The influence of estrogen and testosterone on cardiovascular, bone, and neurocognitive health: A comprehensive review.

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Introduction

Estrogen and testosterone, two primary sex hormones, play crucial roles in the regulation of cardiovascular, bone, and neurocognitive health [1]. These hormones influence various physiological processes, and their imbalance can lead to adverse health outcomes, particularly in women and men undergoing hormonal changes due to aging or conditions like menopause or testosterone deficiency [2].

Estrogen has been widely studied for its protective effects on the cardiovascular system. It helps regulate cholesterol levels by increasing high-density lipoprotein (HDL) and decreasing low-density lipoprotein (LDL), thus reducing the risk of atherosclerosis and heart disease [3]. Postmenopausal women, who experience a natural decline in estrogen, have an increased risk of cardiovascular diseases, which can be mitigated through hormone replacement therapy (HRT) in some cases [4]. However, the protective effects of estrogen may vary depending on factors such as the timing of therapy initiation and the individual's cardiovascular risk profile [5].

Testosterone, while predominantly known as a male hormone, also plays a vital role in cardiovascular health in both men and women [6]. Low levels of testosterone have been associated with increased risks of metabolic syndrome, obesity, and cardiovascular events. In men, testosterone therapy has been shown to improve lipid profiles, reduce visceral fat, and enhance insulin sensitivity, which may positively affect cardiovascular health [7]. However, its use remains controversial due to potential side effects, such as increased red blood cell count and the risk of cardiovascular complications [8].

In terms of bone health, estrogen is essential for maintaining bone density by inhibiting osteoclast activity and promoting osteoblast function [9]. The decline in estrogen during menopause leads to an increase in bone resorption, heightening the risk of osteoporosis. Testosterone also plays a role in bone metabolism, particularly in men, where low levels are associated with decreased bone density and increased fracture risk [10].

Conclusion

Both estrogen and testosterone influence neurocognitive health. Estrogen has neuroprotective effects, contributing to cognitive function, mood regulation, and the prevention of neurodegenerative diseases like Alzheimer's. Testosterone, too, has been shown to support cognitive abilities, including memory and spatial skills, particularly in aging individuals. The balance of these hormones is essential for maintaining mental clarity and emotional well-being. Disruptions in their levels can lead to cognitive decline, mood disorders, and an increased risk of dementia in both sexes.

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