**Supplemental Material - "The evolution of subjective cognition after meditation training in older people: A secondary analysis of the three-arm Age-Well randomized controlled trial"**

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**Appendix II.** Additional measures

Other details on these additional measures can be found in Demnitz-King et al. (2023).

- **<u>Brain amyloid load</u>**:

The amyloid standard uptake value ratios correspond to late (50-60min) Florbetapir-PET acquisition: Amyvid (AV45) solution for injection of 4MBq/kg, 47 slices 2.7x2.7x3.27mm³.

- **<u>Apolipoprotein genotype</u>**:

Participants were considered as ε4 positive when they had at least one ε4 allele (i.e., ε2/ ε4, ε3/ ε4 or ε4/ ε4), and ε4 negative when no ε4 allele (i.e., ε2/ ε3 or ε3/ ε3).

- **<u>Credibility and Expectancy Questionnaire</u>**:

This questionnaire from Devilly & Borkovec (2000) measures the credibility the participant confers to the intervention and the expectancies he has about the outcomes. This scale is composed of 6 items: three questions for the credibility factor (Cronbach's $\alpha$ = between 0.81 and 0.86), and three for the expectancy factor (Cronbach's $\alpha$ = between 0.79 and 0.90) (Devilly & Borkovec, 2000). Each question is Z-scored based on the distribution of baseline values, then averaged for each factor. Scores are then Z-transformed again to create composite scores for credibility and expectancy, with higher scores indicating higher levels of credibility and expectancy.

- **<u>Waves in which participants were included</u>**:

There were three inclusion waves in the study (43 participants in the first one, 50 in the second one and 44 in the third one) corresponding to three periods of 3 months recruitment.

- **Adherence**:

It corresponds to the percentage of class attendance and was rated by the teachers.

- **Practice**:

It corresponds to the number of hours when the participant practiced meditation or learned English during classes and at home. It was rated by the participant himself.

- **Responsiveness**:

Across both intervention groups, whether, and the degree to which participants responded to their assigned intervention was assessed. Specifically, a **dichotomous categorical variable** classifying participants as either intervention 'responders' or 'non-responders', and a **continuous measure** of responsiveness were computed.

1) The **categorical score** (responder or non-responder) made the distinction between those who responded to the intervention and those who did not.
    a. For the meditation training group, it was based on the teachers' opinion regarding the participant's evolution (Likert scale from 0 "not at all" to 5 "a lot" with participants having scores of 0 or 1 ["very few"] considered as non-responders).
    b. For the non-native language training group, the score was created based on two scores: teacher's opinion on the same Likert scale than previously presented and results on an English test. Participants who were given a score of 0 or 1 by the teachers – and had an improvement of less than one point to the English test for the non-native language training group – were deemed to be non-responders.
2) The **continuous score** combined different standardized scores.
    a. For the meditation training group, three scores were used. First, a score of

change (post-intervention minus pre-intervention) on a global meditation composite score was calculated based on results on meditation questionnaires (see Schlosser et al., 2022 for more details). Second, we used scores related to the  perception of intervention responsiveness rated by the teachers (as in point 1) and another 5-Likert scale of their perception of the levels of connection, positive emotions, negative emotions, and meta-awareness of the participant. Third and finally, we considered scores related to the perception of intervention responsiveness rated by the participant on the same scale that presented in point 1 regarding both meditation sessions and daily life. The sub-scores of the meditation score were first standardized using relative means and standard deviation, and second were averaged into one score. The sub-scores of the teacher's rating were also first standardized using the relevant means and standard deviations and then averaged. The same procedure was applied for the sub-scores of the participant's rating. These three domain scores (global meditation score, teacher's perception and participant's perception) were each standardized again. The three standardized domain scores were then averaged and re-standardized to create the final responsiveness variable, with a mean of 0 and standard deviation of 1.

b.  For the non-native language training group, the final score was composed of two sub-scores:  the change on a score obtained on an English test and the perception of intervention responsiveness rated by the teachers as in point 1. Both domain scores (score on the English test and score on the question given to the teachers) were first standardized using the relevant means and standard deviations. The two standardized domain scores were then averaged and re-standardized create the final responsiveness variable, with a mean of 0 and standard deviation of 1.

- **State-Trait Anxiety Inventory (STAI)**:

This questionnaire from Spielberger et al. (1970) measures the level of anxiety of the participant. There are two subscales: STAI-trait (STAI B, Cronbach's $\alpha$ = 0.90) which measures the global anxiety of the participant and the STAI-state (STAI A, Cronbach's $\alpha$ = 0.93) which measures the anxiety felt by the participant at the present moment (Skapinakis, 2014). Each subscale is composed of 20 items. The score of each subscale varies from 20 (low level of anxiety) to 80 (high level of anxiety). The standardized delta score (post- minus pre-test scores / standard deviation of pre-test scores) of the STAI-trait (STAI-B) was calculated and used in the analyses.

- **Geriatric Depression Scale (GDS)**:

This questionnaire from Yesavage (1988) measures the level of depression of the participant. This is a 15-item scale (Cronbach's $\alpha$ = 0.92) and the score varies from 0 (low level of anxiety) to 15 (high level of anxiety) (Durmaz et al., 2018). The standardized delta score (post- minus pre-test scores / standard deviation of pre-test scores) was calculated and used in the analyses.

**References**

D'Agostino, R. B., Vasan, R. S., Pencina, M. J., Wolf, P. A., Cobain, M., Massaro, J. M., & Kannel, W. B. (2008). *General cardiovascular risk profile for use in primary care: The Framingham heart study.* Circulation, 117(6), 743–753. https://doi.org/10.1161/CIRCULATIONAHA.107.699579

Demnitz-King, H., Requier, F., Whitfield, T., Schlosser, M., Gonneaud, J., Ware, C., Barnhofer, T., Coll-Padros, N., Dautricourt, S., Delarue, M., Klimecki, O. M., Paly, L., Salmon, E., Schild, E.-

K., Wirth, M., Frison, E., Lutz, A., Chételat, G., Collette, F., & Marchant N. L. (2023). Effects of Meditation Training and Non-Native Language Training on Cognition in Older Adults: A Secondary Analysis of a Randomized Clinical Trial. *JAMA Network Open*, 6(7), e2317848.

Devilly, G. J., & Borkovec, T. D. (2000). *Psychometric properties of the credibility/expectancy questionnaire.* Journal of Behavior Therapy and Experimental Psychiatry, 31(2), 73–86. https://doi.org/10.1016/S0005-7916(00)00012-4

Godefroy, O. (2008). *Fonctions exécutives et pathologies neurologiques et psychiatriques. Evaluation en pratique clinique.* De Boeck Supérieur.

Groupe de réflexion sur les évaluations cognitives (GRECO). (1994). *Échelle d'évaluation de la démence de Mattis. Manuel de passation. Version française consensuelle.* Retrieved from http://site-greco.net/download/MATTIS_ FeuillesEx.pdf

Poitrenaud, J., Deweer, B., Kalafat, M., & Van der Linden, M. (2007). *Adaptation en langue française du California Verbal Learning Test.* Centre de Psychologie Appliquée.

Schlosser, M., Barnhofer, T., Requier, F., Deza-Araujo, Y. I., Abdoun, O., Marchant, N. L., Chételat, G., Collette, F., Klimecki, O. M., Lutz, A., André, C., Ashton, N., Allais, F., Asselineau, J., Arenaza-Urquijo, E., Bachelet, R., Baez, S., Batchelor, M., Beaugonin, A., … Wingrove, J. (2022). Measuring psychological mechanisms in meditation practice: Using a phenomenologically grounded classification system to develop theory-based composite scores. *Mindfulness, 13*(3), 600–614. https://doi.org/10.1007/s12671-021-01816-0

Skapinakis, P. (2014). Spielberger State-Trait Anxiety Inventory. In: Michalos, A.C. (eds) Encyclopedia of Quality of Life and Well-Being Research. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-0753-5_2825

Wechsler, D. (2008). *Wechsler Adult Intelligence Scale--Fourth Edition (WAIS-IV) [Database record].* APA PsycTests. https://doi.org/10 1037/ t15169-000

**Supplemental Table 1.** Raw data for anxiety and depression scales

| Variables of interest | Whole sample (N=135) | Number of people above the cut-off values |
|---|---|---|
| **STAI B raw pre-score,** *Mean ± SD* | 34.55 ± 7.02 | **Moderate anxiety** (score>37): 34/135 (25.19%)<br><br>**High anxiety** (score>44): 12/135 (8.89%) |
| **GDS raw pre-score,** *Mean ± SD* | 1.28 ± 1.75 | **Mild depression** (score>9): 1/135 (0.74%)<br><br>**Severe depression** (score>19): 0/135 (0%) |

*Note.* SD: Standard Deviation.

**Supplementary table 2.** Mixed model analyses with i) anxiety as covariate, ii) depression as covariate, iii) with a sample with more than 20% of adherence to the intervention (in comparison with no-intervention), with the responders to the intervention (in comparison with no-intervention)

| | | i) Anxiety as covariate | ii) Depression as covariate | iii) Adherence > 20% | iv) Subsample of responders |
|---|---|---|---|---|---|
| **Group effect on CDS delta score**, *estimate (95% CI)* | *Meditation training vs non-native language training* | -0.02 (-0.36, 0.32) | -0.01 (-0.35, 0.32) | -0.04 (-0.38, 0.30) | 0.01 (-0.35, 0.38) |
| | *Meditation training vs no intervention* | -0.16 (-0.50, 0.18) | -0.21 (-0.55, 0.14) | -0.16 (-0.50, 0.19) | -0.12 (-0.48, 0.24) |
| | *Non-native language training vs no intervention* | -0.14 (-0.49, 0.22) | -0.19 (-0.55, 0.17) | -0.12 (-0.47, 0.24) | -0.13 (-0.49, 0.23) |
| **Group effect on ASQ delta internal score**, *estimate (95% CI)* | *Meditation training vs non-native language training* | -0.13 (-0.53, 0.27) | -0.14 (-0.54, 0.26) | -0.14 (-0.54, 0.27) | -0.21 (-0.64, 0.22) |
| | *Meditation training vs no intervention* | -0.02 (-0.42, 0.39) | -0.02 (-0.43, 0.39) | -0.01 (-0.42, 0.40) | -0.09 (-0.51, 0.34) |
| | *Non-native language training vs no intervention* | 0.11 (-0.31, 0.54) | 0.12 (-0.32, 0.55) | 0.12 (-0.30, 0.55) | 0.12 (-0.30, 0.55) |
| **Group effect on ASQ delta external score** *estimate (95% CI)* | *Meditation training vs non-native language training* | **-0.36 (-0.69, -0.05)** | **-0.37 (-0.69, -0.05)** | **-0.37 (-0.69, -0.05)** | **-0.36 (-0.70, -0.02)** |
| | *Meditation training vs no intervention* | **-0.35 (-0.67, -0.02)** | **-0.35 (-0.67, -0.02)** | **-0.34 (-0.66, -0.02)** | -0.34 (-0.68, 0.002) |
| | *Non-native language training vs no intervention* | 0.02 (-0.32, 0.37) | 0.02 (-0.32, 0.37) | 0.03 (-0.31, 0.37) | 0.02 (-0.32, 0.37) |

*Note.* CI: Confidence Interval, CDS: Cognitive Difficulties Scale, Tukey-Cramer correction for 95% CI of the group effect. Adjusted for education, age, gender and baseline outcome data.

**Supplementary table 3.** Mixed model analyses with different predictors

| Predictor | Estimate (95% CI) | | | | | |
|---|---|---|---|---|---|---|
| | **Meditation training** | | | **Foreign language training** | | |
| | **CDS** | **ASQ internal** | **ASQ external** | **CDS** | **ASQ internal** | **ASQ external** |
| **Age** | 0.002 (-0.05, 0.06) | -0.02 (-0.08, 0.05) | -0.05 (-0.11, 0.01) | **0.02 (0.01, 0.08)** | **0.07 (0.02, 0.12)** | 0.01 (-0.03, 0.05) |
| **Sex** [1] | 0.02 (-0.49, 0.52) | 0.06 (-0.48, 0.61) | 0.25 (-0.22, 0.71) | -0.21 (-0.56, 0.15) | -0.07 (-0.51, 0.37) | 0.20 (-0.14, 0.53) |
| **Education** | -0.01 (-0.08, 0.07) | -0.06 (-0.15, 0.02) | -0.02 (-0.10, 0.06) | -0.07 (-0.03, 0.06) | 0.04 (-0.04, 0.11) | -0.003 (-0.06, 0.05) |
| **Baseline score** | -0.01 (-0.03, 0.01) | **-0.10 (-0.15, -0.04)** | **-0.06 (-0.10, -0.02)** | -0.01 (-0.02, 0.0001) | -0.03 (-0.08, 0.02) | **-0.09 (-0.13, -0.04)** |
| **APOE** [2] | -0.11 (-0.62, 0.41) | -0.21 (-0.76, 0.34) | -0.17 (-0.67, 0.34) | 0.21 (-0.18, 0.59) | -0.11 (-0.60, 0.38) | -0.13 (-0.49, 0.24) |
| **Amyloid** | **1.87 (0.52, 3.22)** | -1.21 (-2.82, 0.40) | 1.00 (-0.39, 2.38) | 0.39 (-0.55, 1.33) | 0.18 (-1.03, 1.38) | 0.29 (-0.62, 1.19) |
| **Credibility** | -0.01 (-0.29, 0.26) | -0.03 (-0.33, 0.26) | -0.05 (-0.31, 0.22) | -0.06 (-0.25, 0.14) | 0.18 (-0.04, 0.41) | 0.003 (-0.17, 0.18) |
| **Expectancy** | -0.04 (-0.31, 0.23) | -0.20 (-0.48, 0.09) | -0.001 (-0.26, 0.26) | -0.12 (-0.29, 0.05) | **0.21 (0.01, 0.40)** | -0.11 (-0.27, 0.05) |
| **Adherence** | -0.01 (-0.04, 0.02) | -0.01 (-0.04, 0.02) | 0.02 (-0.004, 0.05) | 0.005 (-0.01, 0.02) | 0.001 (-0.02, 0.02) | -0.0001 (-0.01, 0.01) |
| **Wave** [3] | | | | | | |
| **Wave 2** | -0.25 (-0.82, 0.32) | -0.03 (-0.65, 0.60) | 0.47 (-0.06, 0.99) | 0.29 (-0.13, 0.71) | -0.30 (-0.89, 0.28) | -0.17 (-0.62, 0.28) |
| **Wave 3** | 0.16 (-0.44, 0.77) | 0.05 (-0.58, 0.67) | 0.47 (-0.05, 0.99) | 0.09 (-0.31, 0.49) | -0.04 (-0.56, 0.49) | -0.17 (-0.56, 0.23) |
| **Practice** | -0.00002 (-0.00005, 0.000004) | -0.00001 (-0.00003, 0.00002) | 0.00001 (-0.00002, 0.00003) | -0.000003 (-0.00003, 0.00001) | -0.000002 (-0.00004, 0.00001) | -0.0000002 (-0.00002, 0.00002) |
| **Responsiveness** | -0.16 (-0.40, 0.08) | -0.10 (-0.37, 0.16) | -0.04 (-0.28, 0.20) | 0.03 (-0.15, 0.20) | -0.06 (-0.29, 0.17) | -0.02 (-0.19, 0.15) |

*Note.* Estimates and confidence intervals (CI 95%) of the different predictors with age, gender, education and baseline data as covariates. **Significant results (p<.05) in bold.** CDS: Cognitive Difficulties Scale, ASQ:

Attentional Style Questionnaire, CI: Confidence intervals, APOE: Apolipoprotein E), [1] Reference sex is male. [2] Reference APOE genotype is no ε4 allele. [3] Reference wave is the first wave).