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REPORT

Increasing Male Fertility and Longevity

By Dr. Ed Rosick

The past 50 years have seen some amazing changes in the world. In 1953 a man who was 40 to 50 years old was already considered 'old' and well on his way to retirement. However, in 2003, being 40 isn't thought of by most (and especially those who have hit their fourth decade of life) as being old. It's now common to see 40-year-old men starting a 2nd or 3rd career, playing in professional sports or even being first-time fathers. Recent studies have indicated that the number of men aged 35 to 54 who are fathering children is up 20% in the past 20 years.

It's certainly heartening to realize that being past 40 doesn't mean a man can't enjoy the special pleasure of being a father. However, even in the 21st century, when the rules of aging are seemingly being rewritten on a daily basis, there are still some hard biological facts that all men must deal with. For those men who are trying to become a father, one of these facts is the decline in both the quality and the quantity of their sperm.

Infertility is not just a female 'problem'

Most couples will agree that one of the happiest times in their lives as husband and wife is when they first learn they're going to be parents. In fact, most couples take for granted their ability to have children and use birth control measures until they're ready to be parents. However, the truth is in the United States, at least 15% of all couples have great difficulty conceiving a child.1 While it's now known that in 30% to 40% of these cases this inability to conceive is due to male infertility, there is still a common misconception among both the lay population and the medical community that infertility is primarily a female 'problem.'

Female fertility testing/ treatment carries significant costs

Once a couple has decided to start a family, many become worried that 'something is wrong' after trying to conceive without success. This usually leads to a visit to their physician for testing. While the common definition of an infertile couple is one in which the woman has not become pregnant in one year of unprotected intercourse, many doctors will order testing in order to alleviate both the patients' and their own concerns.

With the rapid advance of medical technology, there are now multiple infertility tests and treatments for women. The problem is that these procedures can be extraordinarily expensive. In addition, emotionally and psychologically, these tests can put the entire burden of not being able to conceive on the woman when in fact, the man may be the cause of the couple's inability to conceive. Common tests and treatments such as in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI) can cost $80,000 to $90,000 per procedure.2

For couples who are having trouble conceiving a child, it's quite reasonable to have the man checked first for reproductive problems. Most tests and treatments for male infertility are considerably less expensive than those for women. Simple tests for male infertility, such as semen analysis and ultrasound exam of the testicles, which can detect anatomical problems, cost in the hundreds, not thousands of dollars.

The 74-day life of a sperm

In order to more fully understand and appreciate male fertility issues, it's worth looking at the cycle of life from a man's point of view. The 74-day life cycle of sperm, the tiny, tadpole-shaped carriers of a man's DNA, is an amazing journey. Actually, one could argue that the life of a sperm begins not in the testicles, but in the brain, where hormones critical for reproduction are made. This biochemical cascade begins in the part of the brain known as the hypothalamus, which secretes gonadotropin-releasing hormone (GnRH). This hormone signals the pituitary gland to make follicle-stimulating hormone (FSH) and lutenizing hormone (LH). Normal levels of FSH act on the testicles to make sperm, while LH stimulates the production of testosterone. While it might seem on first glance that FSH is by far the most important of these hormones to maintain fertility, studies have shown that both FSH and LH (through its effects of stimulating testicular testosterone secretion), are needed for normal sperm output.4

In the testicles, the life of a sperm starts in one of several hundred microscopic coils known as seminiferous tubules. In lower parts of the seminiferous tubules are specialized areas called Sertoli cells, where sperm begin their development. As sperm mature, they leave the Sertoli cells and migrate up to the upper portion of the tubules, where they develop their characteristic head and tail. After this metamorphosis, the sperm are released into the epididymis. This remarkable 20-feet long C-shaped microscopic tube that envelops the testicle is contained in a space just one and a half inches long. It's in this tube, that has a diameter of only 1/300 of an inch, that sperm finish their maturation. During an orgasm, the sperm pass from the epididymis into one of two rigid, wire-like channels, the vas deferens. These channels join together just outside the prostate gland (which supplies the sperm with lubricating fluid to aid it on it's long journey) and form the ejaculatory duct. Finally, the ejaculatory duct empties into the urethra, which then empties out through the penis.

Are sperm in the western world an endangered species?

It's well known to physicians who deal with male infertility that the vast majority of male infertility is due to low sperm counts and/or poor sperm quality. What isn't as well known is that multiple studies have shown that in highly industrialized countries, sperm counts and sperm quality has been decreasing during the past 40 to 50 years. One of the most widely publicized studies showing a decline in sperm quality was published in the prestigious British Medical Journal in 1992 by Carlsen et al.5 The study was a meta-analysis of 61 studies done between 1938 and 1991 that examined sperm counts and sperm quality in men without a history of infertility. The results were startling: both sperm counts and sperm density showed significant declines between 1938 and 1991. This led the authors of the study to conclude that "as male fertility is to some extent correlated with sperm count, the results may reflect an overall reduction in male fertility."

As can be imagined, the results of this study were looked upon with skepticism by mainstream medicine, and in fact, several papers have come out that seriously questioned the validity of the Carlsen study.6 If the Carlsen report was the only study that showed a decline in sperm quality in industrialized western societies, then it's validity should be questioned.

However, there have now been multiple studies done in different regions of Europe and America that consistently show sperm quality and quantity are in serious decline. A paper in the New England Journal of Medicine showed a decline in semen quality among men in Paris, France between 1973 and 1992.7 Another study published in the British Medical Journal in 1996 showed there had been a significant decline in the quality of semen in a group of 500 Scottish men between 1951 and 1973.8 Finally, a critical reanalysis done of the Carlsen study showed that there were indeed significant declines in sperm density in both the United States and Europe but not in non-industrialized third-world nations during the past 50 years.9 To help quell any lingering doubts, in 2000 the authors of this reanalysis examined 47 more studies done between 1934 to 1996 and again found that semen quality was in significant decline throughout the western world.10

Environmental toxins are unseen thieves of male fertility

Through the food we eat, the water we drink and the air we breathe, we are exposed to thousands of chemicals whose effects on human physiology are just now beginning to be understood. One way in which this chemical soup may be causing danger to the entire human race is by decreasing sperm counts.

An insidious way in which environmental pollutants may damage male fertility is through the production of free radicals, which are molecules produced inside cells in the body, including sperm cells, during normal cellular metabolism. While the body can produce some antioxidant scavengers to protect cells against free radicals, environmental pollution, and the resulting increase in free radical production it causes, this negative cascade

can overwhelm the body's own defenses and allow free radical cellular damage to occur. In the case of sperm, elevated levels of free radicals have been linked to abnormal sperm density, motility, morphology and degradation of the sperm's outer membrane.11 Sperm are very dependent on the integrity and fluidity of this membrane for proper function, so damage by free radicals can easily lead to sperm death, and thus, seriously impair fertility. Studies have shown abnormally high levels of free radicals in the semen of 40% of infertile men.12,13

A group of chemicals that has received significant coverage in light of their possible negative effects on human health in general and male fertility in particular are endocrine disrupters. The term endocrine disrupters comes from the chemicals' ability to interfere with the normal functioning of the endocrine system, which is the system of ductless glands in the human body that secretes hormones into the blood. In terms of the reproductive system, the most well known hormones are estrogen and testosterone.

Clues that certain chemicals such as herbicides and pesticides can interfere with the normal functioning of the endocrine system began surfacing 30 years ago. In the 1970s, scientists working at the Thames River Water Authority in London observed that 40% of the male roach fish in the river were hermaphrodites (that is, they had both female and male sexual organs), and were thus sterile. In America, alligators exposed to pesticide runoff in Lake Apopka, Florida had multiple reproductive abnormalities, including smaller-than-normal penises and reduced fertility. Studies in rats have shown that female rats that are exposed to environmental estrogens produce male rat pups that have a significant reduction in their Sertoli cells, which are critical for sperm production.14 While no human studies have yet shown the same to be true in humans, it seems reasonable to think that this could very well hold true for people and could be another reason for declining sperm counts.

Besides affecting a man's reproductive system even before he is born, endocrine disrupters may adversely affect male fertility by decreasing testosterone levels. Adequate testosterone secretion by the Leydig cells (occur between the germ cells of the gonads) in the testis is essential for normal sperm production. Scientists in Britain have done studies on the estrogen-mimicking chemical HPTE, which is a metabolite of the commonly used pesticide methoxychlor. Through experiments done on rats, scientists have shown that HPTE directly interferes with testosterone production in the Leydig cells.15 Another way endocrine disrupters may harm sperm is by causing them to mature too quickly. A study released in 2002 presented direct proof that commonly used endocrine disrupting chemicals found in dozens of herbicides, pesticides and even paints can adversely affect a man's ability to impregnate a woman. In this landmark study, mouse sperm were exposed to a variety of common endocrine disrupters at levels that were roughly comparable to what a man living in the United States or Europe might have in his blood. After only 30 minutes, the majority of sperm exposed to the chemicals had matured too quickly, causing the sperm to lose the enzymes that are needed to enter an egg and cause conception.16

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A healthy lifestyle and nutritional supplements can help keep your sperm healthy and happy

There should be no doubt that male fertility in the western world is under assault by the very industries that have given us a high standard of living. However, through lifestyle changes and nutritional supplements, you can protect and nourish your overall health and fertility.

With all the environmental toxins that your body has to fight off each and every day, it makes no sense to put more toxins into your body via cigarettes or excessive alcohol. Numerous studies have shown that excessive alcohol consumption can impair fertility through decreased testosterone production and direct impairment of sperm production and function.17,18,19 Cigarette use can also significantly decrease a man's ability to reproduce. Multiple tests have confirmed that chronic smoking can cause testicular atrophy, decreased semen volume and impaired sperm production.20,21,22 In addition, byproducts of cigarette smoke can significantly increase a person's free radical load, which can damage sperm.

Zinc-an essential mineral for healthy sperm and optimal testosterone levels

One supplement that should be considered absolutely essential for a healthy sperm is zinc. This busy mineral is involved in almost every aspect of male reproduction, including sperm formation, sperm motility and testosterone metabolism. There have been multiple studies on the effectiveness of zinc in treating male infertilty.23,24 A prime example of the usefulness of zinc was illustrated in a study of 37 infertile men with documented low sperm counts and decreased testosterone levels.25 The men were given 60 mg of zinc daily for 45 to 50 days. In 22 patients that had low testosterone levels, mean sperm count increased significantly from 8 to 20 million and testosterone levels also increased.

Selenium and arginine may help improve sperm motility

Selenium, like zinc, is a mineral that is crucial for maintaining optimal fertility. It is thought that this mineral (that's deficient in many areas of the country) is important for sperm motility. In one study done in Scotland, 69 infertile men were given either placebo, selenium or selenium in combination with vitamins A, C and E for three months.35 At the end of the study, the men who took either selenium alone or in combination with the other vitamins showed significant improvements in sperm motility.

Another supplement that can help increase sperm motility is arginine. This amino acid is a biochemical precursor for the molecules putrescine, spermidine and spermine, all of which are thought to be important for maintaining sperm motility. A study done in Italy on 40 men whose infertility was thought to be due to immotile sperm were given supplemental arginine for six months.36 The men were then rechecked, and a significant improvement in their sperm motility was noted.

Folic Acid-A B vitamin that is needed for healthy reproduction in women and men

It took many years for mainstream medicine to realize the vital importance of a particular B vitamin, folic acid, in pregnancy. It's now standard protocol for doctors to have their pregnant female patients take folic acid supplements to lessen the risk of having a child born with neural tube defects. What's not so widely known, or told to patients, is that folic acid is also important in maintaining male fertility. A recent study done at the University of California at Berkley highlighted the role of folic acid in maintaining healthy sperm. The study examined folic acid levels in both the blood and semen of 48 men, 24 who were smokers and 24 nonsmokers. They found that low levels of folic acid were associated with a decreased sperm count and decreased sperm motility. The authors also postulated the low levels of folic acid might contribute to sperm DNA damage that can then lead to possible health problems in their offspring.26

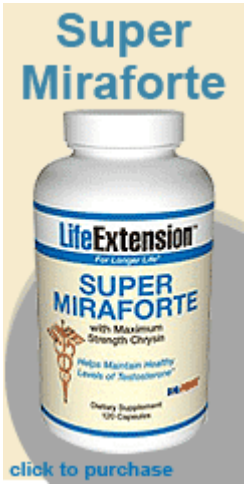
Vitamins C and E are essential

antioxidants for maintaining fertility

Multiple studies have shown that optimal vitamin C levels are very important for maintaining healthy sperm; the concentration of vitamin C in semen directly reflects vitamin C intake. It is postulated that vitamin C maintains the health of sperm by protecting the sperm's DNA from free radical damage. A study examined the effects of decreasing vitamin C intake from 250 mg/day to 5 mg/day in otherwise healthy men; the results showed a 50% decline in the men's semen vitamin C levels and a 91% increase in sperm with significant DNA damage.27 Another important study looked at the effects of giving vitamin C supplements to 30 infertile but otherwise healthy men. During a one-week period, the men were either given a placebo, 200 mg/day of vitamin C or 1000 mg/day of vitamin C. The results were important and impressive: the men who received 200 mg/day of vitamin C showed a 112% increase in their sperm count; the men receiving 1000 mg/day had a 140% increase in their sperm count; the men receiving the placebo showed no increase in their sperm count.28

Besides vitamin C, vitamin E helps protect sperm through its ability to inhibit free radical-induced damage to the sperm's outer membrane. In one study, supplementation with vitamin E decreased the peroxidation damage to sperm caused by free radicals and also increased sperm motility.29 In another randomized controlled trial, it was shown that 600 mg/day of vitamin E improved the sperm's ability to fertilize an egg in test tubes.30

L-carnitine and coenzyme Q 10 helps
keep sperm strong and alive



In order to make their long journey through a man's reproductive system, sperm need a significant amount of energy. Carnitine is a supplement that is thought to be involved in both sperm energy production and motility. There have been multiple studies looking at the effectiveness of giving L-carnitine or acetyl-L-carnitine supplements to men who have low sperm counts and sperm with abnormal motility. In one study, 100 men with abnormal sperm were given 1 gram of L-carnitine three times daily for four months. At the end of the study, the men's sperm showed significant increases in motility, as well as an increase in the total number of sperm.31 Another study examined 47 men with abnormal sperm who were given 1 gram of L-carnitine three times a day for three months. The results again showed an increase in sperm concentration, as well as increased sperm motility.32

Another well-known supplement that appears to hold promise for helping men maintain their fertility is coenzyme Q 10. While this important and extremely safe supplement has been in the news of late concerning its beneficial effects for people who have Parkinson's disease, CoQ10 is also important for a sperm's energy production, along with providing protection against free radicals. Initial studies of CoQ10 supplements in men with defective sperm have shown that anywhere from 10 mg/day to 60 mg/day of supplementation can increase sperm counts and motility.33,34

Don't give up your rights to
your health or fertility

I can still vividly recall the joy that overcame me when my wife walked into my office five years ago and showed me her positive pregnancy test and I realized I'm going to be a father! However, for many couples, that wonderment is something that they have a hard time obtaining through no fault of their own. While some things in life can't be controlled, you certainly have a right to live in a healthy environment that does not rob you of your ability to have children. By demanding that the government examine more closely the chemicals that are put into our land, water and air, by buying organic, hormone-free foodstuffs, and by taking the correct nutritional supplements, you can do your part in keeping both yourself and your fertility happy and healthy.

A protocol to maintain healthy sperm

Lifestyle issues:

- Avoid cigarettes and all tobacco products
- Avoid alcohol, or at least no more than two drinks/day
- Increase consumption of organically grown fruits and vegetables, especially cruciferous vegetables like broccoli, cauliflower and brussel sprouts
- Increase consumption of food containing essential fatty acids, such as wild (not farm-raised) salmon, mackerel, sardines, nuts, avocados and olives)
- Dairy products in moderation, and only from organic sources that do not use hormones, pesticides or herbicides

Supplements:

- Daily antioxidant complex that includes 250 to 500 mg of vitamin C and 400 to 800 I.U. of vitamin E (in the form of mixed tocopherols and toco-trienols)
- Zinc-30 mg/day to no more than 60mg/day
- Selenium-200 mcg/day
- Arginine-2 to 4 gms/day
- Daily Vitamin B complex that contains at least 400 mcg of folic acid
- Carnitine (either L-carnitine or acetyl-l-carnitine) 500 to 1000 mg three times a day
- CoQ-10 30 to 100 mg/day

Hormonal replacement:

- Men who have decreased sperm counts secondary to low testosterone levels may be able to boost their sperm production by increasing their testosterone level via testosterone injections, patches or gel.

Note: A physician trained in male hormonal replacement therapy should monitor any exogenous hormone administration.

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