Exploratory Research and Hypothesis in Medicine **2024** vol. 9(2) | 178–180
DOI: 10.14218/ERHM.2023.00011

Letter to the Editor

Cortical Brain Response to Acute Bouts of Exercise in Patients with Severe Psychiatric Disorders: Report of Three Cases

Renato Sobral Monteiro-Junior[1,2,3,4*], Iaggo Raphael David[3], Iara Heloísa Ramos Mendes[3], Luciana Aparecida Coutinho[3], Biancart José Monteiro Júnior[5] and Henrique Nunes Pereira Oliva[1,3,6]

[1]Postgraduation Programme of Health Sciences, State University of Montes Claros, Montes Claros, Minas Gerais, Brazil; [2]Postgraduation Programme of Neurology/Neuroscience, Fluminense Federal University, Niterói, Rio de Janeiro, Brazil; [3]Research and Study Group in Neuroscience, Exercise, Health and Sport – GENESEs, Physical Education Department, State University of Montes Claros, Minas Gerais, Brazil; [4]Institute of Innovation and Health Research – IPS, Aroldo Tourinho Hospital, Montes Claros, Minas Gerais, Brazil; [5]Psychiatry Service, Aroldo Tourinho Hospital, Montes Claros, Minas Gerais, Brazil; [6]Department of Psychiatry, Yale University School of Medicine, New Haven, Connecticut, USA

Received: February 16, 2023 | **Revised:** February 24, 2023 | **Accepted:** March 06, 2023 | **Published online:** April 13, 2023

Dear Editor,

Patients with severe psychiatric disorders have multiple morbidities, high risk of mortality associated with drug treatments, and experience low levels of physical activity (PA).[1] PA has been recommended to improve general health of these patients.[1,2] However, the effects of planned PA on brain responses in patients with psychosis or addiction remain unclear. Here, we present the effects of exercise on cortical brain response for three patients with severe psychiatric disorders at the Hospital Aroldo Tourinho (Montes Claros, Brazil).

Psychiatric inpatients with no head trauma were diagnosed by attending psychiatrists. A woman was diagnosed with bipolar disorder (BD) (Patient 1), while two men presented with addiction (ADD) to illicit drugs; one was diagnosed with schizophrenia (SCZ, Patient 2), and the other presented with no other disorders (Patient 3). Patient characteristics are shown in Table 1. Individuals were admitted to the hospital and were stable (using anti-psychotic drugs), oriented to regular supervised exercise, and administered psychotherapy as standard procedures at the hospital. Brain mapping based on a six-minute electroencephalography (EEG, 20 electrodes) in a seated and quiet position with closed eyes was recorded using Neurometria v6® (Bioevolution, Campinas, Brazil).[3] According to the wave frequency, power, and amplitude, the machine used an algorithm to create graded colored neuroimages that indicate the intensity of cortical activity. EEG was recorded before and after a single bout of 30 min exercise and control (chatting) conditions. Exercise included aerobic training (10 min bicycle), 2–3 sets of 10–15 repetitions of resistance training (rowing with elastic band, sit-to-stand from a chair, biceps curl, shoulder abduction plus sit-to-stand from a chair, chest press at a wall, and leg curl), postural control on an unstable surface, and stretching. Cognitive stimulation was performed during some activities. Psychotherapy was not performed during data collection. The guidelines established by the Helsinki Declaration were followed and the individuals consented to participate.

Patient 1 showed high activity in the frontal, temporal, and parietal regions, and the cerebellum bilaterally at rest and after control, whereas reduced activity was observed in these regions after exercise (Fig. 1a). Patient 2 showed low activity in the frontal, temporal, and parietal regions bilaterally at rest, but increased activity was observed after control (high) and exercise (moderate) conditions in these regions and in the cerebellum, particularly on the right side (Fig. 1b). Patient 3 had increased activity in the frontal, parietal, and temporal regions, and cerebellum after control rather than at rest, particularly on the right side. However, a decrease in occipital activity was observed in the control conditions. Moreover, a high activity was noted in the frontal, parietal, temporal, and occipital regions, and cerebellum after exercise (Fig. 1c).

The findings presented herein demonstrate that exercise may modify the brain dynamics of patients with severe psychiatric disorders, which is an interesting finding that could be tested in hospital settings. It is important to note that patients with BD may present with high frontal neural activity-associated to mania at rest.[4] Nevertheless, hypoactivity in the prefrontal cortex is common in those with SCZ and ADD, which is associated with impaired social cognition and executive functions.[5,6] Exercise may modulate or regulate neural networks as an auxiliary treatment, improving brain dynamics and the health of patients with severe psychiatric disorders.

These results are particularly interesting because patients with different diagnoses showed distinct brain activity patterns before and after exercise. Patients with BD showed high activity in the

Keywords: Bipolar disorder; Schizophrenia; Addictive behavior; Physical activity.
Abbreviations: ADD, addiction; BD, bipolar disorder; EEG, electroencephalography; PA, physical activity; SCZ, schizophrenia.
***Correspondence to:** Renato Sobral Monteiro-Junior, Postgraduation Programme of Health Sciences, Universidade Estadual de Montes Claros - Avenida Doutor Rui Braga, s/n, Vila Mauricéia, Montes Claros, Minas Gerais, 39401-089, Brazil. ORCID: https://orcid.org/0000-0002-8472-262X. Tel: +55(38)3229-8289, Fax: +55(38)3229-8289, E-mail: renato.monteiro@unimontes.br
How to cite this article: Monteiro-Junior RS, David IR, Mendes IHR, Coutinho LA, Júnior BJM, Oliva HNP. Cortical Brain Response to Acute Bouts of Exercise in Patients with Severe Psychiatric Disorders: Report of Three Cases. *Explor Res Hypothesis Med* 2024;9(2):178–180. doi: 10.14218/ERHM.2023.00011.

Table 1. Summary of patient characteristics

Patient	Sex (M/F)	Age (y)	Weight (kg)	Height (m)	SBP/DBP (mmHg)	HR (bpm)	Hospitalization (days)
1 – BD	F	28	88	1.51	113/76	104	15
2 - SCZ	M	58	78	1.89	132/85	70	7
3 - ADD	M	34	53	1.65	100/52	75	9

ADD, addiction; BD, bipolar disorder; DBP, diastolic blood pressure; F, female; HR, heart rate; M, male; SBP, systolic blood pressure; SCZ, schizophrenia.

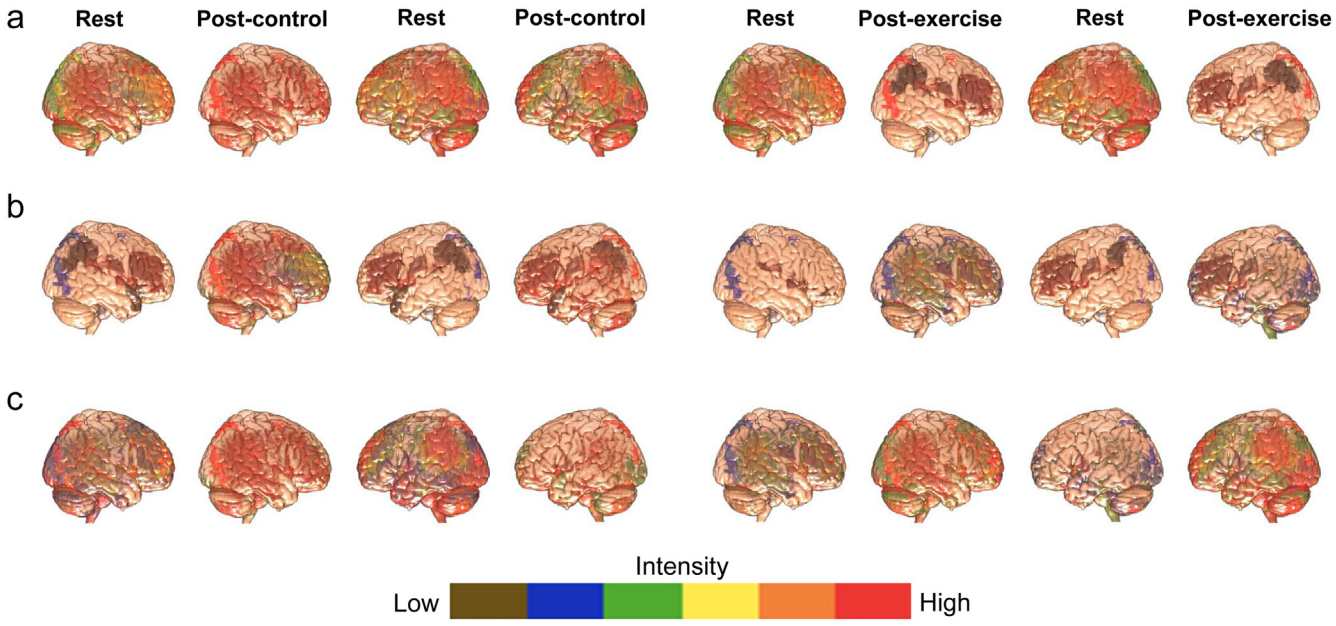

Fig. 1. Neuroimages depicting right- and left-brain hemispheres of each patient during rest, control, and exercise conditions. Colored bar indicates the intensity of cortical activity.

frontal, temporal, and parietal regions, whereas patients with SCZ and ADD showed low activity in the prefrontal cortex at rest. Exercise appeared to improve brain dynamics, increasing or decreasing activity in specific regions depending on the patient's diagnosis. These findings support the hypothesis that exercise could be used as an auxiliary treatment, improving brain dynamics and the overall health of patients with severe psychiatric disorders, especially among those with diagnoses that affect social cognition and executive functions. These results suggest the need for further research to explore the impact of exercise on the brain dynamics of patients with severe psychiatric disorders.

Acknowledgments

The authors thank Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG), Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and Hospital Aroldo Tourinho.

Funding

No funding was received.

Conflict of interest

Authors declare no conflict of interests.

Author contributions

Contributed to study concept and design (RSMJ), acquisition of the data (IHRM), assay performance and data analysis (RSMJ, IHRM, IRD and LAC), drafting of the manuscript (RSMJ, BJMJ and HNPO), critical revision of the manuscript (RSMJ and HNPO), and supervision (RSMJ and HNPO).

Ethics statement

The guidelines established by the Helsinki Declaration were followed and the individuals consented to participate.

References

[1] Firth J, Siddiqi N, Koyanagi A, Siskind D, Rosenbaum S, Galletly C, *et al*. The Lancet Psychiatry Commission: a blueprint for protecting physical health in people with mental illness. Lancet Psychiatry 2019;6(8):675–712. doi:10.1016/S2215-0366(19)30132-4, PMID:31324560.

[2] Stubbs B, Vancampfort D, Hallgren M, Firth J, Veronese N, Solmi M, *et al*. EPA guidance on physical activity as a treatment for severe mental illness: a meta-review of the evidence and Position Statement from the European Psychiatric Association (EPA), supported by the International Organization of Physical Therapists in Mental Health (IOPTMH). Eur Psychiatry 2018;54:124–144. doi:10.1016/j.eurpsy.2018.07.004, PMID:30257806.

[3] Ribas VR, Psychologist PI, Ribas RD, Viana MT, Dias JM, Cavalcanti IR,

et al. The Functional neurometry of Nelson Alves Pereira Júnior: An advanced method of mapping and biofeedback training of the autonomic nervous system functions. J Psychol Psychother 2020;7:1–19. doi:10.12974/2313-1047.2020.07.1.

[4] Harmon-Jones E, Abramson LY, Nusslock R, Sigelman JD, Urosevic S, Turonie LD, *et al*. Effect of bipolar disorder on left frontal cortical responses to goals differing in valence and task difficulty. Biol Psychiatry 2008;63(7):693–698. doi:10.1016/j.biopsych.2007.08.004, PMID: 17919457.

[5] Holt DJ, Cassidy BS, Andrews-Hanna JR, Lee SM, Coombs G, Goff DC, *et al*. An anterior-to-posterior shift in midline cortical activity in schizophrenia during self-reflection. Biol Psychiatry 2011;69(5):415–423. doi:10.1016/j.biopsych.2010.10.003, PMID:21144498.

[6] Trantham-Davidson H, Lavin A. Acute cocaine administration depresses cortical activity. Neuropsychopharmacology 2004;29(11):2046–2051. doi:10.1038/sj.npp.1300482, PMID:15138440.