Review of Follicle Stimulating Hormone (FSH)

Low Sperm Count in Men Explained

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Introduction

Follicle Stimulating Hormone (FSH) is an essential reproductive hormone that acts in gonadal maturation and gamete production. This hormone has been identified in invertebrates (including humans), reptiles, and birds and has many homologous structures and functions between species. The FSH receptor gene has been mapped on chromosome 2 p21 in the human (Simoni, Gromoll, Nieschlag, 1997). Sertoli Cell Only Syndrome (SCOS) has been identified as a cause for low sperm count in men. Several studies reported the possibility to conceive after treatment of the male patient with follicle-stimulating hormone for a period of time. Ongoing research being conducted on this disease shows that those affected by SCOS now have the opportunity to procreate with medical assistance.

Source and Structure of Follicle Stimulating Hormone

FSH is the essential hormone that acts in gonadal development of males. It is secreted from the anterior lobe of the pituitary gland by specialized cells called gonadotroph cells. The GnRH secreted in the hypothalamus enters the blood stream supplied by the superior hypophyseal artery and goes through the portal vessels into the anterior lobe of the pituitary gland. This causes a release of FSH into the bloodstream and to its target cells. FSH is a glycoprotein hormone that binds to FSH receptor (FSHR), which is a glycoprotein-coupled hormone. The FSHRs are found on the granulosal cells of the ovary and the Sertoli cells of the testes. The FSH has a hinge region and a hormone binding site. The FSH binds to the hormone binding subdomain of the FSH receptor, which ressembles the molecule to form a sulfotyrosine (sTyr) binding pocket. The FSH inserts sTyr into the hormone receptor complex. The activated FSHR dissociates into α- and β-subunits. The β-subunit activates adenylyl cyclase, which increases the cAMP levels. This leads to increased steroid production. The β-subunits recruit G-protein coupled receptor kinases and β-arrestin to the receptor (Jiang, Liu, Chen, Fischer, Srimaram, Yu, Arkarstall, He 2012).

Methods

FSH released from the anterior lobe of the pituitary gland and sent through the bloodstream to FSH receptors on the Sertoli cells in the testes. The Sertoli cells are dependent on FSH to function properly. The FSH is needed in low concentrations because the hormone can be effective in the cell for long periods of time. The Sertoli cells continuously secrete Inhibin (hormone) to stop the secretion of FSH, but the Testosterone that is secreted in waves allows a pulsatile flow of FSH to the Sertoli cells. The Sertoli cells govern spermatogenesis (sperm production) by secreting Estadiol, Androgen Binding Proteins, Sulfated Gonadotrophins 1 and 2, Transferrin, and Inhibin (Senger, 2012).

Actions within Female Body

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- The FSH is needed in low concentrations because the hormone can be effective in the cell for long periods of time.
- The Sertoli cells continuously secrete Inhibin (hormone) to stop the secretion of FSH, but the Testosterone that is secreted in waves allows a pulsatile flow of FSH to the Sertoli cells.
- The Sertoli cells govern spermatogenesis (sperm production).
- The Sertoli cells also secrete Estadiol, Androgen Binding Proteins, Sulfated Gonadotrophins 1 and 2, Transferrin, and Inhibin.

Research

Infertility is a problem affecting 15% of all couples globally. Infertility is caused by either the female, male, or in many cases the combination of both. The Research and Reports in Urology’s has the first study with an SCOS patient detailing the production of sperm that could be extracted by TESE after treatment with FSH. This 30 year old male patient had a sperm count of 26-57% of azoospermia patients and there is not yet any formal treatment though several studies have discussed the possibility of testicular sperm extraction (TESE). Various studies show that there is a greater likelihood of sperm retrieval after TESE in patients with NOA and SCOS when FSH blood levels are higher. So far there have been two reported live births after treating SCOS patients with TESE.

The female patient also underwent treatment without even though she didn’t have any reproductive issues to aid in the process. After three months of being administered FSH, three times a week, the 30 year old male patient had spermatозoa present in his seminal tubes. Intracytoplasmic sperm injection was performed where every spermatozoon is injected into the cytoplasm of six mature oocytes. Three developed into zygotes and one 4BB blastocyst is retrieved to be transferred to wife’s uterus.

Structure and Classification

FSH is part of the glycoprotein hormone family, which includes FSH, Luteinizing hormone, Thyroid Stimulating hormone, and Chorionic Gonadotropin. These hormones have homologous structures, sequences, and functions. They share a common α-subunit, but have a hormone-specific β-subunit. Therefore, these hormones have similar biological pathways, but distinct biological responses (Jiang, Liu, Chen, Fischer, Srimaram, Yu, Arkarstall, He 2012).

References

- Simoni, G., Gromoll, H., Nieschlag, E. (1997). Follicle Stimulating Hormone (FSH) in Complex with the Entire β-subunit, but have a hormone-specific β-subunit. Therefore, these hormones have similar biological pathways, but distinct biological responses (Jiang, Liu, Chen, Fischer, Srimaram, Yu, Arkarstall, He 2012).