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Nutritional Therapy for Male infertility

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ABSTRACT

Infertility is defined by most authorities as the inability to achieve a pregnancy after one year of unprotected intercourse. An estimated six percent of adult males are thought to be infertile. Infertility is a multi-factorial condition and poor nutrition, exposure to pollutants and toxins, recreational drugs and medications, plus lifestyle factors and stress all play their part in affecting sperm count, motility and morphology (shape). Falling sperm counts and the rise in male infertility has led to an increased interest in the nutritional and environmental factors that influence the development and quality of sperm A number of nutritional therapies have been shown to improve spermcounts and sperm motility, including carnitine, arginine, zinc, selenium, and vitamin B-12 etc. Numerous antioxidants have also proven beneficial in treating male infertility, such as vitamin C, vitamin E, coenzyme Q10 etc.

Key words: Male infertility, Factors influenzing male fertility, Nutiritional thereapy.

INTRODUCTION

A normal semen sample should have a volume of 1.5-5.0 ml, with greater than 20million sperm/ml. The number of abnormal sperm should be less than 40 percent, with greater than 30 percent of the sperm sample demonstrating proper motility. Sperm is particularly vulnerable to oxidative stress or free radical damage. Free radicals are unstable molecules that are linked with cellular destruction and high levels endanger sperm function and viability. Some causes are poor nutrition, pollutants such as smoking and poor detoxification processes by the body. Burnt, fried and barbequed foods are also sources of free radicals. Damage often results in abnormally formed sperm, and a poor morphology result. Free radicals can also cause sperm to become hyperactive whilst still in the reproductive tract which affects their motility. Semen normally contains agents known as anti-oxidants to protect sperm against free radicals and if in some way this natural defence system is impaired, the effect on sperm can be extremely damaging. Therefore it is essential to both remove potential causes of free radical damage and to eat a diet high in anti-oxidants.Potential Contributing Factors in Male Infertility areInfection, Hormonal imbalances, Hepatic cirrhosis Infection,Excessive heat,Radiation exposure,Heavy metal toxicity, Cigarette smoking, Pesticide exposure & High intake of cottonseed oil etc.

Factors Influencing Male Fertility

Alcohol

Alcohol consumption can affect male semen quality, and higher consumption may lead to serious problems with sperm morphology & motility.,leading to an increase in malformed sperm. Alcohol can also deliver a double blow to sperm, as it is also a major source of free radical damage and depletes the body of valuable vitamins and minerals.

Caffeine

Caffeine may be associated with chromosome damage and the effect on sperm appears to be dose related, so keeping to a moderate total caffeine intake is important. Caffeine is contained in tea, green tea, chocolate, colas and some medications, as well as coffee.

Weight

Excess weight can effect male reproduction because a process carried out in fat cells called aromatization can cause the conversion of testosterone to oestrogen, which can affect sperm count. Moreover, obesity can lead to the development of an apron of fat around the genital area which can lead to over heating of the testicles potentially reducing sperm numbers.

Synthetic Chemicals as harmone disruptors

Synthetic chemicals found in shampoos, cosmetics and household cleaning products to pesticides, plastics, food wrappings, tincan linings and heavy metals like lead and arsenic are known as hormone disruptors because their molecular shape is very similar to that of oestrogen. The delicate balance between the hormones oestrogen and testosterone in men is disrupted and may well be a cause of much male infertility.

Nutritional Therapies for Male infertility

Carnitine

The main function of carnitine in the epididymis is to provide an energetic substratefor spermatozoa. Carnitine contributes directly to sperm motility and may be involved in the successful maturation of sperm. 23 This is especially important since epididymal sperm use fatty acid oxidation as their main source of energy metabolism, and thus tend to concentrate carnitine while in the epididymis, as carnitine is necessary for transport of fatty acids into the mitochondria.[1]

Low levels of carnitine reduce fatty acid concentrations within the mitochondria, leading to decreased energy production and potential alterations in sperm motility.In a study involving 124 infertile patients, a direct correlation between semen carnitine content and sperm motility was found. The results also show a positive correlation between free L-carnitine and both sperm count and the number of motile sperm per milliliter ($P<0.01$).25 In one multi-center trial, 100 patients received 3 g/day of oral L-carnitine for four months. Sperm parameters were assessed before, during, and after the study. Motility was determined by computer-assisted sperm analysis. The results clearly demonstrate carnitine has a positive effect on sperm motility. The percentage of motile spermatozoa increased from 26.9 ± 1.1 to 37.7 ± 1.1 percent. The per-cent of sperm with rapid linear progressionincreased from a baseline of 10.8 percent to18.0 percent. Not only did carnitine significantly affect sperm motility, but the total number of spermatozoa per ejaculate also increased.[2]

Another clinical study reported similar results with 3 g carnitine given daily for three months. Thirty-seven of the 47 participants had increases in sperm motility, rapidlinear progression, and total number of sperm.[3]

Arginine

The amino acid arginine is a biochemical precursor in the synthesis of putrescine,spermidine, and spermine, which are thought to be essential to sperm motility. In 1973,Schachter et al published a study in which arginine was given to 178 men with low sperm count. Seventy-four percent of the subjects had significant improvement in sperm count and motility after taking 4 g/day for three months.[4]

More recently, researchers in Italy evaluated the clinical efficacy of arginine in 40 infertile men. All the men had a normal number of sperm (> 20 million/ml) but had decreased motility which was not due to immunological disorders or infections. Subjects were given 80 ml of a 10-percent arginine HCl solution for six months. Arginine supplementation significantly improved sperm motility without any side effects.[5]

Zinc

Zinc is a trace mineral essential for normal functioning of the male reproductivesystem. Numerous biochemical mechanisms are zinc dependent, including more than 200 enzymes in the body.[6] Zinc deficiency is associated with decreased testosterone levels and sperm count. An adequate amount of zinc ensures proper sperm motility and production.

Zinc levels are generally lower in infertile men with diminished sperm count, and several stud-ies have found supplemental zinc may prove helpful in treating male infertility.[7]

In one trial, the effect of zinc supplementation on testosterone,dihydrotestosterone, and sperm count was studied. Thirty-seven patients with idiopathic infertility of more than five-years duration and diminished sperm count received 24 mg elemental zinc from zinc sulfate for 45-50 days.The results were dramatic in the 22 subjects with initially low testosterone levels; a signifi-cant increase in testosterone levels and sperm count (from 8 to 20 million/ml) was noted, along with nine resulting pregnancies.Fourteen infertile males with idiopathic oligospermia were supplemented with 89 mg zinc from oral zinc sulfate for four months. Serum zinc levels were unaffected, but seminal zinc levels significantly increased.There were also improvements in sperm count and in the number of progressively motile and normal sperm. Three pregnancies occurred during the study.[8]

Zinc supplementation appears warranted in the treatment of male infertility, especially in cases of low sperm count or decreased testosterone levels.

Selenium

This antioxidant mineral is vital for healthy sperm formation, particularly motility. It also protects against toxic metal contamination. Consumption of selenium in food is dependant on the amount in the soil where the food is grown, and it is believed that the soil is often highly depleted of this mineral, so supervised supplementation is especially recommended.

Antioxidants

Polyunsaturated fatty acids and phospholipids are key constituents in the sperm cell membrane and are highly susceptible to oxidative damage. Sperm produce controlled concentrations of reactive oxygen species, such as the superoxide anion, hydrogen peroxide, and nitric oxide, which are needed for fertilization; however, high concentrations of these free radicals can directly damage sperm cells.[9]

Disruption of this delicate balance has been proposed as one of the possible etiologies of idiopathic male infertility.

Vitamin C

Studies have shown the concentration of ascorbic acid in seminal plasma directly reflects dietary intake, and lower levels of vitamin C may lead to infertility and increased damage to the sperm's genetic material.[9]

Fraga et al demonstrated this by reducing ascorbic acid intake in healthy men from 250mg to 5 mg per day. Seminal plasma levels of vitamin C decreased by 50 percent, with a concomitant 91-percent increase in sperm with DNA damage.[10]

Cigarette smoking has been documented as having deleterious effects on sperm quality. In a University of Texas study on vitamin C and sperm quality in heavy smokers, 75 men were divided into three supplementation groups; one was given placebo, the other groups received 200 mg or 1000 mg ascorbic acid. While the placebo group showed no improvement, the ascorbic acid groups showed significant improvement in sperm quality, with the greatest improvement occurring in the 1000 mg group.[11]

In perhaps one of the best studies on vitamin C and male infertility, 30 infertile but otherwise healthy men were given a placebo, 200 mg, or 1000 mg vitamin C daily. After one week, the group receiving 1000 mg/day had a 140-percent increase in sperm count, while there was no change in the placebo group. The 200 mg/day group had a 112 percent increase in sperm count, while both groups demonstrated significant reductions in the number of agglutinated sperm. Most importantly, by the end of the 60-day study every participant in the vitamin C group had impregnated their partner, while no pregnancies occurred in the placebo group.[12]

Vitamin E

Vitamin E is a well-documented antioxidant and has been shown to inhibit free-radical-induced damage to sensitive cell membranes.[13]

In one study, lipid peroxidation in theseminal plasma and spermatozoa was estimated by malondialdehyde (MDA) concentrations. Oral supplementation with vitamin E significantly decreased MDA concentration and improved sperm motility, resulting in a 21-percent pregnancy occurrence during the study.[14]

In one randomized, cross-over, controlled trial, 600 mg/day vitamin E improved sperm function in the zona binding assay,therefore enhancing the ability of the sperm to penetrate the egg in vitro.[15]

Nine men with low sperm count and alterations in sperm motility were given vitamin E with the antioxidant trace mineral selenium for six months. Compared to the baseline pre-supplementation period of four months, the combination of vitamin E and selenium significantly increased sperm motility and the overall percentage of normal spermatozoa.

Coenzyme Q-10

In sperm cells, coenzyme Q10 (CoQ10) is concentrated in the mitochondrial mid-piece, where it is involved in energy production. It also functions as an antioxidant, preventing lipid peroxidation of sperm membranes. When sperm samples from 22 asthenospermic men were incubated in vitro with 50 microM CoQ10, significant increases in motility were observed. CoQ10 (60 mg) was given to 17 infertile patients for a mean 103 days, and although there were no significant changes in standard sperm parameters, there was a significant improvement in fertilization rate ($p<.0.05$).[16]

In another study, 10 mg/day of coenzyme Q7 (an analog of CoQ10) was given to infertile men, with resulting increases in sperm count and motility.[17]

Clearly, additional studies will be needed to evaluate the possible role of coenzyme Q10 in the treatment of male infertility.

Vitamin B12

Vitamin B12, in its various forms, has been studied for its effect on male infertility. Vitamin B12 is important in cellular replication, especially for the synthesis of RNA and DNA, and deficiency states have been associated with decreased sperm count and motility.Methylcobalamin (1,500 mcg/day) was given to a group of infertile men for a period of 8-60 weeks. They were evaluated periodically by semen analysis, and standard sperm parameters were increased by 60 percent.[18]

In another methylcobalamin study,1,500 mcg/ day was given to 26 infertile men for a period of 4-24 weeks.Sperm analysis was conducted eight weeks into the study. Sperm concentration increased in 38.4 percent of the cases and total sperm count increased in 53.8 percent of the men. Sperm motility increased in 50 percent of the participants.Serum LH, FSH, and testosterone levels were unchanged.[19] When 6000 mcg/day was given to men with low sperm count, it resulted in a 57-percent improvement.[20] .Vitamin B-12 (1000 mcg/day) was administered to men with a sperm count less than 20 million/ml. By the end of the study, 27 percent of the men had a sperm count over 100 million/ml. [21]

In addition, folic acid, the amino acid taurine and the anti-oxidant glutathione are also important for fertility

Conclusion

Nutritional therapies have been shown to improve spermcounts and sperm motility, Numerous antioxidants have also proven beneficial in treating male infertility, such as vitamin C, vitamin E, coenzyme Q10 etc Infertility is a multi-factorial condition and poor nutrition, exposure to pollutants and toxins, recreational drugs and medications, plus lifestyle factors and stress all play their part in affecting sperm count, motility and morphology (shape).Spermatogenesis is an energetically demanding process which requires an optimal intake of antioxidants, minerals, and nutrients.

Table: 1 Foods Containing Nutrients to boost Male Fertility

Selenium	Vitamin E	Vitamin C	Zinc	Arginine	Carnitine	Vitamin B12	Folic Acid
Brazil nuts Wheat germ Oats Garlic & onions Barley Butter Smoked herring Brown rice Whole grains Red Swiss chard	Nut & seed oils Nuts & seeds Wheat germ & wheat germ oil Whole grains Eggs Green leafy vegetables	Citrus fruits Kiwi fruit Strawberries Blackcurrants Red pepper Broccoli & cabbage Brussels sprouts Melon Mango Watercress Spinach Papaya Parsley	Meat Fish Chicken Eggs Pumpkin / Sunflower seeds Whole grains Beans & pulses Ginger root Rye Oats	Nuts especially Walnuts Almonds Brazil nuts Beans Lentils	Beef Pork Lamb Dairy products	Meat Fish esp. trout, salmon, sardines Eggs Cheese esp. Edam	Green leafy vegetables Beans Lentils Asparagus Oatmeal Dried figs Avocado

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