**Supplementary** **Methods**

Cognitive tasks

We used a computerized (PsychoPy Version 1.83.01) verbal n-back paradigm with 3 different loads or difficulties (1-back, 2-back, 3-back), as previously described [1]. Each load contained 30 targets. The letters were presented for 500 ms each, and the interstimulus interval was 2500 ms. Before the first visit, all participants performed a trial run (total duration: 8 minutes [instead of 21 minutes in the main trial]) with all 3 conditions to ensure that the instructions were clear and to minimize learning effects between the first visits. We recorded the sums of hits, errors, false alarms (FA), correct rejections, and missing trials for each load, as well as the respective reaction times [2]. Higher loads (2-back and 3-back) are more demanding and are considered to predict inter-individual differences in other higher cognitive functions (eg, fluid intelligence) [3]. The discriminability index (d prime) was calculated as a measure to discriminate between targets and irrelevant stimuli; and the response criterion c, as a measure to describe the tendency to respond with signal or noise, regardless of the stimulus, as described elsewhere [2, 4].

In the Trail Making Test (TMT) version A, participants were required to connect 25 numbers in sequential order on a sheet of paper. In version B, the participants alternated between numbers and letters. If participants made a mistake, the investigator corrected them before allowing them to move on. Mistakes therefore increased the processing time (main measure of the task). Before each visit, to ensure that participants understood the task they performed a trial run with a reduced number of items and without time being measured. In the TMT, smaller values represent better performance (in contrast to the other tasks, where higher values represent better performance) [5, 6].

The d2 task was performed on a sheet of paper that contained 14 rows with 57 letters “p” or “d”; each letter had 1 to 4 small marks around it. The task was to strike out all the “d’s” with exactly 2 marks around them and not to cross out any distractors. Participants were given exactly 20 seconds to complete each task. Concentration performance (CP) was calculated as the difference between correct and incorrect marked letters. Before each task, participants performed a trial run with only 1 row and without time being measured [7, 8].

Study timeline

The first visit (visit -1) was performed 10 to 12 weeks before the 2017 Munich marathon, ie, before the commonly recommended start of intensive training approximately 10 weeks before a marathon. The second visit (visit 0) took place within the 2 weeks before the marathon (during the tapering period); the third assessment (visit 1), immediately after successful completion of the marathon (all measurements were made within 2 hours after the participant had finished the marathon); the fourth and fifth visits, which captured responses to the short-term recovery period, 24 hours (visit 2.1) and 72 hours (visit 2.2) after the marathon; and the sixth visit (visit 3), which assessed the long-term recovery period, about 10 to 12 weeks after the marathon (see Suppl. Figure 1).

**Supplementary Results**

Correlation of chronic alterations of vascular and cognitive parameters, analyses without adjusting covariates

In the GEE analyses without covariates, d prime 3-back and d2 CP correlated positively with AVR (P=0.017 and 0.036, see Suppl. Table 1). Moreover, TMT B correlated negatively with CRAE and CRVE (P=0.001 and 0.036, see Suppl. Table 1).

Correlation of acute alterations of vascular and cognitive parameters, analyses without adjusting covariates

Please see Suppl. Table 2 for full test statistics. We found a significant positive correlation of AVR with d2 CP (P=0.017); a negative correlation of both CRAE and CRVE with d prime 1-back (P=0.048 and P=0.013), TMT A (P=0.005 and P=0.003), and TMT B (P=0.004 and P=0.044); and a positive correlation of CRAE and CRVE with d2 CP (P<0.001 and P=0.029).

Supplementary References

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**Supplementary tables**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | N | B | SE | P |
| d prime 3-back~ AVR | 93 | 1.992 | 0.838 | 0.017 |
| d prime 2-back~ AVR | 93 | 1.079 | 0.968 | 0.265 |
| d prime 1-back~ AVR | 93 | -0.070 | 0.634 | 0.913 |
| D2 CP~ AVR | 93 | 85.735 | 40.980 | 0.036 |
| TMT A~ AVR | 93 | -1.406 | 8.963 | 0.875 |
| TMT B~ AVR | 93 | -21.171 | 21.019 | 0.314 |
| d prime 3-back~ CRAE | 93 | 0.001 | 0.003 | 0.826 |
| d prime 2-back~ CRAE | 93 | 0.004 | 0.003 | 0.180 |
| d prime 1-back~ CRAE | 93 | -0.002 | 0.002 | 0.268 |
| D2 CP~ CRAE | 93 | 0.713 | 0.408 | 0.081 |
| TMT A~ CRAE | 93 | -0.046 | 0.049 | 0.349 |
| TMT B~ CRAE | 93 | -0.215 | 0.066 | 0.001 |
| d prime 3-back~ CRVE | 93 | -0.004 | 0.003 | 0.164 |
| d prime 2-back~ CRVE | 93 | 0.001 | 0.003 | 0.820 |
| d prime 1-back~ CRVE | 93 | -0.002 | 0.002 | 0.235 |
| D2 CP~ CRVE | 93 | 0.448 | 0.395 | 0.257 |
| TMT A~ CRVE | 93 | -0.044 | 0.040 | 0.262 |
| TMT B~ CRVE | 93 | -0.154 | 0.076 | 0.042 |

**Supplementary Table 1** Correlation of cognitive parameters with vascular parameters in marathon runners. No adjustment was made for covariates. Table shows correlations for chronic effects; analyses included all visits (-1, 0, 2.1, 2.2, 3) except visit 1 immediately after the marathon.

V-1, baseline (10 to 12 weeks before marathon); V0, 2 weeks before marathon; V2.1, 24 hours after the marathon; V2.2, 72 hours after the marathon; V3, 10 to 12 weeks after the marathon

AVR, arteriolar-to-venular ratio; B, regression coefficient B; CRAE, central retinal arteriolar equivalent; CRVE, central retinal venular equivalents

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AVR | N | B | SE | P | CRAE | N | B | SE | P | CRVE | N | B | SE | P |
| d prime 3-back ~ AVR, RRsys, age |  |  |  |  | **d prime 3-back ~ CRAE, RRsys, age** |  |  |  |  | **d prime 3-back ~ CRVE, RRsys, age** |  |  |  |  |
| ~AVR | 93 | 1.861 | 0.824 | 0.024 | **~CRAE** | 93 | -0.001 | 0.003 | 0.704 | **~CRVE** | 93 | -0.006 | 0.003 | 0.050 |
| ~RRsys | 93 | 0.004 | 0.004 | 0.296 | **~RRsys** | 93 | 0.003 | 0.004 | 0.416 | **~RRsys** | 93 | 0.003 | 0.004 | 0.417 |
| ~age | 93 | -0.016 | 0.008 | 0.048 | **~age** | 93 | -0.018 | 0.008 | 0.020 | **~age** | 93 | -0.021 | 0.008 | 0.011 |
| d prime 2-back ~ AVR, RRsys, age |  |  |  |  | **d prime 2-back ~ CRAE, RRsys, age** |  |  |  |  | **d prime 2-back ~ CRVE, RRsys, age** |  |  |  |  |
| ~AVR | 93 | 0.888 | 0.989 | 0.359 | **~CRAE** | 93 | -0.001 | 0.003 | 0.704 | **~CRVE** | 93 | -0.002 | 0.003 | 0.636 |
| ~RRsys | 93 | 0.001 | 0.003 | 0.859 | **~RRsys** | 93 | <0.001 | 0.004 | 0.917 | **~RRsys** | 93 | <0.001 | 0.004 | 0.951 |
| ~age | 93 | -0.017 | 0.008 | 0.040 | **~age** | 93 | -0.017 | 0.009 | 0.056 | **~age** | 93 | -0.018 | 0.009 | 0.033 |
| d prime 1-back ~ AVR, RRsys, age |  |  |  |  | **d prime 1-back ~ CRAE, RRsys, age** |  |  |  |  | **d prime 1-back ~ CRVE, RRsys, age** |  |  |  |  |
| ~AVR | 93 | -0.103 | 0.644 | 0.873 | **~CRAE** | 93 | -0.003 | 0.002 | 0.192 | **~CRVE** | 93 | -0.002 | 0.002 | 0.210 |
| ~RRsys | 93 | 0.001 | 0.002 | 0.656 | **~RRsys** | 93 | 0.001 | 0.002 | 0.745 | **~RRsys** | 93 | 0.001 | 0.002 | 0.638 |
| ~age | 93 | -0.002 | 0.004 | 0.562 | **~age** | 93 | -0.004 | 0.005 | 0.93 | **~age** | 93 | -0.004 | 0.005 | 0.422 |
| d2 CP ~ AVR, RRsys, age |  |  |  |  | **d2 CP ~ CRAE, RRsys, age** |  |  |  |  | **d2 CP ~ CRVE, RRsys, age** |  |  |  |  |
| ~AVR | 93 | 68.464 | 36.286 | 0.059 | **~CRAE** | 93 | 0.556 | 0.447 | 0.213 | **~CRVE** | 93 | 0.294 | 0.407 | 0.471 |
| ~RRsys | 93 | -0.129 | 0.136 | 0.341 | **~RRsys** | 93 | -0.101 | 0.138 | 0.464 | **~RRsys** | 93 | -0.124 | 0.137 | 0.366 |
| ~age | 93 | -1.555 | 0.424 | <0.001 | **~age** | 93 | -1.216 | 0.623 | 0.051 | **~age** | 93 | -1.427 | 0.543 | 0.009 |
| TMTA ~ AVR, RRsys, age |  |  |  |  | **TMTA ~ CRAE, RRsys, age** |  |  |  |  | **TMTA ~ CRVE, RRsys, age** |  |  |  |  |
| ~AVR | 93 | 1.321 | 8.573 | 0.878 | **~CRAE** | 93 | -0.022 | 0.053 | 0.677 | **~CRVE** | 93 | -0.029 | -0.113 | 0.499 |
| ~RRsys | 93 | 0.062 | 0.052 | 0.227 | **~RRsys** | 93 | 0.059 | 0.050 | 0.231 | **~RRsys** | 93 | 0.061 | 0.052 | 0.235 |
| ~age | 93 | 0.096 | 0.059 | 0.102 | **~age** | 93 | 0.080 | 0.075 | 0.287 | **~age** | 93 | 0.077 | 0.069 | 0.261 |
| TMTB ~ AVR, RRsys, age |  |  |  |  | **TMTB ~ CRAE, RRsys, age** |  |  |  |  | **TMTB ~ CRVE, RRsys, age** |  |  |  |  |
| ~AVR | 93 | -13.771 | 21.131 | 0.515 | **~CRAE** | 93 | -0.155 | 0.069 | 0.025 | **~CRVE** | 93 | -0.108 | 0.079 | 0.168 |
| ~RRsys | 93 | 0.035 | 0.085 | 0.684 | **~RRsys** | 93 | 0.028 | 0.086 | 0.749 | **~RRsys** | 93 | 0.040 | 0.085 | 0.638 |
| ~age | 93 | 0.407 | 0.178 | 0.022 | **~age** | 93 | 0.304 | 0.181 | 0.093 | **~age** | 93 | 0.348 | 0.183 | 0.058 |

**Suppl. Table 2** Correlation of cognitive parameters with vascular parameters in marathon runners, with systolic blood pressure (RRsys) and age as covariates; analyses excluded visit 1 immediately after the marathon; GEE analysis.
AVR, arteriolar-to-venular ratio; B, regression coefficient B; CRAE, central retinal arteriolar equivalent; CRVE, central retinal venular equivalents; d prime, discriminability index; d2 CP, d2 test concentration performance; RR\_sys, systolic blood pressure; TMT A, Trail Making Test A; TMT B, Trail Making Test B

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **V-1** | **N** | **V0** | **N** | **V2.1** | **N** | **V2.2** | **N** | **V3** | **N** | **P****V0/V-1; df** | **P****V2.1/V-1; df** | **P****V2.2/-1; df** | **P****V3/V-1; df** |
| **d prime 3-back** | 1.55 (0.58) | 94 | 1.67 (0.68) | 78 | 2.16 (0.93) | 56 | 1.98 (0.89) | 56 | 1.94 (0.86) | 58 | 0.939; 152.4 | < 0.001; 80.6 | 0.022; 82.9 | 0.032; 88.9 |
| **d prime 2-back** | 2.82 (0.88) | 94 | 3.18 (0.89) | 78 | 3.47 (0.88) | 56 | 3.46 (0.94) | 56 | 3.50 (0.84) | 58 | 0.084; 164.0 | < 0.001; 116.1 | 0.001; 110.3 | < 0.001; 125.9 |
| **d prime 1-back** | 4.11 (0.61) | 94 | 4.24 (0.50) | 78 | 4.36 (0.44) | 56 | 4.20 (0.67) | 56 | 4.29 (0.49) | 58 | 0.730; 170.0 | 0.039; 142.0 | 0.995; 107.0 | 0.335; 140.2 |
| **d2 CP** | 182.71 (36.20) | 92 | 197.66 (46.37) | 79 | 219.73 (46.81) | 59 | 230.42 (43.44) | 57 | 220.93 (43.69) | 58 | 0.196; 146.6 | < 0.001; 101.5 | < 0.001; 102.9 | < 0.001; 104.7 |
| **TMT A [s]** | 26.57 (9.21) | 91 | 22.02 (9.30) | 81 | 20.80 (11.82) | 63 | 19.11 (6.80) | 56 | 20.28 (7.42) | 57 | 0.015; 167.3 | 0.015; 111.5 | < 0.001; 140.1 | < 0.001; 136.9 |
| **TMT B [s]** | 59.30 (22.5) | 91 | 52.20 (20.60) | 81 | 43.84 (17.78) | 63 | 40.07 (18.21) | 56 | 44.27 (19.20) | 57 | 0.278; 169.9 | < 0.001; 149.3 | < 0.001; 134.4 | < 0.001; 132.7 |
| **meanAVR** | 0.89 (0.07) | 92 | 0.88 (0.07) | 77 | 0.90 (0.07) | 60 | 0.89 (0.07) | 58 | 0.88 (0.06) | 57 |  |  |  |  |
| **meanCRVE** | 219.82 (18.82) | 92 | 221.81 (19.17) | 77 | 215.98 (16.47) | 60 | 216.80 (19.03) | 58 | 220.58 (19.99) | 57 |  |  |  |  |
| **meanCRAE** | 194.22 (17.96) | 92 | 195.28 (18.80) | 77 | 193.29 (16.02) | 60 | 192.66 (16.94) | 58 | 193.64 (17.10) | 57 |  |  |  |  |
| **RRsys [mmHg]** | 122.37 (12.15) | 93 | 121.97 (16.02) | 76 | 124.76 (12.91) | 62 | 126.02 (15.33) | 59 | 120.92 (12.47) | 60 |  |  |  |  |

**Suppl. Table 3** Longitudinal changes in cognitive performance in marathon runners. Table shows chronic effects and includes all visits (-1, 0, 2.1, 2.2, 3) except visit 1 immediately after the marathon. All values are presented as mean (SD); LMM analysis. P, df, F for parameters with significant effect of time: : d prime 3-back, F(4,127.458)=7.258, P<0.001; d prime 2-back, F(4,125.700)=8.566, P<0.001; d prime 1-back, F(4,117.269)=2.358, P=0.058; d2 CP, F(4,124.029)=17.441, P<0.001; TMT A, F(4,121.863)=9.026, P<0.001; TMT B, F(4,115.103)=10.634, P<0.001; AVR, F(4,129.212)=0.696, P=0.596; CRAE, F(4,113.748)=0.165, P=0.956; CRVE: F(5,108.337)=1.246, P=0.296; and RRsys: F(4,129.290)=1.417, P=0.232.

V-1, baseline (10 to 12 weeks before marathon); V0, 2 weeks before marathon; V2.1, 24 hours after the marathon; V2.2, 72 hours after the marathon; V3, 10 to 12 weeks after the marathon

d prime, discriminability index; AVR, arteriolar-to-venular ratio; CRAE, central retinal arteriolar equivalent; CRVE, central retinal venular equivalent; RR\_sys, systolic blood pressure; TMT A, Trail Making Test A; TMT B, Trail Making Test B; d2 CP, d2 test concentration performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | N | B | SE | P |
| d prime 3-back~ AVR | 78 | 1.326 | 0.835 | 0.697 |
| d prime 2-back~ AVR | 78 | -0.250 | 1.241 | 0.841 |
| d prime 1-back~ AVR | 78 | 0.694 | 0.615 | 0.259 |
| D2 CP~ AVR | 77 | 136.076 | 68.510 | 0.017 |
| TMT A~ AVR | 77 | 2.683 | 13.181 | 0.839 |
| TMT B~ AVR | 77 | -12.878 | 26.584 | 0.628 |
| d prime 3-back~ CRAE | 78 | 0.004 | 0.003 | 0.199 |
| d prime 2-back~ CRAE | 78 | 0.001 | 0.004 | 0.826 |
| d prime 1-back~ CRAE | 78 | -0.006 | 0.003 | 0.048 |
| D2 CP~ CRAE | 77 | 0.851 | 0.230 | < 0.001 |
| TMT A~ CRAE | 77 | -0.113 | 0.040 | 0.005 |
| TMT B~ CRAE | 77 | -0.218 | 0.076 | 0.004 |
| d prime 3-back~ CRVE | 78 | 0.003 | 0.003 | 0.321 |
| d prime 2-back~ CRVE | 78 | 0.001 | 0.004 | 0.766 |
| d prime 1-back~ CRVE | 78 | -0.007 | 0.003 | 0.013 |
| D2 CP~ CRVE | 77 | 0.400 | 0.183 | 0.029 |
| TMT A~ CRVE | 77 | -0.111 | 0.037 | 0.003 |
| TMT B~ CRVE | 77 | -0.167 | 0.083 | 0.044 |

**Supplementary Table 4** Correlation of cognitive parameters with vascular parameters (GEE analysis). Table shows acute effects, ie, it compares baseline visit 0 (12 weeks before the marathon) with visit 1, immediately after the marathon.
AVR, arteriolar-to-venular ratio; B, regression coefficient B; CRAE, central retinal arteriolar equivalent; CRVE, central retinal venular equivalents; d prime, discriminability index; TMT A, Trail Making Test A; TMT B, Trail Making Test B; d2 CP, d2 test concentration performance

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AVR | N | B | SE | p | CRAE | N | B | SE | p | CRVE | N | B | SE | p |
| d prime 3-back ~ AVR, RRsys, age |  |  |  |  | **d prime 3-back ~ CRAE, RRsys, age** |  |  |  |  | **d prime 3-back ~ CRVE, RRsys, age** |  |  |  |  |
| ~AVR | 77 | -0.081 | 0.929 | 0.930 | **~CRAE** | 77 | 0.001 | 0.003 | 0.834 | **~CRVE** | 77 | 0.001 | 0.003 | 0.714 |
| ~RRsys | 77 | -0.002 | 0.003 | 0.510 | **~RRsys** | 77 | -0.002 | 0.003 | 0.551 | **~RRsys** | 77 | -0.002 | 0.003 | 0.529 |
| ~age | 77 | -0.013 | 0.008 | 0.105 | **~age** | 77 | -0.013 | 0.008 | 0.115 | **~age** | 77 | -0.013 | 0.008 | 0.119 |
| d prime 2-back ~ AVR, RRsys, age |  |  |  |  | **d prime 2-back ~ CRAE, RRsys, age** |  |  |  |  | **d prime 2-back ~ CRVE, RRsys, age** |  |  |  |  |
| ~AVR | 77 | -0.552 | 1.237 | 0.655 | **~CRAE** | 77 | -0.003 | 0.005 | 0.513 | **~CRVE** | 77 | -0.001 | 0.005 | 0.805 |
| ~RRsys | 77 | -0.002 | 0.004 | 0.604 | **~RRsys** | 77 | -0.003 | 0.004 | 0.493 | **~RRsys** | 77 | -0.002 | 0.004 | 0.592 |
| ~age | 77 | -0.015 | 0.009 | 0.099 | **~age** | 77 | -0.017 | 0.010 | 0.092 | **~age** | 77 | -0.015 | 0.010 | 0.117 |
| d prime 1-back ~ AVR, RRsys, age |  |  |  |  | **d prime 1-back ~ CRAE, RRsys, age** |  |  |  |  | **d prime 1-back ~ CRVE, RRsys, age** |  |  |  |  |
| ~AVR | 77 | 1.008 | 0.619 | 0.104 | **~CRAE** | 77 | -0.005 | 0.003 | 0.082 | **~CRVE** | 77 | -0.007 | 0.003 | 0.016 |
| ~RRsys | 77 | 0.004 | 0.003 | 0.147 | **~RRsys** | 77 | 0.002 | 0.002 | 0.393 | **~RRsys** | 77 | 0.002 | 0.002 | 0.339 |
| ~age | 77 | 0.004 | 0.006 | 0.497 | **~age** | 77 | < 0.001 | 0.006 | 0.992 | **~age** | 77 | < 0.001 | 0.005 | 0.943 |
| d2 CP ~ AVR, RRsys, age |  |  |  |  | **d2 CP ~ CRAE, RRsys, age** |  |  |  |  | **d2 CP ~ CRVE, RRsys, age** |  |  |  |  |
| ~AVR | 76 | 113.846 | 59.064 | 0.054 | **~CRAE** | 76 | 0.492 | 0.211 | 0.020 | **~CRVE** | 76 | 0.125 | 0.176 | 0.478 |
| ~RRsys | 76 | -0.252 | 0.151 | 0.095 | **~RRsys** | 76 | -0.153 | 0.158 | 0.334 | **~RRsys** | 76 | -0.271 | 0.157 | 0.083 |
| ~age | 76 | -1.855 | 0.474 | < 0.001 | **~age** | 76 | -1.620 | 0.493 | 0.001 | **~age** | 76 | -1.861 | 0.494 | < 0.001 |
| TMT A ~ AVR, RRsys, age |  |  |  |  | **TMT A ~ CRAE, RRsys, age** |  |  |  |  | **TMT A ~ CRVE, RRsys, age** |  |  |  |  |
| ~AVR | 76 | 11.266 | 13.052 | 0.388 | **~CRAE** | 76 | -0.062 | 0.033 | 0.063 | **~CRVE** | 76 | -0.075 | 0.034 | 0.028 |
| ~RRsys | 76 | 0.124 | 0.043 | 0.003 | **~RRsys** | 76 | 0.103 | 0.038 | 0.006 | **~RRsys** | 76 | 0.103 | 0.039 | 0.007 |
| ~age | 76 | 0.149 | 0.059 | 0.011 | **~age** | 76 | 0.101 | 0.061 | 0.096 | **~age** | 76 | 0.103 | 0.062 | 0.095 |
| TMT B ~ AVR, RRsys, age |  |  |  |  | **TMT B ~ CRAE, RRsys, age** |  |  |  |  | **TMT B ~ CRVE, RRsys, age** |  |  |  |  |
| ~AVR | 76 | 4.094 | 28.287 | 0.885 | **~CRAE** | 76 | -0.124 | 0.081 | 0.125 | **~CRVE** | 76 | -0.108 | 0.083 | 0.193 |
| ~RRsys | 76 | 0.161 | 0.086 | 0.060 | **~RRsys** | 76 | 0.127 | 0.088 | 0.147 | **~RRsys** | 76 | 0.141 | 0.082 | 0.086 |
| ~age | 76 | 0.328 | 0.159 | 0.038 | **~age** | 76 | 0.247 | 0.163 | 0.131 | **~age** | 76 | 0.269 | 0.162 | 0.096 |

**Suppl. Table 5** Correlation of cognitive parameters with vascular parameters in marathon runners, with systolic blood pressure (RRsys) and age as covariates (GEE analyses). Table shows acute effects of the marathon, ie, it compares baseline visit 0 (1 week before the marathon) with visit 1, immediately after the marathon.
AVR, arteriolar-to-venular ratio; B, regression coefficient B; CRAE, central retinal arteriolar equivalent; CRVE, central retinal venular equivalents; d prime, discriminability index; d2 CP, d2 test concentration performance; RR\_sys, systolic blood pressure; TMT A, Trail Making Test A; TMT B, Trail Making Test B

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **V0** | **N** | **V1** | **N** | **p** | **df** | **F** |
| **d prime 3-back** | 1.67 (0.68) | 78 | 1.67 (0.74) | 65 |  |  |  |
| **d prime 2-back** | 3.18 (0.89) | 78 | 3.10 (1.04) | 65 |  |  |  |
| **d prime 1-back** | 4.24 (0.50) | 78 | 3.98 (0.66) | 65 | 0.011 | 1,118.331 | 6.747 |
| **d2 CP** | 197.66 (46.37) | 79 | 211.97 (44.05) | 63 |  |  |  |
| **TMT A [s]** | 22.02 (9.30) | 81 | 19.84 (6.87) | 66 |  |  |  |
| **TMT B [s]** | 52.20 (20.60) | 81 | 47.75 (14.06) | 66 |  |  |  |
| **meanAVR** | 0.88 (0.07) | 77 | 0.89 (0.06) | 65 |  |  |  |
| **meanCRAE** | 195.28 (18.80) | 77 | 205.04 (16.40) | 65 | 0.001 | 1,139.836 | 10.923 |
| **meanCRVE** | 221.81 (19.17) | 77 | 231.89 (20.12) | 65 | 0.003 | 1,133.609 | 9.239 |
| **RRsys [mmHg]** | 121.97 (16.02) | 76 | 109.21 (16.26) | 67 | < 0.001 | 1,138.227 | 22.249 |

**Suppl. Table 6** Acute effects of the marathon (linear mixed models). Table shows analysis of visit 0 (within 1-2 weeks before the marathon) and visit 1 (immediately after the marathon).
All values are presented as mean (SD). P, df, F for parameters with significant effect of time: d prime 3-back, F(1,130.875)=0.003, P=0.956; d prime 2-back, F(1,126.361)=0.251, P=0.617; d prime 1-back, F(1,118.331)=6.747, P=0.011; d2 CP, F(1,135.734)=3.529, P=0.062; TMT A, F(1,143.705)=2.669, P=0.104; TMT B, F(1,140.938)=2.406, P=0.123; mean AVR, F(1,139.133)=0.227, P=0.635; mean CRAE, F(1,139.836)=10.923, P=0.001; mean CRVE, F(1,133.609)=9.239, P=0.003; and RRsys: F(1,138.227)=22.249, P<0.001.

AVR, arteriolar-to-venular ratio; B, regression coefficient B; CRAE, central retinal arteriolar equivalent; CRVE, central retinal venular equivalents; d prime, discriminability index; d2 CP, d2 test concentration performance; RR\_sys, systolic blood pressure; TMTA, Trail Making Test A; TMTB, Trail Making Test B

**Suppl. Figure 1**: Study timeline. Participants were assesssed 12 weeks before (Visit -1) and 1 to 2 weeks before the marathon (Visit 0), immediately after Munich marathon 2017 (Visit 1), at 24 (Visit 2.1) and 72 (Visit 2.2) hours after the marathon, and 12 weeks after the marathon (visit 3). This longitudinal design covered the training period, the acute marathon event and the follow-up period.

-12

-1

visit

weeks

Munich Marathon

-1

0

2.1/2.2

3

Training period

Follow-up