Mini Review

Exercise Improves Physical Health and Symptom Profiles in Schizophrenia Spectrum Disorder

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Abstract

Physical exercise intervention programs have been found to ameliorate the deficits expressed within daily behavioral, symptom-profile, affective status, neurocognitive and brain structural and functional domains in addition to improvements in quality-of-life, adherence to training schedules, physical health and well-being in schizophrenia spectrum disorder, despite the genetic, epigenetic and phenotypic background of disorder characterization. Neurotoxicological/neurodegenerative processes, such as immunoelectotoxicity and apoptosis that contributory to the disorders' etiopathogenesis, reduction of telomerase activity and telomeric shortening and loss of neuronal integrity are mitigated or alleviated by exercise and motor activity schedules. Several aspects of the disorder, structural and functional appear to be ‘buttressed’ through the applications of exercise paradigms whether endurance or resistance, dependent on intensity, duration and frequency.

INTRODUCTION

Physical exercise provides a plethora of acute and chronic, ontogenic and epigenetic properties that are associated with multiple health benefits covering several domains of health through the reinforced resilience among regional brain, cellular, neurophysiological and neurobehavioral processes governing structure and function [1-4]. The health benefits of exercise regimes have been documented in patients presenting type II diabetes [5] and in healthy individuals [6] using relatively modest activity schedules, e.g. 30 min of moderate exercise/3 times weekly. Several of the brain neuropsychiatric conditions arising from neurodevelopmental dysregulation, toxicity exposures, perinatal ‘accidents’ or inflammatory, neuroimmunoexcitotoxity, ‘incidents’ may be ameliorated by physical exercise [7], as well as problems arising from the encroachments of immunosenescence [8]. Exercise programs, both clinical, laboratory and health-promotional, are associated with anti-apoptotic and anti-excitotoxic influences [9] with improvements in affective status, neurocognition and physical activity propensities [10,11], as well as well-being in older adults [12]. These programs initiate and maintain not only physical/psychological health and well-being, but also, individuals' coping strategies against stress/trauma and body image, activities of daily living independence, and quality-of-life especially among older persons [13]. It appears to be the case also that in accordance with the neural diathesis-stress model the hypothalamic-pituitary-adrenal axis may arbitrate the influences of lifestyle factors, such as exercise, on psychotic symptoms and neurological deficits [14].

Patients diagnosed with schizophrenia spectrum disorders present conditions of deteriorated physical and general health, illustrated by increased incidence of cardiovascular disease and metabolic disorders, accompanied by undesirable health-related behaviors [15-20]. They present premature mortality gap of between 10 to 20 years in comparison with the general population [21,22]. Unhealthy body mass indices were registered in 44% of schizophrenia-diagnosed patients despite self-reported acceptable levels of exercise and dietary restrictions [23]; these elevated body mass indices were associated with intake of two or more antipsychotic drugs thereby implying a greater risk for obesity and related disorders by these patients. The negative symptoms and cognitive impairments ensure that disadvantageous long-term outcomes contribute to both disability and poor prospects for adequate quality-of-life. Aerobic, endurance-type, exercise consisting of treadmill
walking and cycling at a moderate level of intensity (30-40 min during each exercise session, three times/week, over 10 to 16 weeks), arranged in the form of supervised group intervention, provided measurable benefits for schizophrenia/schizoaffective patients [24,25]. However, a walking exercise program induced improvements in indicators of physical health, activity level, social support, and mental health at a level of program satisfaction [26], whereas an intervention centered around ‘aerobic dance’ induced cognitive performance improvements in schizophrenic patients [27]. A great proportion of available evidence implies that the endurance-type physical exercise does not pose safety hazards, improves symptom-profiles, basal physiology, and quality-of-life and indeed improves patients’ capacity to maintain or even further develop exercise propensities [28-32]. Cognitive performance was assessed in a group of 199 schizophrenic patients together with physical activity, demographic variables, metabolic parameters, positive and negative symptoms, duration of illness and hospitalization, and details of medication [33], in comparison with a control group. Patients displayed lower levels physical activity and poorer performance on tests of attention/concentration and speed of information processing than the control group. Interestingly, those patients who applied more time to light physical activity evidence higher performance levels for attention/concentration and speed of information processing than those patients who showed lesser physical activity. Furthermore, overall cognitive performance was associated with expressions of moderate-vigorous physical activity. Indeed, much of the physical incapacity/sedentary behavior attributed to patients presenting schizophrenia spectrum disorders seems to lay at the ‘health-doorstep’ of the lack of availability, motivation, propensity and encouragement to engage in physical exercise [34-36]. Furthermore, neurotoxicological processes, e.g. apoptosis, contributory to the etiopathogenesis of disorder, reduction of telomerase activity and telomeric shortening and loss of cellular integrity are ameliorated or attenuated by exercise and motor activity [37,38,39].

As a potential adjunctive interventional therapy, physical exercise (e.g. 90 min moderate-to-vigorous activity/week) was shown to elevate fitness condition, improve cognitive performance and decrease positive and negative symptoms, as well as reinforcing the necessary daily activities of living [40-42]. Supervised exercise with arrangements for patients’ personal preferences induced higher rates of activity adherence [43,44], a recurring issue in this disorder since these schizophrenia spectrum disorder patients express individual preferences regarding general exercise alignment [45]. Furthermore, early exercise intervention schedules promoted improvements in negative and cognitive symptom profiles with good prognosis for maintained functional and physiological recovery [46-49] with marked benefits for health and physical-psychological well-being [50,51]. In a group of schizophrenic patients selected for early intervention [52], have documented participating patients’ explanations of how physical exercise programs had improved their own subjective psychological health and incurred in themselves a sense of confidence and a feeling of achievement. It was observed that autonomy and social support were essential ingredients for the induction of engagement and commitment to moderate-to-vigorous exercise programs in first-episode patients, with accompanying benefits for physical fitness/activity condition symptom management and social functioning. In a random-effects meta-analysis combined with meta-regression analysis covering 35 studies presenting 3453 individuals diagnosed with schizophrenia and controls engaged in either light, moderate-vigorous or vigorous exercise per day[53], found that the patients utilized significantly less moderate and vigorous exercise than the healthy controls but higher levels of light-to-moderate exercise, implying that all attempts to induce patients to increase levels of exercise/activity ought to pay marked health dividends.

Several neuropsychiatric conditions, including diabetes type 2, obesity, Alzheimer’s disease and the schizophrenia spectrum disorders, linked to long-term or chronic activation of the immune system accompanied by an ongoing pro-inflammatory state [54,55], have reverted and reduced immune activation due to the initiation of physical activity and exercise [56,57,58] with a return to a normalization of a healthy condition. Nevertheless, it should be borne in mind that intensive, prolonged and ultra-strenuous bouts of activity and exercise, such as extreme sports and marathons, are linked to immune imbalance, immune suppression, elevated pro-inflammatory markers and cellular damage [59], arising from dramatic increases in serum IL-6, IL-8, IL-10 and TNF-α and cardiac markers for myocardial dysfunction following intense endurance exercise of multiple hours duration by trained subjects [60]; these considerations are essential to any contemplation of a training schedule for schizophrenic patients which ought not to detract from the situation that a sedentary existence by these patients is catastrophic for their health. It was been found that voluntary running reduced tumor incidence by 60% in tumor-bearing mice [61]. Furthermore, NK cell infiltration was increased markedly within the tumors obtained from these running mice, contrasting a depletion of NK cells augmented tumor growth and blunted the beneficial effects of exercise. These observations bear much consequence for patient’s general health parameters. For example, sedentary mice expressing myocardial infarction displayed massively higher levels of circulating IL-6, IL-1β and TNF-α, increased infarct size and retarded recovery compared to exercised counterparts [62,63] have hypothesized that the neuroimmune-modifying properties of exercise, most especially engaged in chronic neuropsychiatric disorders such as schizophrenia and Alzheimer’s disease, reduce disorder expression and propagation through modifications of glial-mediated neuroinflammation processes.

Structural abnormalities occur early in the neurodevelopment of schizophrenia and through disorder progression maintain a more-or-less severe pattern [64]. Against the background of elevated hippocampal plasticity and cognitive improvements following exercise by patients [65,66] compared schizophrenic patients with healthy controls to assess whether or not gray matter density was increased, before and after three months of aerobic exercise schedules in combination table football games. Although gray matter density increases were obtained only in the right frontal and occipital cortices, the authors suggested that expected effects in patients may have been attenuated. Although endurance capacity improved in both exercising schizophrenic patients and healthy controls, the psychopathological symptoms in patients did not alter markedly [67]. However,
subtle changes in the left temporal cortex implied an impact of exercise on brain volumes in these patients. Nevertheless [68], conclude that research strategies for schizophrenia spectrum disorders ought to include physical exercise within multimodal intervention programs to ameliorate psychopathological and cognitive symptoms. In a comparison of schizophrenic and major depressive disorder patients [69], observed that four-week exercise interventions improved cognitive performances pertaining to visual learning, working memory and speed of processing as well as reducing state anxiety and elevating quality-of-life. Cognitive performance improvements were higher for the former whereas individual psychopathology improvements were higher for the latter. [70] Observed that endurance exercise (30 min, 3 times weekly) in combination with add-on computer-assisted cognitive remediation training, but not table football games, ameliorated deficits in the Verbal Learning Memory Scale test and in the Wisconsin Card Sorting test [71]. compared schizophrenic patients and healthy controls assigned to a standardized aerobic endurance exercise training program over 12 weeks with patients presented with table football games. They found that both patients and controls adapted comparably over 12 weeks with patients presented with table football games. To endure exercise with regard to a buttressing of endurance capacity and a reduction in the baseline deficit in relation to the healthy controls.

In conclusion, physical exercise or activity programs are seldom accepted unequivocally by patients diagnosed with schizophrenia spectrum disorder nor are those efforts aimed at exercise interventions, once initiated, easily maintained and adhered to [72]. Nevertheless, an increasing bulk of evidence indicates that, where successful, the exercise intervention therapy for schizophrenia symptoms and general physical health parameters holds much promise for these patients. As indicated [73], social support measures seem to provide an essential facilitation these individuals’ initiation, adherence and compliance to physical exercise/activity interventions and programs.

REFERENCES


