Data Article

Effect of aerobic exercise on cortical thickness in patients with schizophrenia—A dataset

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ARTICLE INFO

ABSTRACT

This is a data article from the original publication "Effect of aerobic exercise combined with cognitive remediation on cortical thickness and prediction of social adaptation in patients with schizophrenia" [1]. Twenty-one patients with schizophrenia and 23 healthy controls underwent aerobic exercise. Another 21 patients with schizophrenia played table soccer instead. The 12-week exercise intervention was combined with computer-assisted cognitive remediation training from week 6 to week 12. Clinical assessments were conducted at baseline and after the 12-week intervention. Magnetic resonance imaging (MRI) scans were acquired at baseline then in weeks 6, 12, and 24. The thickness of the entorhinal, parahippocampal, and lateral and medial

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prefrontal cortices was assessed with FreeSurfer 6.0. Data are publicly available via https://osf.io/sfgxk/.

Specifications table

Subject	Psychiatry and Mental Health
Specific subject area	Effect of aerobic exercise on cortical thickness in patients with schizophrenia
Type of data	Table, Image
How data were acquired	Clinical assessments: Global Assessment of Functioning (GAF), Social Adjustment Scale-II (SAS-II), Clinical Global Impression-Severity (CGI), Positive and Negative Syndrome Scale (PANSS), Calgary Depression Scale for Schizophrenia (CDSS), Verbal Learning Memory Test (VLMT), Trail Making Tests parts A and B (TMT-A, TMT-B), Wisconsin Card Sorting Test (WCST). Composite measures of short-term memory (STM) and long-term memory (LTM) were obtained from previous factor analyzes of the VLMT.
	MRI scans: single 3T scanner (Magnetom TIM Trio, Siemens Healthcare, Erlangen, Germany) with a standard 8-channel phased-array head coil.
Data format	Raw, Comma Separated Value *.csv
	Analyzed, Nifti *.nii.gz
Parameters for data collection	MRI scan: 3D anatomical T1- weighted dataset of the whole head (Magnetization Prepared Rapid Gradient Echo [MPRAGE]; 176 continuous sagittal slices of 1 mm thickness, echo time $= 3.26$ ms, repetition time $= 2250$ ms, inversion time $= 900$ ms, flip angle 9°, in-plane voxel size $1 \times 1 \times 1$ mm^3).
Description of data collection	The participants were recruited at the Department of Psychiatry and Psychotherapy of the University Medical Center Goettingen.
Data source location	Munich, Germany, Latitude 48°07′57.6″N, Longitude 11°33′34.2″E
Data accessibility	The analyzed data can be downloaded from https://osf.io/sfgxk/.
Related research article	Shun Takahashi, Daniel Keeser, Boris-Stephan Rauchmann, Thomas Schneider-Axmann, Katriona Keller-Varady, Isabel Maurus, Peter Dechent, Thomas Wobrock, Alkomiet Hasan, Andrea Schmitt, Birgit Ertl-Wagner, Berend Malchow, Peter Falkai
	Effect of aerobic exercise combined with cognitive remediation on cortical thickness and prediction of social adaptation in patients with schizophrenia
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Value of the data

- Our dataset shows the longitudinal effect of aerobic exercise on clinical symptoms and structural brain imaging in patients with schizophrenia.
- Researchers on neuroimaging and/or sports scientists may benefit from this dataset.
- This dataset is useful for the research of exercise effects in psychiatric diseases or the research of longitudinal brain changes in patients with schizophrenia.

1. Data description

The dataset in this article supports the research article "Effect of aerobic exercise combined with cognitive remediation on cortical thickness and prediction of social adaptation in patients with schizophrenia" [1]. Our dataset shows the longitudinal effect of aerobic exercise on
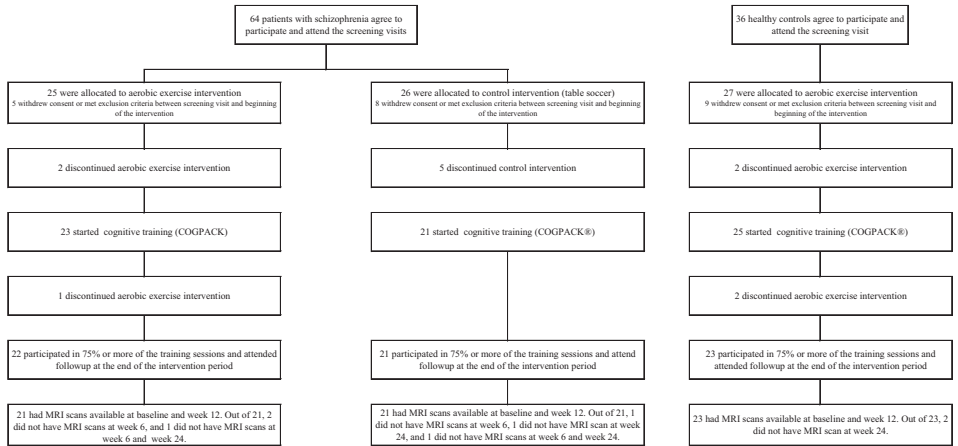
Fig. 1. Flowchart of the participants and dropouts.

clinical symptoms and structural brain imaging in patients with schizophrenia compared to healthy controls. A 12-week exercise intervention was combined with computer-assisted cognitive remediation training between weeks 6 and 12. Clinical assessments were performed at baseline and after the 12-week intervention. Magnetic resonance imaging (MRI) scans were acquired at baseline and weeks 6, 12, and 24. Clinical data and cortical thickness values and the longitudinal MRI data of all subjects can be downloaded from https://osf.io/sfgxk/. The CSV file "participant_clinical_data" contains demographic and clinical variables and the CSV file "cortical_thickness_results" contains cortical thickness values.

2. Experimental design, materials, and methods

The participants comprised 21 patients with schizophrenia that undertook aerobic exercise (SCZ-EX group), 21 patients with schizophrenia that played table soccer (SCZ-EXCONT group), and 23 healthy controls that underwent aerobic exercise (HC-EX group). The participants were recruited at the Department of Psychiatry and Psychotherapy of the University Medical Center Goettingen. Inclusion criteria were: diagnosis of schizophrenia according to the International Statistical Classification of Diseases and Related Health Problems10th revision (ICD-10) with confirmation by MINI-Plus Interview, patient age between 18 and 60 years, and a history of at least two confirmed psychotic episodes. The patients in the SCZ-EX group were recruited first, followed by patients for the SCZ-EXCONT group. Healthy controls were matched for age, sex, and handedness to participants in the SCZ-EX group. Fig. 1 is a flowchart of the number of participants and dropouts. The local ethics committee approved this clinical trial, which was performed in accordance with the Declaration of Helsinki (https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/). All participants provided written informed consent prior to inclusion in this clinical trial which was registered at www.clinicaltrials.gov (NCT01776112).

Fig. 2 shows the exercise intervention protocol. Exercise training consisted of three 30-min sessions per week. Aerobic exercise was conducted on bicycle ergometers (Ergobike Premium 8, Daum electronic GmbH, Fürth, Germany) at an individually defined intensity that was gradually increased until blood lactate concentrations reached approximately 2 mmol/l. The non-aerobic exercise group played table soccer in groups of two to four players for the same amount of time as the aerobic exercise group. The same sports scientist supervised both the intervention and control groups. After 6 weeks of either aerobic exercise or table soccer, all participants per-
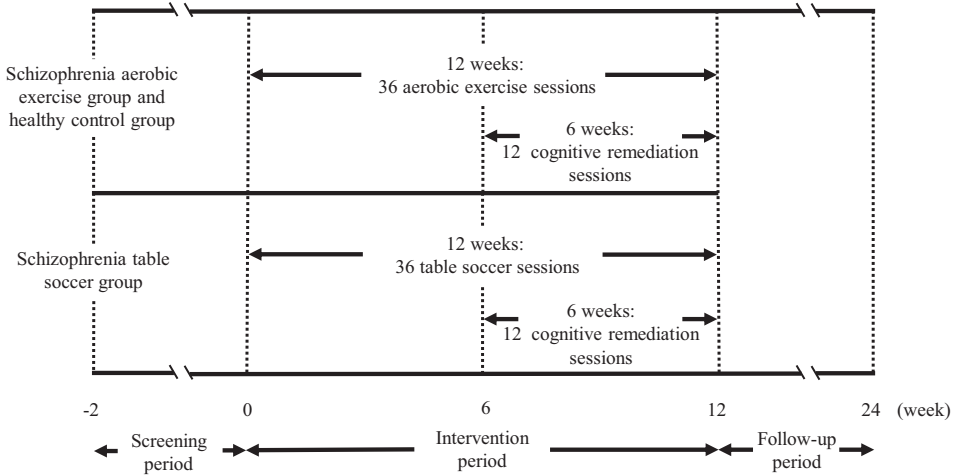
Fig. 2. Protocol for exercise intervention. After a two-week screening period, patients with schizophrenia and healthy controls eligible for the study began a 12-week exercise intervention combined with computer-assisted cognitive remediation training from week 6 to week 12. Weeks 12 to 24 were a training-free follow-up period.

formed an additional standardized cognitive remediation training with the computer-assisted training program COGPACK (software version 8.19 D/8.30 DE; Marker Software, Ladenburg, Germany). Participants completed the memory and attention tasks twice per week in weeks 6 to 12. Each session lasted 30 min and took place after the aerobic exercise or table soccer session. Weeks 12 to 24 were a training-free follow-up period.

Clinical assessments were performed at baseline and after the 12-week intervention with the following scales: Global Assessment of Functioning (GAF) was used to assess global functioning and Social Adjustment Scale-II (SAS-II) (subscale of work, household, social/leisure activity, general) was used to assess patients' functional adaptation. To assess psychiatric symptoms, Clinical Global Impression-Severity (CGI), Positive and Negative Syndrome Scale (PANSS) positive, negative, general, and total scores, and Calgary Depression Scale for Schizophrenia (CDSS) were used. To assess cognitive functions, Verbal Learning Memory Test (VLMT), Trail Making Tests parts A and B (TMT-A, TMT-B), and Wisconsin Card Sorting Test (WCST) were used. Composite measures of short-term memory (STM) and long-term memory (LTM) were obtained from previous factor analyzes of the VLMT [2]. All raters and other people assisting with the cognitive testing were blinded to the interventions.

Structural MRI scans were acquired at baseline (T1) and in weeks 6 (T2), 12 (T3), and 24 (T4). All images were quality controlled by a board-certified radiologist. Cortical thickness was assessed using FreeSurfer (v6.0, http://surfer.nmr.mgh.harvard.edu/) [3]. The command was "recon-all -s subject_ID -i subject_ID.nii.gz -all". The cortical surface of each hemisphere was inflated to an average spherical surface to locate both the pial surface and the boundaries between white and gray matter. Cortical thickness was measured based on the shortest distance between the pial surface and the white matter/gray matter boundary at each point across the cortical mantle. The quality of pre-processed images was visually checked and no participants were excluded. FreeSurfer software automatically divided the cerebral cortex into 34 cortical regions in each hemisphere according to the Desikan-Killiany cortical labeling protocol [4] and the mean cortical thickness of each of these regions were calculated. The entorhinal and parahippocampal cortices were included in these 34 cortical regions. The lateral prefrontal cortex was defined by combining rostral and caudal middle frontal, pars opercularis, and pars triangularis regions. The medial prefrontal cortex was a combination of the superior frontal, frontal polar, and rostral and caudal anterior cingulate regions (Fig. 3).
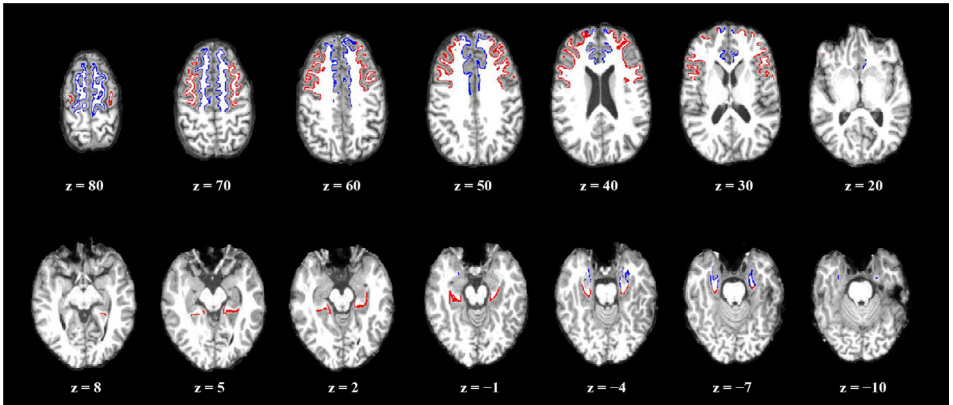
Fig. 3. Cortical regions of interest in an individual structural MRI image. Top row: blue area is medial prefrontal cortex and red area is lateral prefrontal cortex. Lower row: blue area is entorhinal cortex and red area is parahippocampal cortex. Images are displayed in radiological convention (i.e. patient's left on the right of the image). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Statistical analysis can be found in the original publication, doi:10.1016/j.schres.2019.11.004 [1].

Conflict of interest

S. Takahashi, D. Keeser, B. Rauchmann, T. Schneider-Axmann, K. Keller-Varady, I. Maurus, P. Dechent, T. Wobrock, B. Ertl-Wagner, and B. Malchow report no conflicts of interest. A. Hasan received funding from Lundbeck, Janssen-Cilag, and Pfizer, received a paid speakership from Desitin, Otsuka, and Lundbeck and was a member of a Roche advisory board. A. Schmitt was an honorary speaker for TAD Pharma and Roche and a member of Roche advisory boards. P. Falkai has been an honorary speaker for AstraZeneca, Bristol Myers Squibb, Lilly, Essex, GE Healthcare, GlaxoSmithKline, Janssen Cilag, Lundbeck, Otsuka, Pfizer, Servier, and Takeda and has been a member of the advisory boards of Janssen-Cilag, AstraZeneca, Lilly, and Lundbeck.

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