0.78; 0.02) | -1.70 | .109 | **-0.41a** |
| Alpha high | -0.77 (-1.14; -0.09) | -0.44 (-1.14; -0.09) | -0.85 | .469 | -0.21 |
| Beta | -0.70 (-0.90; -0.74) | -0.31 (-0.74; -0.04) | -1.52 | .078 | **-0.37a** |
| **Balance group** | **Pre (N=10)** | **Post (N=9)** |  |  |  |
| **Auditory stimuli** |  |  |  |
| Delta | 1.70 (1.28; 2.10) | 1.99 (1.55; 2.29) | -0.56 | .641 | -0.13 |
| Theta | 1.81 (1.63; 2.02) | 1.92 (1.65; 2.10) | -0.70 | .547 | -0.16 |
| Alpha low | 0.79 (0.44; 1.17) | 1.30 (0.69; 1.47) | -1.54 | .148 | **-0.35a** |
| Alpha high | 0.79 (0.29; 1.28) | 1.26 (0.77; 1.46) | -1.82 | .078 | **-0.42a** |
| Beta | -0.16 (-0.33; 0.20) | -0.26 (-0.90; 0.21) | -1.54 | .148 | **-0.35a** |
| **Visual stimuli** |  |  |  |  |  |
| Delta | -0.12 (-0.48; 0.18) | -0.14 (-0.68; 0.15) | 0.00 | 1.000 | 0.00 |
| Theta | -0.24 (-1.49; 0.03) | -0.77 (-1.55; -0.43) | -1.40 | .195 | **-0.32a** |
| Alpha low | -0.27 (-1.12; -0.13) | -0.60 (-0.90; -0.37) | -0.70 | .547 | -0.16 |
| Alpha high | -0.21 (-1.81; -0.07) | -0.97(-1.74; -0.32) | -1.12 | .313 | -0.26 |
| Beta | -0.35 (-1.38; 0.07) | -0.84 (-1.16; -0.28) | -0.70 | .547 | -0.16 |

*Normalized data from pre-post are median values (interquartile range) as indicated.\*Significant within-group differences pre-post (p ≤ 0.05) calculated with Wilcoxon signed-rank test (p-values are two-tailed). For effect size r, r=0.1 indicates a small effect, a r=0.3 indicates a medium effect, and b r=0.5 indicates a large effect*

**Executive functions**

**Table 3 Interaction effects (time × intervention) of repeated measures Puri & Sen-analyses of ranked data for test for attention performance**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Pillai’s trace***r2*  | **L***L = (N-1)\*r2* | **p** |
| Working memory+  | 0.144  | 3.456  | .061  |
| Divided attention auditory++ | 0.040  | 1.000  | .326  |
| Divided attention visual  | 0.043  | 1.118  | .297  |
| Go/No-go  | 0.063 | 1.701 | .206 |
| Set shift  | 0.023  | 0.598  | .446  |

*Test for attentional performance measured reaction time [ms]. N=27; exergame group N=13 and balance group N=14. +N=25; exergame group N=12 and balance group N=13; ++N=26; exergame group N=12 and balance group N=14. p ≤ 0.05, p-values are one-tailed.*

**Table 4 Pre- vs. post-test of test for attention performance for exergame and balance group**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | **z** | **p** | **r** |
| **Exergame group**  | **Pre (N=13)** | **Post (N=13)** |  |  |  |
| Working memory | 876.5 (701.8; 1104.5)+ | 750 (649.5; 907.5) | -2.28 | **.021\*** | **-0.46a** |
| Divided attention auditory | 631.5 (580; 756.25)++ | 598 (533.5; 629) | -2.51 | **.009\*\*** | **-0.50b** |
| Divided attention visual  | 1109 (835; 1291) | 945 (879.5; 1082) | -2.06 | **.040\*** | **-0.40a** |
| Go/No-go | 450 (426; 496) | 421 (410.5; 451.5) | -2.55 | **.008\*\*** | **-0.50b** |
| Set shift | 1723 (1143.5; 2273.5) | 1405 (855; 1727.5) | -2.90 | **.002\*\*** | **-0.57b** |
| **Balance group** | **Pre (N=14)** | **Post (N=14)** |  |  |  |
| Working memory | 802 (682.3; 871.5) | 767 (726; 926.5)+++ | -0.31 | .787 | -0.06 |
| Divided attention auditory | 720 (606.25; 787.75) | 665.5 (604.25; 733.5) | -1.10 | .296 | -0.21 |
| Divided attention visual  | 961 (841.75; 1082.25) | 907.5 (8855.5; 1054.25) | -0.60 | .583 | -0.11 |
| Go/No-go | 472 (448.5; 503.75) | 466 (417.3; 509) | -0.25 | .802 | -0.05 |
| Set shift | 1196 (1045.5; 1752.25) | 1110 (984; 1409.5) | -2.04 | **.042\*** | **-0.39a** |

*The table presents the reaction time [ms] for each test for attentional performance. Data from pre-post are median values (interquartile range) as indicated. \*Significant within-group differences pre-post (\*p ≤ 0.05 and \*\* p ≤ 0.01) calculated with Wilcoxon signed-rank test (p-values are two-tailed). For effect size r, r=0.1 indicates a small effect, a r=0.3 indicates a medium effect, and b r=0.5 indicates a large effect. + N=12; ++ N=13; +++N=12.*

**Spatio-temporal gait parameters**

**Table 5 Interaction effects (time × intervention) of repeated measures Puri & Sen-analyses of ranked data for gait parameters**

|  |  |  |  |
| --- | --- | --- | --- |
| **Time × intervention interaction** | **Pillai’s trace***r2*  | **L***L = (N-1)\*r2* | **p** |
| **Speed [m/s]** |  |  |  |
| Single task normal  | 0.001 | 0.026 | .880 |
| Single task fast  | 0.068 | 1.768 | .189 |
| Dual task normal  | 0.001 | 0.026 | .882 |
| Dual task fast  | 0.004 | 0.104 | .753 |
| **Cadence [steps/min]** |  |  |  |
| Single task normal  | 0.003 | 0.078 | .774 |
| Single task fast  | 0.108 | 2.808 | .094 |
| Dual task normal  | 0.032 | 0.832 | .371 |
| Dual task fast  | 0.031 | 0.806 | .376 |
| **Stride [m]** |  |  |  |
| Single task normal  | 0.000 | 0.000 | .915 |
| Single task fast  | 0.007 | 0.182 | .682 |
| Dual task normal  | 0.014 | 0.364 | .554 |
| Dual task fast  | 0.070 | 1.820 | .183 |

*N=27; exergame group N=13 and balance group N=14. p ≤ 0.05, p-values are one-tailed*

**Table 8 Pre- vs. post-test of gait parameters for exergame and balance group**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | **z** | **p** | **r** |
| **Exergame group** | **Pre (N=13)** | **Post (N=13)** |  |  |  |
| **Speed** [m/s] |  |  |  |  |  |
| Single task normal  | 1.13 (0.92; 1.22) | 1.19 (1.06; 1.29) | -1.64 | .110 | **-0.32a** |
| Single task fast  | 1.54 (1.31; 1.63) | 1.49 (1.38; 1.64) | -1.29 | .216 | -0.25 |
| Dual task normal  | 1.02 (0.88; 1.18) | 1.08 (0.95; 1.29) | -2.90 | **.002\*\*** | **-0.57b** |
| Dual task fast  | 1.40 (1.13; 1.47) | 1.45 (1.10; 1.62) | -2.97 | **.001\*\*** | **-0.58b** |
| **Cadence [steps/min]** |  |  |  |  |  |
| Single task normal  | 103.7 (95.9; 109.3) | 106.3 (100.9; 113.3) | -1.78 | .080 | **-0.35a** |
| Single task fast  | 129.7 (114.9; 142.6) | 125.6 (118.48; 134.0) | -0.45 | .685 | -0.09 |
| Dual task normal  | 104.4 (94.37; 107.3) | 104.1 (96.8; 116.7) | -2.97 | **.001\*\*** | **-0.58b** |
| Dual task fast  | 116.7 (106.6; 129.8) | 124.2 (110.3; 131.1) | -1.43 | .168 | -0.28 |
| **Stride [m]** |  |  |  |  |  |
| Single task normal  | 1.26 (1.14; 1.34) | 1.30 (1.26; 1.37) | -1.92 | .057 | -**0.38a** |
| Single task fast  | 1.39 (1.35; 1.48) | 1.43 (1.37; 1.48) | -1.15 | .273 | -0.23 |
| Dual task normal  | 1.18 (1.10; 1.30) | 1.21 (1.15; 1.32) | -1.57 | .127 | **-0.31a** |
| Dual task fast  | 1.33 (1.21; 1.39) | 1.36 (1.29; 1.53) | -2.69 | **.005\*\*** | **-0.53b** |
| **Balance group** | **Pre (N=14)** | **Post (N=14)** |  |  |  |
| **Speed [m/s]** |  |  |  |  |  |
| Single task normal  | 1.06 (0.92; 1.25) | 1.12 (1.04; 1.41) | -2.54 | **.009\*\*** | **-0.48b** |
| Single task fast  | 1.44 (1.29; 1.62) | 1.56 (1.40; 1.78) | -1.98 | **.049\*** | **-0.37a** |
| Dual task normal  | 1.00 (0.87; 1.05) | 1.04 (0.90; 1.24) | -1.54 | .135 | -0.29 |
| Dual task fast  | 1.22 (1.16; 1.47) | 1.40 (1.17; 1.54) | -1.98 | **.049\*** | **-0.37a** |
| **Cadence [steps/min]** |  |  |  |  |  |
| Single task normal  | 108.2 (100.1; 112.8) | 115.1 (101.1; 116.9) | -2.79 | **.003\*\*** | **-0.53b** |
| Single task fast  | 133.1 (117.78; 147.4) | 137.4 (129.6; 150.2) | -1.92 | .058 | **-0.36a** |
| Dual task normal  | 101.9 (92.0; 111.8) | 111.1 (99.8; 115.4) | -1.85 | .068 | **-0.35a** |
| Dual task fast  | 115.9 (110.4; 131.7) | 127.0 (117.5; 135.0) | -1.35 | .194 | -0.26 |
| **Stride [m]** |  |  |  |  |  |
| Single task normal  | 1.18 (1.06; 1.34) | 1.29 (1.04; 1.39) | -1.92 | .058 | **-0.36a** |
| Single task fast  | 1.32 (1.11; 1.53) | 1.40 (1.15; 1.56) | -0.91 | .391 | -0.17 |
| Dual task normal  | 1.17 (1.02; 1.28) | 1.20 (0.97; 1.34) | -0.79 | .463 | -0.15 |
| Dual task fast  | 1.30 (0.93; 1.53) | 1.37 (1.07; 1.42) | -1.10 | .296 | -0.21 |

*Data from pre-post are median values (interquartile range) as indicated. \*Significant within-group differences pre-post (\*p ≤ 0.05 and \*\* p ≤ 0.01) calculated with Wilcoxon signed-rank test (p-values are two-tailed). For effect size r, r=0.1 indicates a small effect, a r=0.3 indicates a medium effect, and b r=0.5 indicates a large effect.*

**Adverse events**

There were no adverse events associated with this trial.