The Influence of Physical Exercises on Psychic Disorders

Hagiu Bogdan-Alexandru

Faculty of Physical Education and Sport, “Al. I.Cuza” University, Iași, Romania

Abstract: It is known that exercise has positive therapeutic effects on mental illness, but the mechanisms of action are still little studied. Based on the correlation of literature data, this work shows that progressive strength training exercises result in increased blood somatotropic concentration, which may lead to an improvement in the well-psychosocial state, and a combination of running, calisthenic exercises and recreational activities induces the increase in plasma testosterone, with positive effects on depression, schizophrenia, anxiety, bipolar affective disorder. Increasing testosterone in elderly men as a result of high-intensity interval training could result in preventing or treating cognitive decline.

Key words: Psychosis, physical training.

1. Introduction

Regarding the effect of exercises and physical activity on mental illness, the following are known [1]:

- positive therapeutic effects were observed in anxiety, panic, posttraumatic stress, social phobia, obsessive compulsive disorder, major depression, bipolar affective disorder, bulimia, anorexia, nicotine and alcohol addiction, schizophrenia and psychosis, dementia;
- as a mechanism of action, exercise has been found to normalize low levels of neurotrophic factor derived from the brain, induce changes in endorphin and serotonin secretions, have positive effects on the stress-responsiveness of the hypothalamo-pituitary-adrenal system, and anxiolytic effects mediated by atrial natriuretic peptide, psychological mechanisms.

But these are not the only possible mechanisms. There are hormones that have a simultaneous trophic action on the striated muscles and the nervous system. Somatotrope hormone has anabolic actions on striated muscle fibers [2] and growth hormone receptors are expressed in neurons [3]. The same dual action is testosterone [4, 5]. As a result, it is tempting to suppose that the beneficial effects of the two hormones are manifested not only on the development of the nervous system in correlation with the motor needs, but also on the improvement of some psychiatric diseases. In the present paper I propose discussing mechanisms to improve the psychic disorders induced by the stimulation of testosterone and somatotropic secretion by exercise.

The effects of testosterone and somatotrop on the evolution of psychiatric diseases and the impact on the secretion of these hormones by exercise.

Numerous studies have highlighted the effects of testosterone on psychiatric disorders. Thus, a preliminary study showed that men suffering from melancholic depression (characterized by an alternation of manic crises and depressive episodes) had a higher testosterone level than the control group, whereas those diagnosed with atypical depression had lower plasma levels of the hormone compared to the two above categories [6].

Moreover, men with low testosterone who also have a high morbidity or are in the age group 50-60
years are at increased risk for depression [7].

In men with schizophrenia, circulating testosterone causes improvement in social functionality, improving activity in the lower left anterior gyrus [8].

Testosterone in men has a protective role not only for depression but also for anxiety [9].

In terms of bipolar affective disorder, testosterone levels are significantly lower in men suffering from this condition compared to a control, while in women (under the same circumstances) they are higher [10].

Deficient somatotrope adults placed under growth hormone therapy reported improved psychosocial wellbeing [11].

Regarding the effects of exercise, there are researches exploring the simultaneous evolution of the two hormones.

The response of testosterone and somatotropic secretions to a strength training program through progressive resistance differs in young athletes from the elderly [12]:

- after 3 months of training, the response to a strength exercise session showed an increase of 44.9% in the young and 3% in the elderly for the growth hormone
- in both groups the basal level of testosterone was insignificantly low, and increased insignificantly after exercise

For testosterone, the stimulating effect of physical effort is argued by works that have focused on the endurance effort.

It has been found that serum levels of testosterone (the mean being in physiological limits) in men with erectile dysfunction can be increased by reducing the percentage of adipose tissue and improving cardiorespiratory fitness by aerobic exercise [13].

The effects of 4 months of training consisting of running, calisthenic exercises, and recreational activities on the testosterone plasma level were different depending on the previous level of physical training [14]:
- men who followed a program of sports training had a higher increase in blood testosterone versus those who at the beginning of the program had a lower physical condition;
- the most pronounced increase in hormone levels was found in young subjects.

High-intensity interval training results in an increase in both total and free testosterone in lifelong sedentary aging men [15].

2. Discussions

From the data presented, it turns that a combination of strength and endurance exercises results in both the increase in circulating somatotropic and plasma testosterone concentrations with positive effects on depression, schizophrenia, anxiety, bipolar affective disorder, improvement of the psychosocial state of well-being. If for testosterone the mechanism of action appears to be improving activity in the lower left front gyrus [16] about the somatotrope it is known that growth hormone deficiency in the childhood is manifested by abnormalities of the white matter in the tough body and the corticospinal tract, low volume thalamus and basal nuclei, which is associated with a deficiency of cognitive functions and motor performance [17]. Probably, therefore, the somatotrope exerts a morpho-functional stimulation effect on some subcortical areas, while testosterone exerts the same effect on some cortical areas, and the synergistic effect is not excluded. The effects of stimulating testosterone in older men by high-intensity interval training could also target some forms of dementia. Thus, it was emphasized the need to investigate the effects of these exercises on the cognitive decline associated with neurodegenerative vascular diseases [18]. From the presented data it follows that the trapeutical protocols of various psychiatric illnesses could be improved by adding some exercises belonging to specific types of effort, appropriate to the disease to be treated.

3. Conclusions
The Influence of Physical Exercises on Psychic Disorders

(1) Increasing strength through progressive resistance training has the effect of increasing the growth hormone levels, which can lead to an improvement of psychosocial well-being.

(2) A combination of running, exercises, and recreational activities can have positive effects on depression, schizophrenia, anxiety and bipolar affective disorder, by increasing plasma testosterone.

(3) Stimulating testosterone secretion in elderly men by high-intensity interval training could prevent and even treat cognitive decline.

References

[1] Zschucke, E., Gaudlitz, K., and Ströhle, A. 2013. “Exercise and Physical Activity in Mental Disorders: Clinical and Experimental Evidence.” J Prev Med Public Health 46 (Suppl. 1): S12-21.

[2] Chikani, V., and Ho, K. K. 2013. “Action of GH on Skeletal Muscle Function: Molecular and Metabolic Mechanisms.” J Mol Endocrinol, 52 (1): R107-23.

[3] Harvey, S., Lavelin, I., and Pines, M. 2002. “Growth Hormone (GH) Action in the Brain: Neural Expression of a GH-Response Gene.” J Mol Neurosci. 18 (1-2): 89-95.

[4] Reddy, R. C., Amodei, R., Estill, C. T., Stormshak, F., Meaker, M., and Roselli, C. E. 2015. “Effect of Testosterone on Neuronal Morphology and Neuritic Growth of Fetal Lamb Hypothalamus-Preoptic Area and Cerebral Cortex in Primary Culture.” PLoS One 10 (6): e0129521.

[5] Herbst, K. L., and Bhasin, S. 2004. “Testosterone Action on Skeletal Muscle.” Curr Opin Clin Nutr Metab Care. 7 (3): 271-7.

[6] Rodgers, S., Grosse Holtforth, M., Hengartner, M. P., et al. 2015. “Serum Testosterone Levels and Symptom-Based Depression Subtypes in Men.” Front Psychiatry 6: 61.

[7] Shores, M. M., Moceri, V. M., Sloan, K. L., Matsumoto, A. M., and Kivlahan, D. R. 2005. “Low Testosterone Levels Predict Incident Depressive Illness in Older Men: Effects of Age and Medical Morbidity.” J Clin Psychiatry 66 (1): 7-14.

[8] Ji, E., Weickert, C. S., Lenroot, R., Catts, S. V., Vercammen, A., White, C., Gur, R. E., and Weickert, T. W. 2015. “Endogenous Testosterone Levels Are Associated with Neural Activity in Men with Schizophrenia during Facial Emotion Processing.” Behav Brain Res. 286: 338-46.

[9] McHenry, J., Carrier, N., Hull, E., and Kabbaj, M. 2013. “Sex Differences in Anxiety and Depression: Role of Testosterone.” Front Neuroendocrinol 35 (1): 42-57.

[10] Wooderson, S. C., Gallagher, P., Watson, S., and Young, A. H. 2015. “An Exploration of Testosterone Levels in Patients with Bipolar Disorder.” BJPsych Open. 1 (2): 136-8.

[11] Stabler, B., Clopper, R. R., Siegel, P. T., Nicholas, L. M., Silva, S. G., Tancer, M. E., and Underwood, L. E. 1996. “Links between Growth Hormone Deficiency, Adaptation and Social Phobia.” Horm Res. 45 (1-2): 30-3.

[12] Craig, B. W., Brown, R., and Everhart, J. 1989. “Effects of Progressive Resistance Training on Growth Hormone and Testosterone Levels in Young and Elderly Subjects.” Mech Ageing Dev. 49 (2): 159-69.

[13] Yeo, J. K., Cho, S. I., Park, S. G., et al. 2018. “Which Exercise Is Better for Increasing Serum Testosterone Levels in Patients with Erectile Dysfunction?” World J Mens Health. 36 (2): 147-52.

[14] Young, R. J., Ismail, A. H., Bradley, A., and Corrigan, D. L. 1976. “Effect of Prolonged Exercise of Serum Testosterone Levels in Adult Men.” Br J Sports Med. 10 (4): 230-5.

[15] Hayes, L. D., Herbert, P., Sculthorpe, N. F., and Grace, F. M. 2017. “Exercise Training Improves Free Testosterone in Lifelong Sedentary Aging Men.” Endocr Connect. 6 (5): 306-10.

[16] Ji, E., Weickert, C. S., Lenroot, R., Catts, S. V., Vercammen, A., White, C., Gur, R. E., and Weickert, T. W. 2015. “Endogenous Testosterone Levels Are Associated with Neural Activity in Men with Schizophrenia during Facial Emotion Processing.” Behav Brain Res. 286: 338-46.

[17] Webb, E. A., O’Reilly, M. A., Clayden, J. D., Seunarine, K. M., Chong, W. K., Dale, N., Salt, A., Clark, C. A., and Dattani, M. T. 2012. “Effect of Growth Hormone Deficiency on Brain Structure, Motor Function and Cognition.” Brain 135 (1): 216-27.

[18] Lucas, S. J., Cotter, J. D., Brassard, P., and Bailey, D. M. 2015. “High-Intensity Interval Exercise and Cerebrovascular Health: Curiosity, Cause, and Consequence.” J Cereb Blood Flow Metab. 35 (6): 902-11.