

Citation: Beth W. Orenstein and Matt McMillen. Testosterone Use and Male Infertility. African Journal of Medical Sciences, 2020, 5 (9) ajmsc.info

Review Article

Testosterone Use and Male Infertility

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What is testosterone?

Testosterone (T) is a hormone produced in men by the testes (testicles). It is involved in muscle and bone development, hair growth, and development of sex organs such as the penis and prostate. It contributes to a man's sense of overall well-being and sexual function. Testosterone is also required for sperm production.

What is low testosterone?

This medical condition is also called hypogonadism. A low T level is one that is below the normal range, which can vary widely. It is measured with a blood test. Some signs or symptoms of low testosterone are problems with erections or decreased sex drive. Testosterone levels should be checked early in the morning, and an abnormal test should be repeated. Testosterone levels vary throughout the day, and a man's T level will vary from one test to the next.

Can low testosterone be treated?

Men with low T levels and symptoms of low T can consider treatment. Men with low T can be treated with medicine through shots, gels, patches, or implantable pellets. There are advantages and disadvantages to each type of treatment. Recently, the number of men receiving T treatment in the United States has increased significantly. Medications for low testosterone are now marketed directly to patients in the media.

Does low testosterone cause infertility?

Low testosterone does not cause infertility. Sperm production is actually stimulated by hormones other than testosterone. Testosterone is required for sperm production, but the level in the testes where sperm are produced is many times higher than in the blood. Even men with low or borderline T levels may have sufficient T levels for sperm production.

How does testosterone treatment cause infertility?

One side effect of testosterone treatment is infertility. Testosterone treatment decreases sperm production by decreasing levels of another hormone, follicle stimulating hormone (FSH), which is important for stimulating sperm production. In most cases, the infertility caused by testosterone treatment is reversible. Men who have received testosterone for a shorter period of time probably recover more quickly. For a small percentage of men, the infertility is not reversible. It is generally believed that testosterone given by shots and pellets are more likely to cause infertility than gels, although any form of testosterone supplementation can disrupt the normal hormonal balance required for sperm production.

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If a man is taking testosterone and wants to have children, what are his options?

He should consult with a male reproductive specialist. Men should avoid testosterone treatment until they are done trying to have their own biological children. If a man has a pituitary disorder that is causing the low testosterone, then he can be treated with a pituitary hormone (hCG) that will increase his T level without disrupting sperm production. When he is done having children, he can take testosterone to treat his low T level directly.

If a man is infertile and taking testosterone, what are his options?

A man should see a male reproductive specialist who will perform a complete history and physical examination for him. He will need to have hormone testing, at least two semen analyses, and possible additional testing performed. He will need to stop taking testosterone and have hormone tests and semen analyses checked periodically as it could be months before his sperm count returns to baseline.

How else can low testosterone be treated?

There are other medicines, such as clomiphene citrate, letrozole, and fertility injections of pituitary hormones that men can take to raise testosterone levels. This is considered off-label use of these medications. Hormone levels and semen analyses should be monitored as these medications can cause hormone abnormalities and occasionally decrease sperm counts. A man should see a reproductive specialist for additional evaluation and counseling about his condition.

What you should do if doctor suggested putting you on testosterone, and you may want to have children in future?

Patients and providers should be aware that testosterone treatment causes lowered sperm counts and hormone alterations. Men of reproductive age should avoid testosterone treatment if they want to have biological children or consider freezing sperm for use later.

Are there other risks to taking testosterone?

The long-term safety and effectiveness of testosterone supplementation are not known. Men considering treatment should discuss these risks and possible benefits with their health-care provider. You may already know that low testosterone can cause you to lose interest in having sex and to have weaker and fewer erections. But it can also affect your fertility.

“Low testosterone can cause infertility, but it also may represent a testicular problem that results in infertility,” says Harris M. Nagler, MD, chair emeritus of the Sol and Margaret Berger Department of Urology and professor of urology at the Icahn School of Medicine at Mount Sinai in New York.

One treatment for low testosterone is testosterone replacement therapy. But taking testosterone can hurt your fertility, Dr. Nagler says. Here’s why:

A part of the brain (the hypothalamus) and the pituitary gland, which sits just below it, help control male fertility. The hypothalamus produces a chemical, gonadotropin-releasing hormone (GnRH) that sends a message to the pituitary gland to tell it to produce two important fertility hormones: luteinizing hormone (LH) and follicle-stimulating hormone (FSH). FSH triggers the creation of sperm cells. LH tells the testes to produce testosterone, which is needed for sperm production.

When you take testosterone, your brain thinks it's done its job and slows down the production of GnRH. Because it’s not getting the message, your pituitary gland no longer produces normal

levels of the other hormones, FSH and LH, needed to make sperm. As a result, your sperm production decreases. The lower your sperm count, the less chance you have of fathering a child. Men who have low testosterone and are struggling with infertility should see a urologist or an endocrinologist who specializes in male reproduction. After diagnosis, you and your doctor can determine the best treatment for your low testosterone based on your goals, which may be sexual function or reproductive function.

“The treatments are different and need to be tailored to your goals,” Nagler says. If fertility is an issue, your doctor may suggest gonadotropin injections to stimulate the testicles to make more testosterone and sperm.

Steps to Boost Fertility:

If you have low testosterone, certain lifestyle factors may help boost your fertility. Consider these tactics:

- * Keep your private parts cool. “Anything that heats up the genital area for excessive amounts of time can lower sperm counts,” says Suzanne Kavic, MD, a reproductive endocrinologist at Loyola Medicine in Chicago. “Sperm don’t like warm temperatures. That’s why the testes are outside the body.” So avoid saunas, hot tubs, and hot baths. Keep your laptop (which can get warm) off of your lap.

- * Lose weight. Being overweight can change your hormone levels and adversely affect your sperm production. “Men who are obese may have lower testosterone levels because their belly fat converts their testosterone to estrogen,” says Jay Simhan, MD, a urologist at the Einstein Healthcare Network in Philadelphia. “Shedding those extra pounds may have a positive effect on your testosterone and on your fertility.” Even if weight loss doesn’t increase your sperm count, Nagler says, it can make you feel better about yourself and improve your outlook.

- * Don’t smoke. One study of Saudi Arabian men who visited infertility clinics found that those who smoked had lower reproductive hormone levels than nonsmokers. The study was published in the January-March 2015 issue of the journal *Urology Annals*. If you smoke, quit.

- * Be careful with drugs. Some drugs - like steroids and narcotics - can affect sperm production, the Endocrine Society reports. If you need these medications to treat other health concerns, talk with your doctor, Dr. Kavic says. Recreational drugs, including marijuana, also have been linked to low testosterone, according to an article published in the September/October 2014 issue of the journal *Trends in Urology & Men's Health*.

- * Stop alcohol. Excessive alcohol consumption can decrease the amount of testosterone in a man’s body, according to the National Institute on Alcohol Abuse and Alcoholism. Alcohol impairs the secretion of the hormones LH and FSH, according to the article in the journal *Trends in Urology & Men's Health*. “Everyone is encouraged to drink alcohol in moderation for their general health,” Kavic says.

- * Get enough vitamin D. Chinese men who had lower levels of vitamin D also had lower levels of testosterone, according to a study published in July 2015 in the journal *Reproductive Biology and Endocrinology*. Good sources of vitamin D include fatty fish, mushrooms, and fortified foods such as cereal. Sunlight also is a source of vitamin D, but limit your sun exposure because of the risk of cancer

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* Exercise regularly. Exercise not only helps you lose weight and reduce stress, but it can also help build testosterone, Nagler says. A regular routine of aerobic exercise and strength training is considered the most effective.

If you have low T, you may find that it stalls your sex drive. It can also contribute to erectile dysfunction, although there are other causes of ED.

Testosterone replacement therapy (TRT) can bring your testosterone levels back to normal and restore your sex drive.

But if you want to have children, there's one downside to TRT you should know about. It gives you back your sex life, but it might also reduce your ability to father children as long as you're on it.

"Testosterone replacement therapy has a profound impact on a man's reproductive potential," says urologist Michael Eisenberg, MD. He's director of male reproductive medicine and surgery at Stanford Hospital and Clinics in Palo Alto, Calif.

"In fact," Eisenberg says, "it's been studied as a method of birth control, because 90% of men can drop their sperm counts to zero while on testosterone. By increasing testosterone, you're not going to increase fertility."

Testosterone and Fertility:

Testosterone plays an important role in making sperm. Eisenberg describes the relationship between testosterone and sperm production as part of a "feedback loop." Here's how the system works. Your brain makes special hormones, called gonadotropin-releasing hormones (GnRH). These hormones signal the testes to make more testosterone, vital for a healthy sperm count. When you're getting testosterone replacement therapy, testosterone is added into the bloodstream by patches, gels, or other treatment methods.

Your brain interprets this rise in testosterone levels as a sign that you now have enough testosterone. So it stops sending signals to the testes to make more testosterone. But when your testes don't make more testosterone, your sperm production goes down.

A low sperm count makes it harder to conceive a child:

"If you have any kind of reproductive goal, you should not be using TRT," says Eisenberg. Endocrinologist Spyros Mezitis, MD, PhD, agrees. "You want to increase the patient's own testosterone production in order to get an appropriate sperm sample for pregnancy," says Mezitis, who practices at Lenox Hill Hospital in New York City. "When testosterone comes from the outside, it suppresses the body's production of sperm."

Boosting Fertility when Testosterone Levels are Low:

If you have low testosterone, one way to improve sperm count is with gonadotropin injections. This stimulates the production of sperm. It may be considered as a way to increase a man's fertility when he and his partner are having trouble conceiving a child.

Mezitis says it's standard practice to check a man's sperm count when a couple has difficulty getting pregnant. If his sperm count is low, the next step is to measure his testosterone.

"If it's below normal, we can then inject the signal to produce more testosterone.

At this point, Mezitis advises men to seek out a specialist.

"If you have low testosterone and desire fertility, you should work with a reproductive endocrinologist," he says.

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You should also make sure to follow a lifestyle of regular exercise and a healthy diet if you want to father a child. Overweight and obese men tend to have lower testosterone levels because excess belly fat converts testosterone to estrogen, another hormone. Shedding those extra pounds will likely have a positive effect on your fertility.

"Losing weight can definitely increase testosterone," says Eisenberg. "It's a very good strategy. It's difficult to lose weight, but for men who are very motivated, it's a good place to start."

Low testosterone & male fertility at a glance:

* Testosterone (T) is a key male hormone. Low testosterone occurs when a man's testosterone drops below normal levels. It can directly affect fertility by causing decreased sperm production and indirectly affect fertility by reducing his sex drive and causing erectile dysfunction.

* Men with low testosterone levels, called hypogonadism in medical terms and commonly known as low T, can still have enough of the hormone for sperm production.

* Risk factors for low T include advancing age, obesity, testicular injury, excessive alcohol consumption, chronic narcotic use, marijuana abuse, diabetes and cancer treatments such as chemotherapy.

* Lifestyle changes such as quitting smoking and losing weight may help balance testosterone levels naturally.

* Testosterone replacement therapy, a popular way to treat low levels, may actually lower sperm count and should not be used by men trying to conceive.

What is low testosterone?

When an adult male's testosterone level falls below the normal range of around 270 to 1,070 nanograms per deciliter (ng/dL) he is said to have low testosterone. However, what is a normal testosterone level can differ for individual men.

Low testosterone is also known as hypogonadism, which can be present during fetal development or become apparent in childhood. Hypogonadism can cause a variety of problems. In adults, it can alter physical characteristics, such as decreased hair growth, and hamper normal reproduction.

Testosterone is a male sex hormone (known as an androgen) produced in the male testicles that is required for sperm production. Testosterone also affects a man's sense of virility and sexual function. Testosterone helps in the development of muscle, bones, the penis and testicles. Both men and women have testosterone, but males have higher amounts.

The primary cause of low testosterone is age, because as men age their testosterone levels will normally drop. This generally begins around middle age. Some physicians consider low testosterone a normal part of aging and recommend doing nothing about it.

But the number of men being treated for low testosterone has increased significantly in recent years. This is because companies now market medications for low testosterone directly to men. (See section below for treatments.)

NOTE: An important side effect of the low testosterone treatment known as testosterone replacement therapy (TRT) is infertility. TRT can decrease sperm production because it also lowers the level of the follicle-stimulating hormone (FSH), which is responsible for stimulating sperm production. In many cases, the infertility caused by testosterone treatment can be reversed. Men seeking to conceive should not use medications to treat their low testosterone.

Low testosterone's effect on male fertility:

Low testosterone does not always directly cause infertility. Men with low testosterone can still produce healthy sperm because sperm production is mainly stimulated by other hormones. However, low levels of testosterone may result in decreased production of sperm. The levels of testosterone in the testicles, where sperm is produced, is much higher than testosterone levels in the blood.

Low testosterone's indirect effect on fertility involves a reduced sex drive that can result in a lack of desire to even have sex. It can also cause erectile dysfunction by causing a man to have fewer erections or erections that aren't as strong as they once were. This can make it difficult to reach climax or to have sex often enough for reproduction.

Causes of low testosterone:

In addition to natural aging, stress, excessive alcohol consumption, marijuana use, chronic opioid use, soy intake and hormones present in food may all affect a man's testosterone levels. Low testosterone may also be caused by testicular cancer, early or late delayed puberty and kidney disease.

Some other risk factors for low testosterone include:

- * Obesity
- * Diabetes
- * Injury to the testicles
- * Cancer treatments such as chemotherapy and radiation.

Men can get their testosterone levels tested by their doctor. Usually this test is performed in the morning when testosterone levels are usually at their highest. Blood is drawn and analyzed for testosterone levels. We recommend that men be tested at least twice before taking any action.

How is low testosterone treated?

Whether or not a man seeks treatment should depend on how low his testosterone is and if he is experiencing bothersome degrees of symptoms, including:

- * Reduced sex drive
- * Fewer erections and weaker erections
- * Loss of muscle
- * Fatigue
- * Mood swings

Before entering into testosterone replacement therapy (TRT), men should try lifestyle changes first.

- * Lifestyle changes

First, men should make sure they are taking proper care of their testicles. This includes keeping the testicles and scrotum cool. Men may need to avoid hot tubs and saunas and keep their laptop computers off of their laps.

Some other lifestyle changes that will balance testosterone levels:

- * Stop smoking. Men who smoke have lower levels of varying hormones including testosterone
- * Losing weight. Overweight men can have diminished testosterone levels.
- * Complementing a nutritious diet with exercise should also help improve testosterone levels.

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Testosterone replacement therapy

Clinical therapies are available for men who feel as though their quality of life (sex drive, energy levels, etc.) is affected by low testosterone levels. The popular testosterone replacement therapy (TRT), involves delivering testosterone to boost levels. This can be done in several ways:

- * Injections in the muscle
- * Gels
- * Patches
- * Oral tablets
- * Nasal sprays
- * Implants placed under the skin.

Remember: Men who want to conceive should not undergo TRT.

When you think of testosterone, traditionally masculine images and words may come to mind: facial and body hair, toned muscles, virility.

If the idea of testosterone stirs up all things male, then what are the implications of low or no testosterone? Many might assume that less testosterone makes you less manly. Now add pregnancy to the mix. With low or no testosterone, conception would be tricky.

You might believe the most natural fix would be to take testosterone. It makes sense that added testosterone will surely boost your manliness, including your fertility, right? Well, not exactly. Doing so can lead to problems, according to Puneet Masson, MD, assistant professor of Urology and director of the Male Fertility Program at Penn Fertility Care.

What Low Testosterone Really Means?

“Hypogonadism—or low testosterone—can lead to issues with sexual desire,” Dr. Masson says. “It can alter a man’s libido. It could affect sexual functioning—namely, erections. It can also affect the development of sperm.”

In other words: “Low testosterone can definitely affect a man who’s having difficulty achieving a pregnancy,” he says.

A man’s testosterone levels fluctuate throughout the day. They’re usually highest in the morning and lowest at night; however, there are a few things that can lower testosterone levels:

Why Taking Testosterone Supplements for Fertility Is a Bad Idea

“Many times people feel that, ‘Oh, I have low testosterone—it affects fertility—I should take a testosterone supplement,’” Dr. Masson says. “That’s actually something we do not want them to do. If a man is taking any extra testosterone, it can basically shut off his body’s ability to make its own testosterone—and the body’s ability to make its own sperm.”

The number of men taking testosterone supplements has noticeably increased in the last decade. This growth is even among men who don’t need to because their testosterone levels are normal, according to a March 2014 study in the *Journal of Endocrinology and Metabolism*.

“There’s a lot of misuse of these supplements and treatments,” Dr. Masson adds. “People take them as a sort of anti-aging treatment when they have normal testosterone. Testosterone replacement therapy should be given to someone who has low testosterone and is symptomatic from it.”

Potential causes of low testosterone include:

- * Chronic diseases, such as liver or kidney disease, obesity or Type 2 diabetes

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- * Underactive pituitary gland
- * Injury or disease of the hypothalamus (the part of the brain responsible for hormone production)
- * Injury or disease of the testicles
- * Non-cancerous tumor in the pituitary cells
- * Genetic conditions, such as Klinefelter syndrome
- * Certain medications, such as opiate painkillers
- * Radiation or chemotherapy

Low Testosterone Treatment When Trying to Get Pregnant:

“When men come in with low testosterone, they may have already gone to another provider who put them on a testosterone supplement,” Dr. Masson says.

He explains, “Many times I’m taking these guys off of supplements or medications and putting them on something to get their body to make its own testosterone.”

Dr. Masson does this because the goal is “to stir up testicular testosterone production in a man with low testosterone who is interested in fatherhood,” he says.

Additionally, taking exogenous—or external testosterone—shuts off other hormones essential for sperm development. “Many times, these potential fathers have no idea that they are actually undermining their fertility by taking these medications,” adds Dr. Masson.

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