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The potential usage of thyroid hormones as sport doping – a mini-review

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Abstract

A thyroid gland is one of the most important organs of a human body. Thyroid hormones, at least in physiological concentration, have anabolic features. The aid of this review is to summarize knowledge on potential usage of thyroid hormones in sport doping.

Thyroid hormones play a crucial role in skeletal muscles physiology. The exposition to T3 and T4 may improve myogenesis, muscles regeneration and muscles blood blow. In a long-time perspective, those hormones may help in reducing body weight.

According to those mechanisms, thyroid hormones may be considered as a plausible agent in sport doping. However WADA guidelines does not include T3 or T4 in a list o sport

doping substances, the debate on their inclusion is on-going, and the physicians should be aware of thyroid hormones effects on human metabolism from sports medicine perspective.

Keywords: thyroid hormones, triiodothyronine, thyroxine, skeletal muscles, sport doping

Introduction

A thyroid gland is one of the most important organs of a human body. Thyroid hormones, at least in physiological concentration, have anabolic features. Due to this, the more common symptoms of hyperthyroidism are sweeting, elevated body heat and psychosomatic hyperactivity (f.x. hyperthyroidism is more prevalent among the patients with first episode of mania) (Goyal et al., 2021) . But on the other hand, symptoms similar to mentioned, appeals to be useful from the perspective of a sport doping. The aid of this review is to summarize knowledge on potential usage of thyroid hormones in sport doping.

Methods

To access necessary articles, the literature review was performed using two databases – PubMed and GoogleScholar. Used keywords included “thyroid hormones” and “sport” or “sport doping”. Articles written in languages other than Polish and English were rejected.

Results

In skeletal muscles, the enlarged expression of type 2 iodothyronine deiodinase (DIO2) was detected, what links with the crucial role of thyroid hormones in muscles development and regeneration after injury (Salvatore et al., 2013) . Triiodothyronine (T3) stimulates the expression of myosin heavy chain, increases mitochondrial reactions and the relaxation–contraction rate (Bloise et al., 2018) . Even during pregnancy, the embryonal exposition to maternal thyroid hormones results up with enhanced myogenesis (Gao et al., 2022) . The role of thyroid hormones in muscles regeneration may be the cause of correlation between T3 and

thyroxine (T4) concentration and skeletal muscles quantity among the old (di Iorio et al., 2021) . Thus, the significant impact of thyroid hormones on myogenesis and muscle regenerations accompanies the whole human life.

Thyroid hormones have protective effect on various tissues in ischemia(Lourbopoulos et al., 2021), including cardiac muscle(Zeng et al., 2021) and cortical neurons(Li et al., 2019). In according to skeletal muscles, thyroid hormones improve blood flow through vasodilatation(Selivanova & Tarasova, 2020).

From the perspective of sports genomic, there is a polymorphic variant of thyroid stimulating hormone receptor (TSHR) gene named rs7144481 C, which correlates with better sport skills. This polymorphism variant results with hypersensitivity for thyroid stimulating hormone (TSH) and secondary higher concentration of T3 and T4 (Bogdan-Alexandru Hagiu & Ghiciuc, 2020).

Thyroid hormones have also effect on lipids metabolism. Their enhancement of thermogenesis may result up with adipose tissue loss(Ribeiro, 2008). This function of thyroid hormones is concerned for usage in dyslipidemias and obesity treatment(Wiacek et al., 2021).

According to current World Anti-Doping Agency (WADA) guidelines, thyroid hormones intake isn't qualified as sport doping, in contrast to androgens and erythropoietin(Gild et al., 2022; Martínez Brito et al., 2022). Current perspective on hormonal intake in sport doping policy changes, focusing on insulin-like growth factor 1 (IGF-1), directly and indirectly – f.x. indirect effect on IGF-1 secretion may be the result of thyroid hormones(Barroso et al., 2008). On the other hand, the endocrinologists should pay attention to potential abuse of thyroid hormones to ameliorate sport skills. On the other hand, thyroid disorders are the most prevalent among young adults – the group, which sportsmen are recruited from(Gild et al., 2022). The prohibition of thyroid hormones abuse may be hard also in according to inability of differentiation from endogenous and exogenous thyroid hormones.

Conclusion

Thyroid hormones play a crucial role in skeletal muscles physiology. The exposition to T3 and T4 may improve myogenesis, muscles regeneration and muscles blood blow. In a long-time perspective, those hormones may help in reducing body weight.

According to those mechanisms, thyroid hormones may be considered as a plausible agent in sport doping. However WADA guidelines does not include T3 or T4 in a list o sport doping substances, the debate on their inclusion is on-going, and the physicians should be aware of thyroid hormones effects on human metabolism from sports medicine perspective.

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