

Supplementary material

A

Diagnostic material

Wender-Reimherr-Interview (German version from the Homburger ADHD Scales for Adults [HASE]; Rösler, Retz-Junginger, Retz, & Stieglitz, 2008) – It contains questions for 28 characteristics referring to seven domains of adult ADHD (postulated by Wender, Wolf, & Wasserstein, 2001): attention deficits, motor hyperactivity, disorganization, impulsivity, affective lability, emotional over reactivity, and hot temper. Every characteristic is rated with 0 (“not at all”), 1 (“lightly”) or 2 (“moderately to highly”) by the interviewer, sum scores for every domain and in total are calculated. The interviewer gives a global rating for every domain from 0 (“none”) to 4 (“very severe”). Every domain can be evaluated as clinical relevant in cases of a global rating ≥ 2 combined with a sum score larger than the number of included characteristics for the domain. Clinical relevance for inattention and hyperactivity and at least two more domains indicate ADHD symptoms that are specific for adulthood. Another criterion is a total sum score ≥ 40 . One of the two criteria was required for our ADHD group.

Structured Clinical Interview for DSM-IV (SKID I; Wittchen, Zaudig, & Fydrich, 1997) – It provides standardized questions for all diagnoses of DSM-IV Axis 1. Screening questions from the manual supplemented with screening questions from *Diagnostic Interview for Mental Disorders* (Schneider & Margraf, 2006) were obtained. If necessary further questions from the interview sections were evaluated to diagnose comorbid disorders, determine differential diagnosis from ADHD or exclusion criteria.

Short version of the Wender Utah Rating Scale (German version from the HASE; Rösler et al., 2008) – It consists of 21 items with characteristics of childhood

ADHD and four control items. Participants evaluate them from 0 (“not at all”) to 4 (“very much”) for the age between 8 and 10. A sum score is calculated.

ADHD Self-Report Scale (from the HASE; Rösler et al., 2008) – Participants rate 18 items from 0 (“not at all”) to 3 (“very much”) that represent the criteria for ADHD of International Classification of Diseases 10 (ICD-10). Sum scores are generated for inattention, impulsivity, hyperactivity and the whole questionnaire.

Questionnaire for level of functioning (from the Cologne ADHD Test for Adults [KATE]; Lauth & Minsel, 2014) – For eight domains of functioning two items each are given and evaluated from 1 (“very good”) to 10 (“bad”) as well as an item on general functioning. Percentiles for the total score are available.

Adult ADHD Self-Report Scale (German version from the KATE; Lauth & Minsel, 2014) – It contains 18 items referring to the ICD-10 criteria of ADHD and was originated from the World Health Organization. Participants rate them from 0 (“never”) to 4 (“very often”), the clinical range is highlighted in grey and items are summed.

Conners' Adult ADHD Rating Scales (CAARStm; German version: Christiansen, Hirsch, Abdel-Hamid, & Kis, 2014) – 66 items for actual symptoms of adult ADHD are rated from 0 (“not at all”) to 3 (“very much/ often”), sum up to several domains and T-values are available. We used the ADHD-Index.

Beck Depression Inventory II (BDI II; German version: Hautzinger, Keller, & Kühner, 2009) – The inventory quantifies symptoms of major depression during the last two weeks. It provides 21 items with respectively four options ranging from 0 (“not present”) to 3 (“severe”). A significant depressive syndrome must have been verified with criteria of SKID-I (Wittchen et al., 1997).

Table 4

Additional Methods and Tasks

Test	Subtest/ Version	Reference	Administration
Diagnostic			
Assessment: ca. 2 hours 30 minutes			
Personality Styles-and-Disorders-Inventory (PSSI)		Kuhl, J., & Kazén, M. (2009). <i>Persönlichkeits-Stil-und-Störungs-Inventar (PSSI)</i> . Manual [Personality Styles-and-Disorders-Inventory]. Göttingen, Germany: Hogrefe.	End of session
Questionnaire for Experiences of Attention Deficit (FEDA)		Zimmermann, P., Messner, C., Poser, U., & Sedelmeier, P. (1991). <i>Ein Fragebogen erlebter Defizite der Aufmerksamkeit (FEDA)</i> [Questionnaire for Experiences of Attention Deficit]. Universität Freiburg, Germany: Unveröffentlichtes Manuskript.	After session at home
Dysexecutive Questionnaire (DEX)	Self-report	Ufer, K. (2000). <i>Behavioural Assessment of the Dysexecutive Syndrome (BADs)</i> (German ed.). Göttingen, Germany: Hogrefe.	After session at home
Questionnaire on social integration (FSI)		Wietersheim, J. von, Ennulat, A., Probst, B., Wilke, E., & Feiereis, H. (1989). Konstruktion und erste Evaluationen eines Fragebogens sozialen Integration [Construction and initial evaluations of a questionnaire on social integration]. <i>Diagnostica</i> , 35(4), 359–363.	After session at home
ICF-MentalA&P		Brütt, A. L., Schulz, H., & Andreas, S. (2015). Replikation der psychometrischen Gütekriterien des ICF-PsychA&P [Replication of the psychometric properties of the ICF-MentalA&P]. <i>Die Rehabilitation</i> , 54(1), 38–44.	After session at home
Frankfurt Self-Concept Scales (FSKN)		Deusinger, I. M. (1986). <i>Die Frankfurter Selbstkonzeptskalen: (FSKN); Handanweisung</i> [Frankfurt Self-Concept Scales]. Göttingen, Germany: Hogrefe.	After session at home

Short scale for measuring general self-efficacy beliefs (ASKU)		Beierlein, C., Kemper, C. J., Kovaleva, A., & Rammstedt, B. (2013). Kurzsкала zur Erfassung allgemeiner Selbstwirksamkeitserwartungen (ASKU) [Short Scale for Measuring General Self-efficacy Beliefs (ASKU)]. <i>Methoden, Daten, Analysen</i> , 7(2), 251–278.	After session at home
EF-task			
Assessment: ca. 2 hours			
German Test Battery for Attentional Performance (TAP)	Alertness, GoNogo (1 of 2), Working Memory (level 2)	Zimmermann, P., & Fimm, B. (2011). <i>Testbatterie zur Aufmerksamkeitsprüfung Version 2.2</i> [Test Battery for Attentional Performance]. Herzogenrath, Germany: Psychologische Testsysteme.	Alertness: beginning and end of session GoNogo: 4 th task during session Working Memory: 5 th task during session
California Verbal Learning Test (CVLT)	S1	Niemann, H., Sturm, W., Thöne-Otto, A. I. T., & Willmes, K. (2008). <i>California Verbal Learning Test (CVLT). Deutsche Adaptation. Manual</i> . Frankfurt, Germany: Pearson Assessment.	2 nd task during session
Zoo map: from the German version of the Behavioural Assessment of the Dysexecutive Syndrome (BADS)	Version 1	Ufer, K. (2000). <i>Behavioural Assessment of the Dysexecutive Syndrome (BADS) (German ed.)</i> . Göttingen, Germany: Hogrefe.	3 rd task during session
d2 Test of Attention	4 minutes for complete task	Brickenkamp, R. (2002). <i>Test d2 - Aufmerksamkeits-Belastungs-Test</i> [d2 Test of Attention] (9th ed.). Göttingen, Germany: Hogrefe.	6 th task during session
Trail Making Test (TMT): from the German version of the Consortium to Establish a Registry for Alzheimer's Disease (CERAD-Plus)	A & B	Monsch, A. U., & Kressig, R. W. (2010). Specific care program for the older adults: Memory Clinics. <i>European Geriatric Medicine</i> , 1(2), 128–131.	7 th task during session

Letter-Number Sequencing (BZF)		Petermann, F. (2012). <i>WAIS-IV Wechsler Adult Intelligence Scale - Fourth Edition: Deutschsprachige Adaptation nach David Wechsler</i> . Frankfurt am Main, Germany: Pearson Assessment.	8 th task during session
Regensburger word fluency test (RWT)	p-words, animals, G-R, sports-fruits	Aschenbrenner, S., Tucha, O., & Lange, K. (2010). Regensburger Wortflüssigkeits-Test (RWT) [Regensburger word fluency test]. Göttingen, Germany: Hogrefe.	10 th task during session
Assessment of EF-tasks with material close to daily life			
Positive and negative affect schedule (PANAS)	Time frame: “at the moment”	Krohne, H. W., Egloff, B., Kohlmann, C.-W., & Tausch, A. (1996). Untersuchungen mit einer deutschen Version der „Positive and Negative Affect Schedule“ (PANAS) [Investigations with a German version of the Positive and Negative Affect Schedule (PANAS)]. <i>Diagnostica</i> , 42(2), 139–156.	beginning of both sessions with EF- tasks with material close to daily life
State-Trait Anxiety Inventory (STAI)	State-Version	Laux, L., Glanzmann, P., Schaffner, P., & Spielberger, C. D. (1981). <i>Das State-Trait-Angstinventar (STAI)</i> (1st ed.). Weinheim, Germany: Beltz Test GmbH.	beginning of both sessions with EF- tasks with material close to daily life
Observation of inattentive and hyperactive behavior during tasks	Frequency	Based on American Psychiatric Association. (2013). <i>Diagnostic and statistical manual of mental disorders (5th edition)</i> . Arlington, VA: American Psychiatric Publishing.	During both assessment dates with EF-tasks with material close to daily life

Table 5

Comorbid Disorders in the ADHD Group

	% lifetime	% current
Affective disorders		
Major depression, single Episode	19.4	5.6
Major depression, recurrent	44.4	16.7
Dysthymia	-	5.6
Bipolar Disorder	-	2.8 (depressive)
Major depression, unspecified	2.8	5.6
Anxiety disorders		
Social phobia	16.7	16.7
Agoraphobia	2.8	2.8
Panic Disorder	11.1	2.8
Specific Phobia	5.6	8.3
Adjustment Disorders	5.6	-
Somatoform Disorders		
Somatoform pain disorder	-	2.8
Eating Disorders	5.6	2.8
Substance Disorders		
Abuse	33.3	-
Dependency (nicotine or cannabis)	8.3	2.8 (nicotine)

Note. Multiple Diagnosis possible.

Table 6

Tasks and Manipulation

Task (domain)	Manipulation	Aim	Manipulation check
Auction (Inhibition)	Monetary reward and performance feedback during task	Increasing motivation (and activation)	Subjective report after task about motivation/activation (Likert scale 0-4)
Editing (Selective Attention)	Acute physical exercise on bicycle ergometer before task	heighten physical activation	Heart rate during exercise and before task
Lecture Evaluating (Working Memory)	Continuous physical stimulation (anti-stress ball) during task	Increasing arousal or diminishing fatigue effect	Subjective report before and after task for arousal (7 items, Likert scale “not at all” to “extremely”)

B

Future Research

First, reward operationalization needs to be more transparent and reinforcer should be applied separately. Baseline (absence of reward) must be carefully considered and different amounts of reward on the same sort of task would be helpful to assess the stage of optimal performance for adults with ADHD. Second, acute exercise needs to be longer in time or more intensive. Third, for continuous motor movement a more passive administration should be chosen to prevent divided attention effects. Perhaps an auditory presented task fits better to tactile stimulation. Assessment of manipulation success should be more sensitive for this subtle manipulation than subjective report.