

Contributions of Estradiol to Male Pathophysiology

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Abstract

Primarily estrogens are considered female sex hormone, however this is necessary for males too albeit in smaller amounts. Estradiol is the most potent form and also found in males.

Key words: delayed puberty; infertility; erectile dysfunction; and depression; gynecomastia

Summary

Primarily estrogens are considered female sex hormone, however this is necessary for males too albeit in smaller amounts. Estradiol is the most potent form and also found in males. Either are too high or too low levels of estrogen that can cause serious health problems to a person. Germ, Leydig and Sertoli cells all produce estrogen at various stages of testes development leading to testosterone modulation. High levels of estrogen can cause a variety of problems such as short stature, delayed puberty, infertility, erectile dysfunction, and depression, gynecomastia, sometimes it can cause diabetes, tumors of the adrenal glands or testicles, hyperthyroidism, or overactive thyroid, cirrhosis in the male body. All human bodies require estrogen irrespective of their gender. Though, females have always higher estrogen levels than males do, since estrogens are considered female sex hormone [1]. Estrogen regulates the growth, development, and physiology of the human reproductive system. This hormone also influences neuroendocrine, skeletal, adipose, and cardiovascular systems. Estrogen is an important sex hormone produced primarily by the ovaries in females and testes in males. Estradiol in men is essential for modulating libido, erectile function, and spermatogenesis. Estrogen receptors, as well as aromatase, the enzyme that converts testosterone to estrogen, are abundant in brain, penis, and testis, organs important for sexual function [2,3]. There are three major forms of estrogen:

- Estrone (E1) is the primary form of estrogen that the body makes after menopause.
- Estradiol (E2) is the primary form of estrogen in the body during the reproductive years. It's the most potent form of estrogen.
- Estriol (E3) is the primary form of estrogen during pregnancy.

It is important for female puberty and controlling the menstrual cycle. Estrogen is also important for the male reproductive system. The ovaries,

testes, fat cells, and adrenal glands produce estrogen. It is important for female puberty and controlling the menstrual cycle. Estrogen is also important for the male reproductive system. Aromatase excess syndrome and alcohol use disorder may be causes of increased estrogen in males [4,5].

Now this is indicated that abnormally high estrogen levels may contribute to cardiovascular disease in men [6]. The amount of estrogen a male should have will depend on their age and health history. An adult male has an estradiol level of 10–40 picograms per milliliter (pg/mL) and an estrone level of 10–50 pg/ml. Either are too high or too low levels of estrogen that can cause serious health problems to a person. Sex hormone levels alter heart disease risk in older women [7]. that can be used to treat heart disease in women [8]. Low levels of estrogen in the male body can produce hypogonadism [9] with the symptoms such as: decreased sex drive, excess fat around the belly, bone loss and osteoporosis. Researchers found that males with cardiovascular disease had lower levels of testosterone and estrogen.

There is new evidence that a higher proportion of male to female sex hormones was associated with increased relative cardiovascular disease risk. Estrogen is a potential cardio protectant. Low testosterone and estrogen levels correlate with coronary artery disease [10]. High levels of estrogen can cause a variety of problems in the male body. :Increased levels of estrogen can cause symptoms such as short stature, delayed puberty, infertility, erectile dysfunction, and depression, gynecomastia sometimes it can cause diabetes, tumors of the adrenal glands or testicles, hyperthyroidism, or overactive thyroid, cirrhosis [11,12].

Highly regulated hormones, such as testosterone, estradiol and their receptors and enzyme- aromatase- in a proper ratio and their interactions in the male regulate male reproductive functions. The presence of ERs in the testes, penis, and brain confirms an indispensable role of estradiol in these tissues. As estradiol levels below 5 ng dl- correlate to a decrease in libido. Estradiol receptors in the preoptic area and ant hypothalamus have high levels of aromatase and estradiol receptors which regulate libido. Estrogen contributes in male physiology from early sexual development to sexual behaviour in adulthood [13]. In adulthood estrogen can sustain libido as well as affect the amount of serotonin receptors in the brain modulating mood, mental state, cognition, and emotion [2]. The penile vasculature and urothelium are lined with in the mature penis estradiol receptors modulates testosterone with the overall effect being detrimental to erectile dysfunction (ED). Erectile function is adversely

affected by estrogen exposure in early penile development, and exposure to estradiol in the mature penis leads to increased vascular permeability with increased ED [14].

In addition, spermatogenesis is dependent upon estradiol to some extent, as all the germ cells involved in the process of sperm production contain aromatase and express ERs. estradiol can become clinically useful in treating diminished libido, ED, and perhaps even oligospermia [2]. Germ, Leydig and Sertoli cells all produce estrogen at various stages of testes development leading to testosterone modulation. An inappropriate increase in e2 leads to a decrease in testicular size and sperm production [15].

Research into the effect of estrogen on migraines indicates that males with higher estrogen levels may be at higher risk of having migraines. However, researchers note that further study is required to confirm these findings [16].

A 2019 study into the link between high estrogen levels and diffuse cutaneous systemic sclerosis, an autoimmune disease, in males over 50 found that participants with significantly high estrogen levels had higher risk of cardiac involvement or death [17].

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