Letter to editor

The importance of complementary studies in finding mechanisms for the effect of high-intensity exercise training on spermatogenesis

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Dear Editor-in-Chief

The increasing prevalence of diabetes in the world, which is projected to reach 4.4% of the world's population by 2030, has raised concerns about the disease (Wild et al., 2004) so that it can affect any of the psychological, physical, social and economic aspects of the patient's life (Abdel-Gawad, 2014).

Accordingly, epidemiological studies have also indicated that nearly 50% of diabetic patients suffer from various reproductive system diseases such as, erectile dysfunction, ejaculation difficulties, reduced sperm quality, and infertility (Song et al., 2021).

The two main forms of diabetes (type 1 and type 2 diabetes) are characterized by progressive β-cell failure. In type 1 diabetes, β-cell mass is reduced by 70–80% at the time of diagnosis (Cnop et al., 2005).

Pancreatic islet βcell dysfunction leads to glucose metabolism disorder at the whole-body level, which inhibits lactate production by Sertoli cells in testicular tissue. As lactate is the main energy substrate for developing germ cells, its decrease is strongly correlated with spermatogenic dysfunction. Therefore, glucose metabolism disorder appears to be a primary reason of spermatogenic dysfunction in patients with long-term diabetes (Song et al., 2021)

Spermatogenesis is the process by which thousands of spermatozoa are produced daily in the gonads. Spermatogonial stem cells are necessary for the onset and continuation of spermatogenesis. Sertoli somatic cells that are in direct contact with spermatogonia stem cells are known to support, coordinate, nourish, and protect the germ cell populations from onset to the end of their meiotic process (Faure et al., 2017).

Energy metabolism is a key factor supporting spermatogenesis, including cell proliferation, meiotic division, and differentiation of post-meiotic cells into spermatozoa. In mammals, this process occurs under the influence of Sertoli cells, which "nurse" spermatogenic cells by releasing lactate as an end product of glycolytic metabolism. Lactate is taken up and metabolized by meiotic and post-meiotic spermatogenic cell mitochondria. In round spermatids, external lactate is an efficient metabolite for oxidative metabolism in these cells (Brauchi et al., 2005)

In recent decades, the demand for exercise among men and women has increased considerably due to its health benefits, despite this global increase in the desire for physical activity, there is still insufficient knowledge about how the exercise trainings could have positive and negative effects on each organ of the body, including the reproductive system and fertility as well as promoting beneficial effects along with eliminating and preventing unwanted side effects. Relatively, various studies have been indicated that long-term high-intensity exercise training has devastating effects on the male reproductive system. In fact, exercise training causes high physical stress and affects homeostasis, so if done exhaustingly, destructive effects on certain systems and organs of the body, such as reduced sperm parameters (Seminal) and sex hormone levels in elite male athletes might possibly ensue. Additionally, it should be noted that high-intensity exercise training may also have destructive effects on the male reproductive system of non-professionals (Vaamonde et al., 2009).

Although anaerobic exercise training may lead to spermatogenic dysfunction, it could also have positive effects based on the fact that high-intensity exercise training through the glycolytic energy production system can increase blood lactate level which is the substrate of Sertoli cells to continue the process of spermatogenesis. Hence, doing original and crosstalk research by researchers is crucial to complete this hypothesis and identify the related mechanisms.

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