Influence of a multidimensional music-based exercise program on selected cognitive and motor skills in dementia patients – A Pilot-Study.

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Author contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [Prinz A.] and [Schumacher A.]. The first draft of the manuscript was written by [Prinz A.] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Table 1 cognitive test procedures

cognition		
CERAD-NP-Plus (Morris et al. 1989)		
Test procedure (subtest)	**Cognitive area**	**Declaration**
verbal fluency (animals)	Executive functions	- - name as many animals as possible in one minute - - Score is unlimited
Boston-Naming-Test	Word finding and naming, visual perception	- the short form contains 15 images that would need to be named - 3 groups of items: o first group contains 5 frequent items o the second group contains 5 medium frequent items, o the third group contains 5 rare items
Mini-Mental State Examination	General cognitive function level (Screening)	- Answering questions to determine the cognitive abilities of older people - - maximum 30 points
Memory list sum of immediate recall	Verbal memory	- Ten words are read out one after the other and then recalled from memory. - - is performed three times, are the same ten terms only in different orders - - Number of remembered terms in the three rounds á ten terms (max. 30 points possible)
Constructional praxis copy	Visuoconstructive skills	- 4 pictures have to be painted (circle, parallelogram, 2-square, cube) - - maximum 11 points
Word list delayed recall	Verbal memory (delayed verbal memory)	- free reproduction of the 10 terms from the word list memory test - - maximum 10 points
Word list Recognition recall	Verbal memory (delayed verbal memory, recognition)	- - the 10 already mentioned terms and 10 new terms are presented to the respondent - - the respondent has to declare the 10 already mentioned terms as "already known" and the 10 new ones as "not known".

Constructional praxis recall	Nonverbal memory (delayed figural memory)	- Drawing the figures from the constructive part from memory - - maximum 11 points
Trail-Making-Test A	Psychomotor speed, Executive functions	- number linking as fast as possible (from 1-25) - - max. 180 s
Trail-Making- Test B	Executive functions	- combine numbers and letters alternately, keeping the numerical and alphabetical sequence, respectively (1-13; A-L) - max. 300 s
Quality criteria: - Reliability: Interrater reliability: ICC = 0.92 - 1.00 (American version) - Test-restest reliability: good according to authors - - Validity: o Criterion validity: for American version moderate to high correlation with other dementia measures (Ex. R = -.83 Clinical Dementia Rating Scale). o Construct validity: sensitive differentiation between healthy and dementia patients and between the severity of cognitive impairment.		

Table 2 motor skills test procedure

Motor function		
Test procedure	**Motor area**	**declaration**
modified Chair-Rising-Test (Le Berre et al. 2016)	Strength and coordination of the leg muscles	- Measures how long it takes a respondent to stand up and sit down five times with hand assistance. - Score from zero (>60s, high risk of falling) to four (<11.2s, low risk of falling)
	Quality criteria: • Reliability: Interrater reliability: ICC = 0.99 - 1.00 o Test-retest reliability: ICC = 0.95 - 0.99 • Validity: o Construct validity: strong convergences with physical performance (r = -0.59; Incremental Shuttle Walk Test).	

<table>
<tr><td rowspan="2">Drop bar-Test

(Fetz et al. 1978)</td><td>Elementary (simple) reactivity</td><td>- Response measured how fast the subject can grasp the falling rod (in cm)
- subject has three repetitions with the dominant hand
- best value goes into the evaluation</td></tr>
<tr><td colspan="2">Quality criteria:
Objectivity: .83 - .95 (Fetz & Konexl, 1978, p.52); .72 - .91 (Richter & Beuker, 1976).
Reliability: .83 - .91 (Fetz & Konexl, 1978, p.52); .58 (Richter & Beuker, 1976)</td></tr>
<tr><td rowspan="2">Hand Dynamometer

(Richards et al. 1996)</td><td>Hand force
(current muscle force)</td><td>- grip strength is measured in both hands (in Newton)
- three repetitions are performed with each hand
- maximum value is included in the evaluation</td></tr>
<tr><td colspan="2">Quality criteria:
Objectivity very high if the exact implementation rules are followed (Oltman, 2012).
Reliability: .89 -.96 (Fetz & Kornexl, 1993)
Content- and construct-related validity is taken as given (Oltmann, 2012)
Criterion-related validity is also taken as given (Oltmann, 2012).</td></tr>
<tr><td rowspan="2">Timed-Up-and-Go-Test

D. Podsiadlo & S. Richardson (1991)</td><td>Mobility restriction</td><td>The test person is to stand up from a sitting position without assistance, walk back and forth for 3 meters and sit down again (aids are allowed)

Score from ≤10s (Everyday mobility unrestricted) to ≥30 (Pronounced mobility restriction, usually intervention/ Need for assistive devices)</td></tr>
<tr><td colspan="2">Quality criteria:
Reliability: Interrater reliability: ICC = 0.91 (Rydwik,2011)
Test-retest reliability: ICC = 0.96 - 0.99 (Flansbierr,2005)
Validity:
Criterion validity: Berg Balance Scale (r=0.81), Barthel Index (r=0.78) (Podsiadlo, 1991)</td></tr>
</table>

Table 3 Quality of life

<table>
<tr><th colspan="3">Quality of life</th></tr>
<tr><th>Test procedure</th><th>Area</th><th>declaration</th></tr>
<tr><td>NOSGER II

(Spiegel et al. 1991)</td><td>Quality of life (screening)</td><td>- Questionnaire filled out by the nursing staff (external assessment)
- A total of 30 items distributed over the following dimensions:
o Memory,
o Instrumental activities
o Activities of daily living
o mood
o social behavior
o disruptive behavior
- Response options from "always" to "never
- low values no or only minor disturbances
- high values clear disturbances in the behavioral areas</td></tr>
<tr><td colspan="3">Quality criteria:
• Interrater reliability: r = .53 - .89
• Retest reliability: r = .84 - .92 (2 weeks); r = .75 - .93 (30 days)
• Validity:
o Criterion validity: varying degrees of correlation with external criteria, depending on the dimension considered (ex. MMSE: r = .32 - .82)
o Construct validity: discrimination between healthy and impaired persons with regard to dementia.</td></tr>
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