Natural Ways to Enhance Male Fertility

Chris D. Meletis, N.D., and Jason Barker, N.D.

Fertility, in one sense, is the barometer of a person's overall health, all things being equal. In order to conceive, a person must have a certain level of fertility that requires a sufficiently healthy body to maintain, whether a person is male or female. Fertility can be fleeting as well; it has been estimated that nearly 6 million Americans are infertile at any given time. The standard definition of infertility is the inability of a couple of childbearing age to conceive a child after 1 year of regular intercourse without the use of contraceptives. Because the large majority of couples can conceive with this timeframe, it is recommended that those who do not should be assessed for fertility problems. This article focuses on infertility in men and natural ways to address it.

Prevalence

It is important to note that infertility can occur just as equally in men as in women, with 30 percent of infertility attributable to men and 30 percent to women, while another 30 percent is attributed to both partners and the remaining 10 percent is related to unknown factors. Other statistics indicate that the annual incidence of male infertility is at least 2 million cases, which equates to an incidence rate of approximately 1 in 136 men, or 0.74 percent of the men in the United States.[1] In addition, more than 4.5 million couples in the United States do not conceive at their first attempt and more than 1 in 2 (i.e., 50 percent) of the men involved have irreversible infertility and are not able to father children.

Causes

The reasons for infertility in men are numerous; the primary causes of male infertility entail problems with spermatozoa production or delivery that may result from certain types of hormonal dysfunction, whereas trauma or anatomical defects in the reproductive system and other illnesses can all lead to infertility. Some additional causes of male infertility include:

- *Cryptorchidism*—a failure of one or both testes to descend that can impair spermatogenesis
- *Cystic fibrosis*—a condition associated with both an absence and or blockage of the vas deferens
- *Ductal obstruction*—an anatomical problem that may be caused by repeated infections, inflammations, or a developmental defect
- *Hemochromatosis*—a metabolic disorder that causes iron deposition in the testes
- *Hormone dysfunction*—a condition caused by dysregulation in the hypothalamic-pituitary-gonadal axis
- *Drugs and other substances*—pharmaceuticals used to treat hypertension, arthritis, and digestive diseases; agents for chemotherapy; and recreational drugs (such as marijuana) that are associated with sperm-production problems and infertility as is alcohol use
- *Retrograde ejaculation*—an anatomical defect that involves the muscles and nerves of the bladder neck
- *Sexually transmitted infections*—diseases that may cause obstructions, infections, and scarring
- *Sickle cell anemia*—a condition that can cause hypogonadism
- *Systemic diseases*—such as high fevers, infections, kidney diseases, or metabolic disorders that can impair spermatogenesis
- *Testicular cancer*—a condition that may cause obstructions or dysfunctions or problems related to chemotherapy used to treat the disease
- *Testicular trauma*—an event that causes damage to testes, impairing their ability to function
- *Varicocele*—a condition that can alter testicular temperature affecting spermatogenesis.

Spermatogenesis occurs in cycles composed of six stages; each one takes approximately 16 days to complete and it takes 3 months to produce mature sperm. Development of sperm is ultimately controlled by the endocrine system via the hypothalamic-pituitary-gonadal axis. Because sperm production occurs over a relatively long period of time, an illness that occurs within that time period can affect sperm production; therefore, it is important to consider recent health history when exploring causes of infertility.

Environmental and Lifestyle Factors

Although the conditions above are all contributors to infertility, there are many other factors that appear in the environment and or that occur as a result of a person's lifestyle that may contribute to infertility. Among these are workplace hazards (chemical exposures), environmental toxins (xenoestrogens), habits such as smoking or alcohol consumption, dietary factors (insufficient nutrition), oxidation, and even type of underwear worn. Although these factors are not always indicated as causes of infertility, they must be considered to ascertain whether these factors contribute to a particular person's infertility.

Workplace Hazards

There are several chemicals commonly found in workplaces that are known to be reproductive hazards for men. The hazards come from plastic production, welding, and lead and other chemicals.[2] A complete list of reproductive hazards in the workplace is unavailable because this is an ongoing area of research.

More than 1000 different chemicals used in the workplace (of the 4 million chemical mixtures that are commercially used) have been shown to cause reproductive problems in animals: The majority of these chemicals' effects have not been studied in humans. Known workplace hazards affect reproduction by decreasing sperm counts, causing abnormally shaped sperm, altered sperm transfer, and altered hormones and sexual function.

Workplace exposures have been shown to affect the reproductive system in men; however they do not affect each person in a similar way. Quantity, duration, and other factors determine whether someone is affected or not. These substances enter the body via inhalation, skin contact, or ingestion.

Other Environmental Toxins

There are several reports detailing the occurrence of decreased sperm counts in men who have resided in developed countries over the last 50 years. It has been suggested that the reason for this trend is increased environmental exposure to estrogen-like compounds as well as other chemicals that act as antiandrogens. This evidence has been repeated in a number of investigations.[3]

A study investigating the effects of estrogenic substances (diethylstilbestrol, beta-estradiol [E2], daidzein, genistein, and nonylphenyl) on sperm was performed; the investigators found that the effects of these estrogenic substances caused similar negative effects as known reproductive toxins (lead sulfate, nitrate, and acetate, dibromochloropropane, ethylene glycol monoethyl ether, 1,2-epoxybutene, and 1,2,3,4-diepoxybutane).[4]

Additional studies have linked other environmental toxins to fertility problems. A study that examined the blood levels of organochlorines in men with either poor or normal semen quality revealed an inverse relationship between sperm count and progressive motility and polychlorinated biphenyl metabolite concentrations.[5] This study revealed a relationship between significantly decreased sperm counts and elevated organochlorine blood levels. In addition, a linear relationship was shown between organochlorine levels and the ages of the volunteers.

These brief studies provide proof of the effects that environmental factors may have on male reproductive health.

Lifestyle Factors

Lifestyle factors, such as alcohol consumption and tobacco and marijuana smoking, are well-known causes of decreased sperm counts. In drinkers, alcohol has been shown to decrease sperm count; produce morphologic abnormalities; decrease sperm motility; and increase serum luteinizing hormone (LH), follicle-stimulating hormone (FSH), and sex-hormone-binding globulin levels. Patients who abused alcohol were found to be in a state of primary hypogonadism as a result of lifetime alcohol consumption.[6]

Table 1. Dosing Guide for Supplements That Enhance Male Fertility

Supplements	Doses
Zinc[a]	45–60 mg per day
Selenium	200 µg per day
Glutathione	100 mg per day
Vitamin E	400–800 international units per day
Vitamin C	1000– 2000 mg per day
Coenzyme Q10	100 mg per day
Arginine	3000 mg per day
Carnitine	3000 mg per day
Maca	1500–3000 mg per day, in 3 divided doses
Ginseng	200 mg standardized extract per day
Pygeum	200 mg per day
Supplements for increasing intracellular levels of glutathione	
Vitamin C	500 mg per day
N-acetylcysteine	800 mg per day

[a]When using zinc, also add a copper supplement. For long-term (≥ 3 months) zinc use, 2 mg of copper should be taken per day.

Sperm count and motility were found to be lower in smokers compared to nonsmokers, and smokers had a higher incidence of oligospermia, higher levels of endogenous 17 beta-E2, and sperm counts below normal compared to nonsmokers.[7] Marijuana smoking has contributed to male infertility.[8]

Other lifestyle factors, such as type of underwear worn by a man, appear to have an effect on fertility. Brief-style underwear holds the testes closely to the body and thus induces temperature elevations in the testicles that are not conducive to spermatogenesis. This technique was studied as a form of birth control; men enrolled in a study and their testicles were kept in close apposition to their inguinal canals and as a result were unable to cause pregnancies for the duration of the study period.[9]

Nutritional Supports

Several steps can be taken to reverse infertility in some cases. Once a primary cause is treated or removed, then comes the task of enhancing the body's general health by using nutritional supports in order to assist recovery of spermatogenesis. Maintaining a state of fertility for some patients may require constant support; these methods can be used for patients who have suffered some type of damage to existing mature sperm to ensure that normal, healthy sperm production continues. Among the minerals, zinc is a key factor.

Zinc

Zinc is the second most abundant trace element in the human body, totaling nearly 2 g.[10] Found in more than 300 enzymes, zinc is a cofactor for multiple biologic processes including DNA, RNA, and protein synthesis. The mineral is used itself as a catalyst in 100 different enzymes.[11]

Male fertility is influenced by zinc in several different ways. Low zinc levels have a negative effect on serum testosterone concentration and seminal volume.[12] Seminal plasma zinc concentration has been significantly correlated with sperm density, possibly contributing a positive effect on spermatogenesis.[13,14]

Other studies have shown the effects of zinc on sperm motility,[15] emphasizing the mineral's role in flagella function. Infertile males have been shown to have lower levels of seminal plasma zinc that have been associated with reduced levels of zinc in their blood.[16] Treatment with zinc can improve sperm motility parameters in men with decreased motility, suggesting a relatively simple treatment for several factors that influence fertility.[17]

A correlation exists between low prostate zinc levels and prostatic carcinoma.

In this study, men with asthenozoospermia (reduced sperm motility) were treated with 250 mg of zinc, twice per day, for 3 months. After 6 months of follow-up, the study subjects had significant improvements in sperm quality as measured by improved sperm counts, progressive motility, and fertilizing capacity; the men also had a reduced incidence of antisperm antibodies. Furthermore, the investigators hypothesized that zinc improves sperm parameters via a membrane-stabilizing effect as an antioxidant as well as affecting cellular and humoral immunity by decreasing antisperm antibody levels.

As a therapy, zinc has been suggested as a treatment for infertile male smokers by a study that investigated the mechanism of the zinc–cadmium relationship in the testes of laboratory animals.[18] Smokers had increased seminal cadmium levels, decreased sperm counts and motility, and poor sperm morphology. Therapy with zinc improved sperm quality and increased seminal levels of interleukin-4; yet the therapy also decreased tumor necrosis factor–α and interferon-γ. When a zinc-deficient diet was fed to the animals, this allowed cadmium to accumulate in their testicles in similar amounts to that seen in animals who were given cadmium supplements. The investigators of this study stated that, because of the ability of zinc to elevate Th-2 cytokines and downregulate Th-1 cytokines, zinc may modulate the putative effects of cadmium on spermatogenesis.

In addition to the beneficial effects of zinc on fertility, the relationship of zinc in prostate health must also be mentioned. A correlation exists between low prostate (tissue and fluid) zinc levels and prostatic carcinoma. The concentration of zinc in the prostate is higher than that in any other tissue in the body. Prostatic zinc content decreases incrementally from normal prostate to benign prostatic hyperplasia (BPH) to cancer. Quantification of zinc levels in prostate biopsy samples has been proposed as an additional test in the differential diagnosing of BPH and cancer.[19] Investigators have reported the sensitivity and specificity of this test to be 98 percent.

Zinc has been shown to play an important part in male reproductive health. The relationship between zinc and both seminal and prostate health is interesting; the results of inadequate amounts of zinc appear to have rather detrimental effects on the male reproductive system and, thus, zinc supplements should be considered for every man.

Antioxidants

The role of reactive oxygen species (ROS) in male fertility has come under increasing speculation with regard to their physiologic and pathologic effects. Elevated levels of ROS are known to compromise sperm function and viability (damage of spermatic nuclear DNA). This oxidative stress is derived from excessive production of ROS and/or impaired antioxidant defense mechanisms in the semen.[20] The use of antioxidant nutrients, such as selenium, glutathione, vitamin E ,and vitamin C, has produced benefits in relation to sperm health.

Selenium

A study of selenium and vitamins involved 69 infertile men who were treated with placebo, selenium, or selenium in combination with vitamins A, C, and E for 3 months. At the end of the study, both selenium-treated groups had significant improvements in sperm motility.[21] In addition, 11 percent of the men impregnated their partners during the 3-month study period.

Another study utilizing selenium supplementation in a group of infertile men provided a dose of 200 µg per day for 12 weeks.[22] Selenium concentrations were increased in the men's seminal fluid and one form of supplemental selenium (selenium-rich yeast) significantly increased glutathione peroxidase activity in the subjects' seminal fluid.

Glutathione

Glutathione is an important part of sperm antioxidant defense and has been repeatedly shown to have a positive effect on sperm motility when subjects took supplements with this antioxidant.[23–25]

In one interesting study, 600 mg of glutathione was administered intramuscularly to subjects, every other day for 2 months. Compared to subjects in a placebo group, men in the treatment group experienced a statistically significant effect on sperm motility, specifically in the percentage of sperm with forward mobility.[26]

Glutathione and selenium are essential for producing a specific protein in sperm that is responsible for motility. The phospholipid enzyme hydroperoxide glutathione peroxidase is converted to a structural protein that comprises approximately 50 percent of the mitochondrial capsule in the midpiece of mature spermatozoa.[27] A deficiency of either nutrient leads to

impaired motility of the spermatozoa. Deficiencies of either substance can lead to instability of the midpiece, resulting in defective motility.[28]

Vitamin E

Another well-known antioxidant, vitamin E, plays a role in protecting the lipid layer of human cells against ROS.[29] There are several studies in the literature documenting this effect as well as showing the benefits of vitamin E supplementation on spermatic fertility.

A study on men with low sperm counts with decreased motility showed that subjects who were given vitamin E experienced increases in both of these parameters after 6 months of supplementation with vitamin E combined with selenium.[30]

Another study estimated the amount of lipid peroxidation in the seminal plasma and spermatozoa via malondialdehyde (MDA) concentrations.[31] Supplementation with vitamin E was shown to decrease MDA concentration significantly. Sperm motility was improved as well, which led to a 21-percent pregnancy occurrence during the course of the study. A final study showed that 600 mg per day of vitamin E improved sperm function as demonstrated in the zona binding assay, a measurement that assesses sperms' egg penetration abilty.[32]

Vitamin C

Seminal plasma levels are reflective of daily dietary intake and decreased levels of vitamin C have been shown to be related to infertility and increased oxidative damage to spermatic DNA.[33] This was demonstrated in an experiment that reduced vitamin C intake in normal healthy men to a level of 5 mg per day—a decrease from 250 mg.[34] Seminal levels of vitamin C were reduced by 50 percent and were accompanied by a 91-percent increase in spermatic DNA damage in this study.

In another study on the effects of vitamin C on sperm quality, smokers were given a placebo or 200 mg or 1000 mg of vitamin C per day. The two vitamin C–treated groups had improvements in sperm quality related to increased vitamin C intake while the placebo group had no improvement whatsoever.[35]

Another important study on the use of vitamin C and its effects on male fertility demonstrated that supplementation with this vitamin could reverse some aspects of infertility.[36] A group of infertile men were given placebo or 200 mg or 1000 mg vitamin C per day. After only 1 week of supplementation, the group who took the 1000 mg of vitamin C had a 140-percent increase in sperm count and the group who took 200 mg of the vitamin had a 112-percent increase in sperm count. The placebo group had no changes. In addition, the vitamin C–treated groups had decreased sperm agglutination and, at the end of the 60-day study period, every subject who had taken vitamin C had impregnated his partner while no placebo subjects were able to cause their partners to become pregnant.

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Coenzyme Q-10

As the final electron acceptor in the synthesis of adenotriphosphate, coenzyme Q10 (CoQ10) is most concentrated in the mitochondria of the midpiece of spermatozoon, where flagella propulsion is initiated. CoQ10 has demonstrated antioxidant capabilities as well and protects the spermatic membranes against ROS.

One study analyzed samples (from asthenospermic men) that were incubated with 50 micromoles of CoQ10; significant increases in motility were observed while 60 mg of CoQ10 was given to infertile men for approximately 100 days, producing improved fertilization rates for this group.[37]

Another study produced increased sperm counts and motility in the sperm of infertile men after they were given 10 mg per day of coenzyme Q7, an analogue derivative of CoQ10.[38]

Amino Acids: Arginine and Carnitine:

Arginine is a precursor of several compounds (putrescine, spermidine, and spermine) that are thought to play a role in sperm motility. An older study showed that 74 percent of subjects (178 total) had significant improvements in sperm counts and motility after being given 4 g per day of these nutrients for 3 months.[39] In a more recent study, arginine (administered as 80 mL of a 10-percent HCl solution) was given each day to men with normal sperm counts but whose sperm had decreased motility.[40] The sperm of these subjects increased as a result of the treatment and no side-effects were noted.

Carnitine plays several roles in the development of healthy spermatozoa. Carnitine serves as source of energy in the epididymis, helps to boost sperm motility, and is thought to be involved with sperm maturation.[41]

Studies of infertile patients have shown a direct correlation between sperm motility and semen carnitine content as well as demonstrating a positive correlation between carnitine levels and sperm counts and number of motile sperm.[42]

Another large trial supplied patients with 3 g per day of carnitine for 4 months. After assessing sperm parameters before, during, and following the study, the subjects' percent of motile sperm had increased by approximately 10 percent and the actual number of sperm per ejaculate was increased as well.[43]

Botanical Medicines

Maca

Grown exclusively in the central Andes at an elevation of 4000–4500 meters, maca (*Lepidium meyenii*) has traditional uses in the Andean region because of this herb's aphrodisiac and fertili-

ty-enhancing properties. Maca has several interesting applications for promoting male sexual health. Used for increasing energy, stamina, and athletic performance, maca has effects on impotence as well.

Maca has been administered at doses of 1500 mg and 3000 mg in order to determine its effects on male sexual function in relation to serum testosterone levels.[44] After 8 weeks in a study, maca-treated subjects reported improvements in sexual desire while it was determined that serum testosterone and E2 levels were unaffected (compared to a placebo group). In addition, the researchers determined that the effects of maca were not the result of any effect on depression levels, which can influence sexual desire negatively.

Another study was conducted to determine the effects of maca on seminal parameters in healthy men.[45] After giving the men 1500 or 3000 mg of maca per day for 4 months, researchers determined that this treatment caused an increase in seminal volume, sperm counts, motile sperm numbers, and sperm motility. The researchers noted no changes in hormone levels in this study as well. Serum LH, FSH, prolactin, testosterone, and E2 were measured before and after treatment.

This herb has shown definitive effects on male sexual function, as a libido-enhancing agent, and as an enhancer of spermatozoa-related fertility functions. Studies have shown no side-effects of maca and, just as importantly, its beneficial effects do not appear to be mediated via hormonal manipulation.

Ginseng

Ginseng (*Panax ginseng*) is well-known for its energy enhancing effects; it appears to have some impact on sexual function as well. A group of patients treated with an extract of ginseng had increased numbers of sperm and improved motility.[46] Also noted in this study was an increase in total and free testosterone, dihydrotestosterone, LH, and FSH, while prolactin was decreased. The active constituents in ginseng (ginsenosides) are known to have effects on the hypothalamic-pituitary-adrenal axis. More research in the area of male fertility is needed on ginseng.

Pygeum

Pygeum (*Pygeum africanum*) seems to have an effect on male fertility as a result of this herb's effects on prostatic secretions. An important part of the ejaculate, these secretions are designed to assist spermatic survival outside of the body. Sperm motility is affected by the pH of prostatic fluid and some studies have demonstrated a beneficial effect of pygeum on prostatic fluid pH.[47,48] In addition to this effect, pygeum has been shown to be useful for treating prostatitis and BPH. A study of men with these conditions who also had additional sexual disturbance as a result showed that subjects who were treated with an extract of 200 mg per day of pygeum had improvements. At the study's 2-month mark, analysis showed improvement of urinary parameters and sexual activity.[49]

Conclusions

There are many causes of infertility among men. Although many of these factors are related to specific structural or diseases, many infertility problems may be resolved by removing negative influences, such as environmental exposures or alcohol, drug, and cigarette intake. Most interestingly, there are numerous nutritional and botanical supplements that have provided fairly dramatic results in assisting the body to produce more viable spermatozoa. Table 1 summarizes these supports and provides guidelines for dosages. Although not cure-alls, adopting these measures can greatly increase a man's chance of achieving successful reproduction. □

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Chris D. Meletis, N.D., is a naturopathic doctor at the Pearl Clinic and Pharmacy, an integrative medicine clinic in Portland, Oregon, and is the Senior Science Officer and an associate professor of natural pharmacology at the National College of Naturopathic Medicine, Portland, Oregon. **Jason Barker, N.D.,** practices at the Pearl Clinic and Pharmacy, an integrative medicine clinic in Portland, Oregon.

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