

PHYSICAL EXERCISE AND SCHIZOPHRENIA: A SYSTEMATIC REVIEW ON THE COGNITIVE AND SYMPTOMATOLOGICAL BENEFITS OF AEROBIC PHYSICAL EXERCISE IN PEOPLE WITH SCHIZOPHRENIA

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Trabajo de Fin de Grado (TFG)



RESUMEN

La esquizofrenia es un síndrome psiquiátrico con una prevalencia del 0'32% cada 300 personas. A pesar del avance farmacológico respecto a la sintomatología positiva, no se obtienen los mismos resultados satisfactorios en relación a los déficits cognitivos, ni la sintomatología negativa. En este sentido, el ejercicio físico aeróbico ha sido relacionado en numerosas ocasiones con mejoras a nivel cognitivo; y no practicarlo, con una mayor probabilidad de presentar sintomatología depresiva. Por ello, el objetivo de esta revisión bibliográfica es localizar aquellos estudios que utilicen el ejercicio físico aeróbico como tratamiento en la esquizofrenia para comprobar si tiene algún efecto beneficioso en la sintomatología y en las funciones cognitivas; y, por tanto, si es interesante implementarlo en pacientes. El proceso de búsqueda se basó en el modelo PRISMA. Las bases de datos utilizadas fueron Scopus y PubMed, dónde se localizaron un total de 471 artículos tras establecer una serie de palabras clave para la búsqueda. Además, se descartó todo documento que no fuera un ensayo clínico y se delimitaron las fechas de publicación entre 2015-2022. Tras una lectura de los resúmenes se seleccionaron un total de 61 estudios. Paralelamente, de los documentos descartados por tratarse de revisiones, se obtuvieron 17 artículos de sus bibliografías. Finalmente, se obtuvieron 78 estudios, de los cuales se incluyeron un total de 6 en esta revisión. En cuanto a los resultados, se infieren mejoras significativas en los grupos de ejercicio aeróbico en al menos uno de los factores cognitivos respecto al grupo control. Asimismo, se observa una clara tendencia a la mejora de la sintomatología; no obstante, se encuentra variedad en los resultados. Se concluye que, el ejercicio físico aeróbico no puede reemplazar los tratamientos tradicionales, pero podría servir como tratamiento complementario eficaz para mejorar las funciones cognitivas y reducir la sintomatología en pacientes con esquizofrenia. No obstante, se debe seguir estudiando los efectos en la sintomatología dada la alta variedad de esta y de los resultados obtenidos en los estudios.

Palabras clave: ejercicio físico aeróbico, función cognitiva, esquizofrenia, síntoma negativo, síntoma positivo.

ABSTRACT

Schizophrenia is a psychiatric syndrome with a prevalence of 0.32% per 300 people. Despite pharmacological advances in positive symptomatology, the same satisfactory results are not obtained in relation to cognitive deficits or negative symptomatology. In this sense, aerobic physical exercise has been related on numerous occasions with cognitive improvements; and not doing it, with a greater probability of presenting depressive symptomatology. Therefore, the aim of this literature review is to locate those studies that use aerobic physical exercise as a treatment for schizophrenia to see if it has any beneficial effect on symptoms and cognitive functions; and, therefore, if it is interesting to implement it in patients. The search process was based on the PRISMA model. The databases used were Scopus and PubMed, where a total of 471 articles were located after establishing a series of key words for the search. In addition, any document that was not a clinical trial was discarded and the dates of publication were delimited between 2015-2022. After reading the abstracts, a total of 61 studies were selected. At the same time, 17 articles were obtained from the bibliographies of papers that were discarded as reviews. Finally, 78 studies were obtained, of which a total of 6 were included in this review. In terms of the results, significant improvements are inferred in the aerobic exercise groups in at least one of the cognitive factors in contrast to the control group. There is also a trend towards improvement in symptomatology; however, there is variation in the results. It is concluded that aerobic physical exercise cannot replace traditional treatments, but it could serve as an effective complementary treatment to improve cognitive functions and reduce symptomatology in patients with schizophrenia. However, the effects on symptomatology should be further studied because of the wide variety of symptomatology and the results obtained in the studies.

Palabras clave: aerobic physical exercise, cognitive function, negative symptom, positive symptom, schizophrenia

INTRODUCTION

Schizophrenia, a psychiatric syndrome affecting approximately 24 million people, that is, 1 in 300 (OMS, 2022).

- Meyers et al. (2005) differentiate:
 - Positive symptomatology
 - Negative symptomatology
 - Cognitive deficits
- The drugs are not pathway selective and reduce dopaminergic activity at the mesocortical level. In other words, these antipsychotics enhance negative and cognitive symptoms. They also cause EPS and their treatment may worsen cognitive impairment. (Meyer et al., 2005; Tajima et al., 2009).
- There are alternatives such as atypical antipsychotics (AA); however, their superiority is not always proven and they are more expensive (Ceruelo & García, 2007). Partial D2-receptor agonists are another possibility, but more studies are needed (Pagano et al., 2009).
- De Mello et al. (2013) concluded that people who do not practice physical activity are more prone to present depressive symptoms. And Smith et al. (2010) reported improvements in cognitive level thanks to aerobic physical exercise. Vancampfort et al. (2012) report that only a minority of patients with schizophrenia engage in sport.

Objective: to carry out a review of studies that include aerobic physical exercise as a treatment in schizophrenia in order to check if it has any beneficial effect on symptomatology and cognitive functions.



METHOD

Studies identified from:
Articles search in the bibliography of other reviews (n=17)

Publications assessed for eligibility (n=17)

Excluded publications (n=17) for:

- Subjects without schizophrenia or subjects with other diseases (n=2)
- Poor aerobic physical exercise (n=2)
- No cognitive measures (n=4)
- No aerobic exercise intervention (n=1)
- Lack of information (n=4)
- Without control group (n=2)
- Publication date (n=2)

Excluded publications (n=55) for:

- Subjects without schizophrenia or subjects with other diseases (n=6)
- Poor aerobic physical exercise (n=6)
- No cognitive measures (n=11)
- Intervention: aerobic exercise and others (n=6)
- Non-experimental article (n=3)
- Self-reported aerobic exercise (n=3)
- Study not yet completed (n=4)
- No aerobic exercise intervention (n=7)
- Lack of information (n=1)
- Without control group (n=8)

Identified publications (n=471)

Duplicates removed (n=22)

Screened items (n=449)

Excluded articles (n=388)

Publications assessed for eligibility (n=61)

Total number of studies included in the review (n=6)

RESULTS

N=36 EG (n=17) CG (n=19) <i>Chen et al. 2016</i> <i>SDMT/RAVLT/TMT/Asociación Semántica</i> (Pre and post treatment)	3 months (3 days a week for 1 hour); <u>aerobic dance</u> (40min)	N=80 EG (n=40) CG (n=40) <i>Curcic et al. 2017</i> <i>PANSS</i> (Pre and post treatment)	12 weeks (4 times a week for 45 min); <u>brisk walking or jogging</u> (30 min)
N=151 EG (n=101) CG (n=49) <i>Ho et al. 2016</i> <i>PANSS/WAIS-IV</i> (Pre and post treatment; and after 3 months)	Tai-chi and <u>exercise intervention</u> : 12 weeks (one 60-minute class per week)	N=60 EG (n=30) CG (n=30) <i>Ryu et al. 2020</i> <i>BPRS/BDI/RSES/GAF/WCST</i> (Pre, during and post treatment)	16 weeks (1 day/week for 90 min); <u>cycling</u> (40 min), goals and achievements of the day
N=31 EG (n=16) CG (n=15) <i>Kaltsatou et al. 2015</i> <i>GAF/PANSS/Q-LES-Q</i> (Pre and post treatment)	8 months (three days a week for one hour); <u>Traditional Greek dance</u> (40 min)	N=33 EG (n=16) CG (n=17) <i>Kimhy et al. 2015</i> <i>Batería Cognitiva de Consenso MATRICS</i> (Pre and post treatment)	12 weeks (one hour for 3 sessions per week); <u>AE using equipment</u> (45 min)
Processing speed Memory (delayed recall 48%) Executive function (verbal fluency)	No maintenance <u>Tai-chi</u> : digits backwards <u>Exercise</u> : digits forward and negative symptoms.	PANSS general psychopathology PANSS total GAF Depression Executive functions Thought disturbance	Quality of life Negative, Positive and General symptomatology Social cognition Visual learning

DISCUSSION

- Significant improvements in the aerobic exercise groups in at least one of the cognitive factors compared to the control group. Also, there is some improvement in verbal fluency, although not very significant.
- Trend towards improvement in symptomatology; however, there is variation in the results.
- The changes are not permanent importance of maintaining aerobic exercise.

LIMITATIONS

- Small sample size.
- Age and sex range of subjects.
- Follow-up.
- Responses to exercise and preferences to modalities highly individualised.



Conclusion: According to the fact that sport cannot replace traditional treatments, aerobic physical exercise could serve as a complementary treatment to improve cognitive functions and reduce symptomatology in schizophrenia. However, it would be interesting to further study the variety of effects on symptomatology.

REFERENCIAS BIBLIOGRÁFICAS

- Álvarez, A.J., Priede, A., Hetrick, S. E., Bendall, S., Killackey, E., Parker, A. G., McGorry, P. D., & Gleeson, J. F. (2012). Risk factors for relapse following treatment for first episode psychosis: A systematic review and metaanalysis of longitudinal studies. *Schizophrenia Research*, 139, 116-128.
- Ceruelo, B.J., & García, R.S. (2007). Antipsicóticos típicos. Antipsicóticos atípicos. *Terapéutica en APS*; 14(10): p. 637-647.
- Chen, M. D., Kuo, Y. H., Chang, Y. C., Hsu, S. T., Kuo, C. C., & Chang, J. J. (2016). Influences of aerobic dance on cognitive performance in adults with schizophrenia. *Occupational Therapy International*, 23(4), 346-356.
- Curcic, D., Stojmenovic, T., Djukic-Dejanovic, S., Dikic, N., Vesic-Vukasinovic, M., Radivojevic, N., Andjelkovic, M., Borovcanin, M., & Djokic, G. (2017). Positive impact of prescribed physical activity on symptoms of schizophrenia: randomized clinical trial. *Psychiatria Danubina*, 29(4), 459-465.
- Dauwan, M., Begemann, M. J., Heringa, S. M., & Sommer, I. E. (2016). Exercise improves clinical symptoms, quality of life, global functioning, and depression in schizophrenia: a systematic review and meta-analysis. *Schizophrenia bulletin*, 42(3), 588-599.
- De Mello, M. T., de Aquino Lemos, V., Antunes, H. K. M., Bittencourt, L., Santos-Silva, R., & Tufik, S. (2013). Relationship between physical activity and depression and anxiety symptoms: a population study. *Journal of affective disorders*, 149(1-3), 241-246.
- Emery, C. F., Hsiao, E. T., Hill, S. M., & Frid, D. J. (2003). Short-term effects of exercise and music on cognitive performance among participants in a cardiac rehabilitation program. *Heart & lung*, 32(6), 368-373.
- García-Garcés, L., Sánchez-López, M. I., Cano, S. L., Meliá, Y. C., Marqués-Azcona, D., Biviá-Roig, G., Lisón, J. F., & Peyró-Gregori, L. (2021). The short and long-term effects of aerobic, strength, or mixed exercise programs on schizophrenia symptomatology. *Scientific Reports*, 11(1), 1-12.
- Goff, D. C. (2013). Future perspectives on the treatment of cognitive deficits and negative symptoms in schizophrenia. *World Psychiatry*, 12(2), 99-107.
- Gómez Ayala, A. E. (2007). Esquizofrenia. *Offarm*, 26(6), 86-94. <http://www.elsevier.es/es-revista-offarm-4-articulo-esquizofrenia-13107675>

- Gorczynski, P., & Faulkner, G. (2010). Exercise therapy for schizophrenia. *Cochrane database of systematic reviews*, (5).
- Ho, R. T., Fong, T. C., Wan, A. H., Au-Yeung, F. S., Wong, C. P., Ng, W. Y., Cheung, I. K. M., Lo, P. H. Y., Ng, S. M., Chan, C. L. W., & Chen, E. Y. (2016). A randomized controlled trial on the psychophysiological effects of physical exercise and Tai-chi in patients with chronic schizophrenia. *Schizophrenia research*, 171(1-3), 42-49.
- Kaltsatou, A., Kouidi, E., Fountoulakis, K., Sipka, C., Theochari, V., Kandyliis, D., & Deligiannis, A. (2015). Effects of exercise training with traditional dancing on functional capacity and quality of life in patients with schizophrenia: a randomized controlled study. *Clinical rehabilitation*, 29(9), 882-891.
- Keefe, R. S., Bilder, R. M., Davis, S. M., Harvey, P. D., Palmer, B. W., Gold, J. M., Meltzer, H. Y., Green, M. F., Capuano, G., Stroup, T. S., McEvoy, J. P., Swartz, M. S., Rosenheck, R. A., Perkins, D. O., Davis, C. E., Hsiao, J. K., & Lieberman, J. A. (2007). Neurocognitive effects of antipsychotic medications in patients with chronic schizophrenia in the CATIE Trial. *Archives of general psychiatry*, 64(6), 633-647.
- Kimhy, D., Vakhrusheva, J., Bartels, M. N., Armstrong, H. F., Ballon, J. S., Khan, S., Hansen, M. C., Ayanruoh, L., Lister, A. Castrén, E., Smith, E. E., & Sloan, R. P. (2014). Aerobic fitness and body mass index in individuals with schizophrenia: implications for neurocognition and daily functioning. *Psychiatry research*, 220(3), 784-791.
- Kimhy, D., Vakhrusheva, J., Bartels, M. N., Armstrong, H. F., Ballon, J. S., Khan, S., Chang, R. W., Hansen, M. C., Ayanruoh, L., Lister, A. Castrén, E., Smith, E. E., & Sloan, R. P. (2015). The impact of aerobic exercise on brain-derived neurotrophic factor and neurocognition in individuals with schizophrenia: a single-blind, randomized clinical trial. *Schizophrenia bulletin*, 41(4), 859-868.
- Meyer, J. S., Quenzer, L. F., Rice, S. A., & Yates, J. R. (2005). Schizophrenia: Antipsychotic Drugs, *Psychopharmacology: Drugs, the brain, and behavior* (3^a ed., pp.632-639). Sunderland, MA: Sinauer Associates.
- OMS. (2022, 21 enero). *Esquizofrenia*. Organización Mundial de la Salud. <https://www.who.int/es/news-room/fact-sheets/detail/schizophrenia#:~:text=A%20escala%20mundial%2C%20la%20esquizofrenia,como%20muchos%20otros%20trastornos%20mentales>.

- Pagano, E., Ramos, C., Telechea, H. y Speranza, N. (2011). Aripiprazol: ¿una opción en la esquizofrenia? *Boletín Farmacológico*, vol. 2, no. 4.
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo, E. W., McDonald, S.,... Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *International Journal of Surgery*, 88, 105906
- Pajonk, F. G., Wobrock, T., Gruber, O., Scherk, H., Berner, D., Kaizl, I., Kierer, A., Müller, S., Oest, M., Meyer, T., Backens, M., Schneider-Axmann, T., Thornton, A. E., Honer, W. G., & Falkai, P. (2010). Hippocampal plasticity in response to exercise in schizophrenia. *Archives of general psychiatry*, 67(2), 133-143.
- Palomo, T. y Jiménez Arriero, M. A. (2009) Esquizofrenia y psicosis relacionadas en V. Peralta Martín y M. J. Cuesta Zorita (Ed.), *Manual de Psiquiatría*. (Vol. 16, pp. 267-297). Autoeditado.
- Ryu, J., Jung, J. H., Kim, J., Kim, C. H., Lee, H. B., Kim, D. H., Lee, S. K., Shin, J. H., & Roh, D. (2020). Outdoor cycling improves clinical symptoms, cognition and objectively measured physical activity in patients with schizophrenia: A randomized controlled trial. *Journal of psychiatric research*, 120, 144-153.
- Sánchez, E. M., Lacal, A. L., Refoyo, M. B., Cuevas, B. R. y Pelegrín, V. C. M. (25 mayo-5 de junio de 2020). *Estrategias de intervención para disminuir el sedentarismo en pacientes psiquiátricos* [Presentación en papel]. Interpsiquis, congreso virtual internacional de psiquiatría, psicología y enfermería en salud mental.
- Schuch, F. B., Deslandes, A. C., Stubbs, B., Gosmann, N. P., da Silva, C. T. B., & de Almeida Fleck, M. P. (2016). Neurobiological effects of exercise on major depressive disorder: a systematic review. *Neuroscience & Biobehavioral Reviews*, 61, 1-11.
- Smith, P. J., Blumenthal, J. A., Hoffman, B. M., Cooper, H., Strauman, T. A., Welsh-Bohmer, K., Browndyke, J. N., & Sherwood, A. (2010). Aerobic exercise and neurocognitive performance: a meta-analytic review of randomized controlled trials. *Psychosomatic medicine*, 72(3), 239.
- Su, C. Y., Wang, P. W., Lin, Y. J., Tang, T. C., Liu, M. F., & Chen, M. D. (2016). The effects of aerobic exercise on cognition in schizophrenia: A 3-month follow-up study. *Psychiatry Research*, 244, 394-402.

- Tajima, K., Fernández, H., López-Ibor, J. J., Carrasco, J. L. y Díaz-Marsá, M. (2009). Tratamientos para la esquizofrenia. Revisión crítica sobre la farmacología y mecanismos de acción de los antipsicóticos. *Actas Esp Psiquiatr*, 37(6), 330-42
- Vancampfort, D., De Hert, M., Skjaerven, L. H., Gyllensten, A. L., Parker, A., Mulders, N., Nyboe, L., Spencer, F., & Probst, M. (2012). International Organization of Physical Therapy in Mental Health consensus on physical activity within multidisciplinary rehabilitation programmes for minimising cardio-metabolic risk in patients with schizophrenia. *Disability and rehabilitation*. 34 (1), 1–12.
- Wang, P. W., Lin, H. C., Su, C. Y., Chen, M. D., Lin, K. C., Ko, C. H., & Yen, C. F. (2018). Effect of aerobic exercise on improving symptoms of individuals with schizophrenia: a single blinded randomized control study. *Frontiers in psychiatry*, 9, 167.