



PATIENT RESOURCES

Reproductive Hormones

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The main reproductive hormones estrogen, testosterone, and progesterone are instrumental in sexuality and fertility. They are responsible for pregnancy, puberty, menstruation, menopause, sex drive, sperm production and more. These hormones are produced in the ovaries (in females) and testes (in males). The pituitary gland produces, stores and stimulates other reproductive hormones such as:

- › **Human Chorionic Gonadotropin (HcG)**
- › **Prolactin**
- › Luteinizing Hormone (LH)
- › Follicle-Stimulating Hormone (FSH)

Reproduction Hormones

▶ **Anti Mullerian Hormone AMH**

Anti-Müllerian Hormone (AMH) acts as the gatekeeper for fertility and reproductive development. Women are born with their lifetime supply of eggs but these decrease with age. During pregnancy, the anti-Müllerian hormone (AMH) is essential in fetal development. This hormone assists in a male fetus' reproductive development. Prior to birth, AMH is made in the fetus' testes and ovaries. Around eight weeks after conception, a fetus has both Müllerian (female) and Wolffian (male) ducts, which can develop into the male or female reproductive system. If the fetus has XY (male) chromosomes, the testes will produce AMH and the Müllerian ducts will disappear. Then, testosterone produced in the testes will promote the development of the male reproductive system. If a fetus has XX (female) chromosomes, a lack of testosterone will cause the Wolffian duct to vanish and the Müllerian duct will develop into the female reproductive system.

AMH also has role in puberty and in adult ovaries and testes. Within the ovaries, it helps in the early development of follicles. Follicles hold and support eggs before fertilization. A high number of ovarian follicles means the ovaries can produce larger amounts of AMH. AMH levels can be measured to determine how many follicles a woman has in her ovaries.

What Problems Can Occur with AMH?

If a male fetus doesn't make enough AMH, the Müllerian duct doesn't disappear, which can lead to abnormal development of the reproductive system. Patients may be diagnosed with persistent Müllerian duct syndrome. This is a rare condition, but symptoms include having low or no sperm count.

In women, AMH is produced in adulthood. Measuring AMH levels is a good way to determine a woman's remaining egg supply. AMH levels are also used to determine the hormone doses given during in vitro fertilization. For most women, AMH levels are at its highest during puberty and remain at a consistent level until menopause. When there are no more ovarian follicles, levels of AMH decrease.

Low levels of AMH may be related to primary ovarian insufficiency (POI). High levels of the hormone may be due to polycystic ovarian syndrome (PCOS). However, measuring AMH levels alone isn't sufficient to make a clear diagnosis for POI or PCOS. Consider asking your healthcare team:

- › How are AMH levels measured in women and infants?
- › What do the test results mean?
- › What should I do to prepare for AMH testing?

› Androgens

Dihydrotestosterone

Dihydrotestosterone is a hormone with powerful androgenic properties. This important hormone plays a role in puberty and helps men develop their adult male characteristics.

Dihydrotestosterone is an androgen, which means it is a hormone that triggers the development of male characteristics. The hormone is created when testosterone is converted into a new form, dihydrotestosterone. About 10% of the testosterone in the bodies of both men and women is converted into dihydrotestosterone in adults, with a much higher amount in puberty. This may be why it is so closely related to the triggering of puberty. The dihydrotestosterone hormone is much more powerful than testosterone.

How Does Dihydrotestosterone Work?

Dihydrotestosterone initiates the start of puberty in boys. It causes the genitals to develop and can cause the growth of pubic and body hair. It also causes the prostate to grow during puberty and may work together with testosterone to begin the expression of sexual desires and behavior.

Women also have dihydrotestosterone, but its role in their bodies is not as well known. Some research has shown that it can lead to pubic hair growth after puberty in girls. It may also play a role in determining when puberty will start for a girl.

Problems Connected with Dihydrotestosterone

Sometimes both men and women can struggle with high levels of dihydrotestosterone, which stems from excess testosterone production. In men, high levels cause few identifiable changes. However, women who have high dihydrotestosterone levels may have issues with excess body and

facial hair. They may also struggle with adult acne and menstruation. A dihydrotestosterone inhibitor may be able to help restore natural levels of the dihydrotestosterone hormone.

On the other hand, women suffer fewer effects than men if they have low dihydrotestosterone levels. Because dihydrotestosterone function is so closely related to male characteristics, low levels may cause a male going through puberty to fail to develop normal body hair growth or genital development. If a baby boy is exposed to too little dihydrotestosterone in the womb, he may be born with ambiguous genitalia that may resemble female genitalia.

If you feel that your dihydrotestosterone levels may be off, consider asking your healthcare provider:

- › Should we test my dihydrotestosterone or testosterone levels?
- › Could dihydrotestosterone be impacting my health?
- › Is there any treatment that can help my dihydrotestosterone levels return to normal?

› Estrogen Hormones

Estrogen are a group of hormones that play an important role in growth and reproductive development in a woman - estradiol, estriol, and estrone. The ovaries, produce eggs (ova), which are the main source of estrogen from the body. Fat tissue and the adrenal glands- located at the top of each kidney- make small amounts of estrogen. The most common reason for low estrogen in women is menopause or surgical removal of the ovaries. Men have estrogen too but in smaller amounts.

Symptoms of low estrogen include:

- › Menstrual periods that are less frequent or that stop
- › Hot flashes (suddenly feeling very warm) and/or night sweats
- › Trouble sleeping
- › Dryness and thinning of the vagina
- › Low sexual desire
- › Mood swings
- › Dry skin

Some women get menstrual migraine, a bad headache right before their menstrual period, because of the drop in estrogen. Low estrogen in men can cause excess belly fat and low sexual desire. In women, excess estrogen can lead to these problems, among others:

- › Weight gain, mainly in your waist, hips, and thighs
- › Menstrual problems, such as light or heavy bleeding
- › Worsening of premenstrual syndrome
- › Fibrocystic breasts (non-cancerous breast lumps)
- › Fibroids (noncancerous tumors) in the uterus
- › Fatigue
- › Loss of sex drive
- › Feeling depressed or anxious

High estrogen in men can cause:

- › Enlarged breasts (gynecomastia)
- › Poor erections
- › Infertility

► Estradiol

Also called Oestradiol (E2) is the strongest of the three estrogens and an important player in the female reproductive system and the most common type for women of childbearing age. While men and women have estradiol, and it has a role in both of their bodies, women have much higher levels of the hormone than men.

What Does Estradiol Do?

Estradiol has several functions in the female body. Its main function is to mature and then maintain the reproductive system. During the menstrual cycle, increased estradiol levels cause the maturation and release of the egg, as well as the thickening of the uterus lining to allow a fertilized egg to implant. The hormone is made primarily in the ovaries, so levels decline as women age and decrease significantly during menopause. In men, proper estradiol levels help with bone maintenance, nitric oxide production, and brain function. While men need lower levels than women, they still require this important hormone to function well.

What Potential Problems are Connected to Estradiol Hormone Levels?

In women, too much estradiol has been linked to acne, constipation, loss of sex drive, and depression. If the levels are extremely high, they can increase the risk of uterine and breast cancer as well as cardiovascular disease. Women with high estradiol levels may experience weight gain and menstrual problems. For men, it can lead to the development of female characteristics and loss of sexual function or muscle tone.

If the body does not have enough estradiol, bone growth and development are slowed, and adults can develop osteoporosis (bone weakness). Girls may experience delayed puberty with low estradiol levels. Mood swings have also been connected to low estradiol levels.

How is Estradiol and Menopause related?

The effects of estradiol are clearly seen in women experiencing menopause. During this process, women naturally have lower levels of estradiol as the ovaries no longer produce it, causing the menstrual cycles to stop. This change often causes mood swings, vaginal dryness, hot flashes, and night sweats – the symptoms commonly associated with menopause. Over time, lower estradiol levels can lead to osteoporosis.

Until recently, most women going through menopause were treated with estradiol as a form of hormone replacement therapy (HRT) – usually by pill, gel, or patch – to help reduce the symptoms of menopause. While HRT is effective in improving these symptoms, recent studies have shown some risks associated with HRT, such as an increased risk of blood clots, heart disease and stroke, and breast cancer. Women interested in HRT should contact their medical provider, as factors such as age, lifestyle, and medical conditions can affect these risks. There are also non-hormonal options available to help with menopausal symptoms.

► Estrone

Also called, oestrone is an estrogen like estradiol and estriol. Unlike the other two, estrone comes from the ovaries, as well as the adipose tissue

and adrenal glands. It is a weaker estrogen, commonly found in higher quantities in postmenopausal women.

As an estrogen, estrone is responsible for female sexual development and function. Because it is less powerful than the other estrogens, estrone can sometimes serve as a repository for estrogens, and the body can convert it to estrogen when needed.

Possible Problems with Estrone

The effects of low estrone or high estrone levels are not yet well known.

Women who have breast cancer or men who are being treated to reduce testosterone levels — such as in prostate cancer treatment — may need to have their estrone levels monitored, because estrone levels can increase in these cases. Women who are obese will produce more estrone from fatty tissue. Too much estrone has been linked to breast and endometrial cancer growth. Besides this potential outcome, other results of increased estrone levels are not yet known.

Women who have too little estrogen hormones, including estrone, may develop osteoporosis. Low estrogen levels can also cause the symptoms of menopause, including hot flashes, fatigue, poor sex drive and depression. For women who are postmenopausal and who are still struggling with these symptoms, low estrone levels may be the reason. However, research has not yet found a definite link between the ovary hormone and these symptoms.

► **Progesterone**

Progesterone is a steroid hormone belonging to a class of hormones called progestogens. It is secreted by the corpus luteum, a temporary endocrine gland that the female body produces after ovulation during the second half of the menstrual cycle.

Synthetic steroid hormones with progesterone-like properties are called progestins. Progestin is often combined with estrogen, another hormone, to develop contraceptives such as birth control pills and skin patches. Progestin is also useful in treating common menopausal symptoms. Understanding progesterone and progestins will help women make informed choices about their reproductive health.

What Does Progesterone Do?

Progesterone prepares the endometrium for the potential of pregnancy after ovulation. It triggers the lining to thicken to accept a fertilized egg. It also prohibits the muscle contractions in the uterus that would cause the body to reject an egg. While the body is producing high levels of progesterone, the body will not ovulate. If the woman does not become pregnant, the corpus luteum breaks down, lowering the progesterone levels in the body. This change sparks menstruation. If the body does conceive, progesterone continues to stimulate the body to provide the blood vessels in the endometrium that will feed the growing fetus. The hormone also prepares the limit of the uterus further so it can accept the fertilized egg. Once the placenta develops, it also begins to secrete progesterone, supporting the corpus luteum. This causes the levels to remain elevated throughout the pregnancy, so the body does not produce more eggs. It also helps prepare the breasts for milk production.

What Does Progestin Do?

Progestins were created to bind to progesterone receptors in the body and create similar effects as progesterone. Progestin can change the lining of the uterus and stop the lining from building up. Scientists made progestin because progesterone isn't absorbed well when taken as a pill.

Progestin can also be used to treat menopause symptoms such as hot flashes and vaginal dryness. Estrogen can be used alone to treat these symptoms, or it can be combined with progestin. For women who are perimenopausal or newly menopausal, healthcare providers may suggest an oral micronized progesterone treatment. Progestin can also be prescribed to treat amenorrhea, endometriosis, and irregular periods.

Potential Problems with Progesterone Production

Women who have low levels of progesterone will have abnormal menstrual cycles or may struggle to conceive because the progesterone does not trigger the proper environment for a conceived egg to grow. Women who have low progesterone levels and who do succeed in getting pregnant are at higher risk for miscarriage or pre-term delivery, because the hormone helps maintain the pregnancy.

Signs of low progesterone include:

- Abnormal uterine bleeding
- Irregular or missed periods
- Spotting and abdominal pain during pregnancy
- Frequent miscarriages

In addition, low progesterone levels can cause too-high levels of estrogen, which can decrease sex drive, contribute to weight gain, or cause gallbladder problems.

What Problems Can Occur with Progestin?

Women who have low levels of progesterone will have abnormal menstrual cycles or may struggle to conceive because the progesterone does not trigger the proper environment for a conceived egg to grow. Women who have low progesterone levels and who do succeed in getting pregnant are at higher risk for miscarriage or pre-term delivery, because the hormone helps maintain the pregnancy.

If you are taking progestin to treat menopausal symptoms, for birth control, or to treat other conditions side effects may occur. Side effects may occur due to the dosage of progestin, how progestin interacts with hormone receptors, and your body's response to progestin. When taking progestin for menopausal symptoms, side effects may include mood changes, bloating, headaches, and breast tenderness. For newly menopausal women, breakthrough bleeding may occur. In hormonal birth control, progestin side effects can include withdrawal bleeding and increased cramping. Other side effects may include an increased blood pressure and low blood sugar.

For women who are struggling to conceive or carry a pregnancy, the emotional toll of the struggle is high. While you need to pursue every potential cause of this problem, it's valuable to talk to your doctor about your progesterone levels. If this is the problem, treatment is not difficult, but you should talk to your doctor before starting supplementation. Consider asking these questions:

- › How can I determine if I am suffering from low progesterone levels?
- › What other conditions could be causing my symptoms?
- › How can I treat low progesterone levels?
- › If I take supplemental progesterone, how long should I take it or when should I stop taking it?
- › Am I a candidate for menopausal treatment therapy?
- › Am I at risk for any side effects?
- › Which hormonal birth control method should I use?

▶ **Relaxin**

Relaxin is a hormone secreted in the ovary by the corpus luteum. When a woman is pregnant, the placenta will also release the hormone, as will the uterine lining. Men also have relaxin, which comes from the prostate gland and is found in semen, but in men it does not circulate in the blood.

What Does Relaxin Do?

Relaxin is crucial to the female reproductive process. Relaxin levels increase after ovulation during the second half of a woman's menstrual cycle, where it is believed to relax the wall of the uterus and prepare it for pregnancy. If a woman does not conceive, levels drop until the next cycle.

If the woman does conceive, relaxin levels continue to grow through the first trimester, aiding in implantation and placenta growth. This hormone also stops contractions as the tiny baby grows to prevent early delivery. At the end of pregnancy, when labor begins, relaxin helps to relax the ligaments in the pelvis to allow it to stretch as the baby leaves the mother's body.

Other effects of relaxin have surfaced in recent studies, as new relaxin peptides have been discovered. Relaxin has been proven to lessen tissue fibrosis in many organs, and can also promote wound healing. Relaxin has also been found to reduce blood pressure by relaxing the blood vessels. This has led to more study into benefits of relaxin peptide treatment for certain diseases.

Problems Associated with Relaxin

Few studies have considered the side effects of relaxin either in high or low levels. Some have suggested that high relaxin levels can cause a pregnant woman's membranes to rupture, leading to premature birth in pregnant women, but this has not yet been proven. Low relaxin levels may cause scleroderma — a thickening and hardening of the skin — but again, this needs to be studied further.

If you have questions about relaxin levels in the body, discuss them with an endocrinologist. Consider asking:

- › Do I need to be concerned with relaxin levels?
- › Can relaxin levels impact my pregnancy?
- › Could relaxin be a treatment option for my condition?

› Testosterone

Testosterone is the main sex hormone found in men. It controls male physical features. The testes (testicles) make testosterone. Women have testosterone too but in much smaller amounts than in men. Testosterone

helps bring on the physical changes that turn a boy into a man. This time of life is called puberty. Changes include:

- › Growth of the penis and testes
- › Growth of facial, pubic, and body hair
- › Deepening of the voice
- › Building muscles and strong bones
- › Getting taller
- › Men also need normal amounts of this hormone to make sperm and be able to have children.

How Does Testosterone Work?

The brain and pituitary gland, a small gland at the base of the brain, control production of testosterone by the testes. From there, testosterone moves through our blood to do its work. Testosterone levels change from hour to hour. They tend to be highest in the morning and lowest at night. Testosterone levels are highest by age 20 to 30 and slowly go down after age 30 to 35.

What Can Go Wrong With Testosterone Levels?

For many reasons, testosterone can become—and stay—too low. Less often, testosterone levels can become too high. When this hormone is not in balance, health problems can result. Ask your doctor if you should get your testosterone level checked if you have any of the problems mentioned below. You can get treatment to fix hormone problems.

Low testosterone

Early symptoms (changes you feel) and signs (abnormalities that your

doctor finds) of low testosterone in men include:

- › A drop in sex drive
- › Poor erections
- › Low sperm count
- › Enlarged or tender breasts

Later, low testosterone can lead to decreased muscle and bone strength, less energy, and lower fertility. Some things can temporarily lower testosterone, for instance, too much exercise, poor nutrition, or serious illness. Living a healthy lifestyle with regular exercise and a good diet helps maintain normal testosterone levels.

High testosterone

When young boys have too much testosterone, they can start puberty too early (before age 9). Some rare conditions, such as certain types of tumors, cause boys to make testosterone earlier than normal. Young boys also can have too much testosterone if they touch testosterone gel that an adult man is using for treatment

How do you know what your testosterone level is?

To measure your testosterone level, your doctor can order a blood test. The test should be done in the morning between 7:00 and 10:00. If the result is not normal, you should repeat the test to make sure of the result. In healthy men, testosterone levels can change a lot from day to day, so a second test could be normal.

WORDS TO KNOW

androgen (AN-druh-jenn): a male sex hormone, such as testosterone.

endocrinologist (EN-doh-krih-NOLL-uh-jist): a doctor who treats people who have hormone problems.

hypogonadism (HI-po-GO-nad-iz-um): a low testosterone level or sperm count, or both.

sex hormone: a hormone that affects and is made by the reproductive (sex) organs. It is responsible for secondary sex traits, such as facial hair in men.

AN ENDOCRINE SOCIETY PATIENT RESOURCE

WHAT DOES ESTROGEN DO?

Estrogen are a group of hormones that play an important role in the sexual and reproductive development in women. Men have estrogen too but in smaller amounts.

WHY IS ESTROGEN IMPORTANT?

Estrogen helps bring about the physical changes that turn a girl into a woman. This time of life is called puberty. These changes include:

- Growth of the breasts
- Growth of pubic and axillary hair
- Start of menstrual cycles
- Helps control the menstrual cycle and important for child bearing

In women and men estrogen helps control:

- sexual desire
- brain function
- bone health
- skin health
- lipid metabolism

THE THREE TYPES OF ESTROGEN

- ESTRADIOL**
the most common type in women of childbearing age.
- ESTRIN**
the main estrogen produced during pregnancy.
- ESTRONE**
the only estrogen your body makes after menopause.

HOW DOES ESTROGEN WORK?

The ovaries, which produce a woman's eggs, are the main source of estrogen from your body. Fat tissue and your adrenal glands, located at the top of each kidney, make small amounts of this hormone.

Visit endocrine.org/menopausemap for more information.
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