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Literature Report

Dietary effects of micronutrients on male fertility

AG Med

Summary

1. ## Micronutrient combinations

Wong WY, Merkus HMWM, Thomas CMG, et al.
Effects of folic acid and zinc sulphate on male factor subfertility: a double-blind, randomised, placebo-controlled trial
Fertil Steril 2002; 77:491–498

Sinclair, S.
Male Infertility: Nutritional and Environmental Factors
Altern Med Rev 2000; 5(1):28–38

Sheweita SA, Tilmisany AM, Al-Sawaf H
Mechanisms of male infertility: the role of antioxidants
Curr Drug Metab 2005; 6:495–501.

2. ## Vitamins

Wallock, L.M., Tamura, T., Mayr, C.A., Johnston, et al.
Effects of Folic Acid on Seminal Plasma and Sperm Quality in Smokers and Non-Smokers
Fertil. Steril 2001, 75, 252–259

Suleiman SA., Ali ME, Zaki ZM et al.
Lipid peroxidation and sperm motility: the protective role of vitamin E
J Androl 1996; 17:530–7

3. ## Trace Elements

Tikkiwal M., Ajemera R. L., Mathur N. K.
Effect of Zinc on Fertility in Oligozoospermia
Pharmacol 1987. 31:30–34

Netter A, Hartoma R and Nahoul K.
Effect of zinc on testosterone, dihydrotestosterone and sperm count
Arch. Androl. 1981; 7:69–73

Foresta, C, Flohe, L, Garolla, A, Roveri, A, Ursini, F, and Maiorino, M.
Male fertility is linked to the selenoprotein phospholipid hydroperoxide glutathione peroxidise
Biol. Reprod. 2002;67:967–971

4. L-Carnitine and Coenzyme Q_{10}

Balercia G., Mosca F., Mantero F., et al.
Coenzyme Q_{10} supplementation in idiopathic asthenozoospermia
Fertil Steril. 2004 Jan;81(1):93–8

Lenzi A, Lombardo F, Sgro P, et al.
Combination of L-carnitine and L-acetylcarnitine in the treatment of asthenozoospermia
Fertil Steril 2003; 79:292–300

Matalliotakis I., Koumantaki Y., Evageliou A.
L-carnitine in Fertility and Infertility: Connection to Sperm Quality
Int J Fertil Womens 2000 Med 45: 236–240

Khdemi A., Alleyassin A., Safdarian L., et al.
The Effect of L-carnitine on Idiopathic Sperm Anomalies in Smokers and Non-smokers
J Assist Reprod Genet 2005 ; 22(11–12) :395–9

5. Glutathione

Lenzi A., Culasso F., Gandini L., et al.
Clinical Effectiveness of Glutathione Therapy in Male Infertility
Hum Reprod 1993;8(10):1657–62

Eskiocak S., Gozen A.S., Yapar S.B., et al.
Glutathione and free sulphydryl concentration in seminal plasma in healthy medical students during and after exam stress
Hum Reprod 2005; 20(9):2295–600

Effects of folic acid and zinc sulphate on male factor subfertility: a double-blind, randomised, placebo-controlled trial

Wong, WY; Merkus, HM; Thomas, CM; Menkveld, R; Zielhuis, GA and Streegers-Theunissen, RP, *Effects of folic acid and zinc sulphate on male factor subfertility: a double-blind, randomized, placebo controlled trial*, Fertil. Steril 2002, 77: 491–498.

Introduction

The decrease in sperm quality can be attributed to the interaction between genetic factors and environmental factors, including nutritional habits. Studies on diet in the population have shown an inadequate intake of folic acid and zinc. Folic acid is important for DNA synthesis as well as for protein biosynthesis. Zinc is an essential component of the metalloenzymes involved in DNA transcription and expression of steroid receptors for spermatogenesis. The study intends to demonstrate the extent to which folic acid and zinc influence sperm quality and as a further result on male fertility.

Method and Study Design

A double-blind, randomised and placebo-controlled trial was conducted over a 26-week intervention period and included 108 fertile and 103 subfertile men. Both patient groups were further divided into 4 sub-groups. These received either 5 mg folic acid, 66 mg zinc sulphate, a combination of 5 mg folic acid and 66 mg zinc sulphate or a placebo. Before and after treatment, semen samples were obtained and analyzed for sperm density, motility and morphology according to WHO guidelines.

Folate and vitamin B_{12} were determined in blood and seminal plasma using a radioassay. Zinc levels were established using AAS (atomic absorption spectroscopy) and the presence of follicle-stimulating hormone in serum was established using an immune assay.

Study results

No differences were found in the folate and zinc concentrations in blood and seminal plasma between fertile and subfertile men prior to the treatment.

In subfertile men, the combined supply of folic acid and zinc increased the sperm count by 74% ($p < 0.05$) and led to a higher number of normally formed spermatozoa ($p=0.002$).

Conclusion

The total number of sperm increased after the combined administration of folic acid and zinc in both subfertile and fertile men. The positive effects of micronutrients will continue to be investigated in future studies. Results to date, however, indicate new therapies for the treatment of fertility disorders

Male Infertility: Nutritional and Environmental Factors

Sinclair, S., *Male infertility: nutritional and environmental considerations*, Altern Med Rev 2000; 5(1):28–38

Introduction

It is assumed that approximately 6% of all men are infertile, whereby infertile is understood to mean that no pregnancy has occurred after one year of unprotected sexual intercourse. In certain cases, the infertility is attributed to anatomical changes. In 40–90% of cases, the cause lies in insufficient sperm production of unknown aetiology. Studies have shown a clear decrease of 58% in sperm count over the last 50 years. Possible causes for this are attributed to lifestyle and environmental factors. The increasing environmental impact of oestrogens, which are used in cattle breeding and milk production, is also significant. Moreover, pesticides such as DDT can have an oestrogen-like effect and therefore negatively affect sperm production. Other factors include heavy metals in the environment, ongoing stress, alcohol, nicotine and other narcotics as well as a nutrient deficiencies.

Study results

An important micronutrient, which positively affects sperm development, count and motility, is the amino acid L-carnitine. L-arginine also has a positive effect on sperm motility, and zinc improves sperm count and motility via testosterone levels. In order to protect the spermatozoa, which are sensitive to oxidative stress while maturing, antioxidants such as vitamin E, glutathione and selenium can be used. Studies have proven that vitamin E reduces the concentration of malondialdehyde in the seminal fluid and thus can decrease oxidative stress. When combined with selenium, a significant increase in sperm motility and the proportion of normally formed spermatozoa could be demonstrated. Glutathione and selenium are necessary for the formation of an enzyme (phospholipid hydroperoxide glutathione peroxidase), a structural protein, which makes up 50% of the mitochondrial capsules in the midpiece of the spermatozoon and is responsible for sperm motility.

Conclusion

Male infertility is a multifactorial disease with a series of genetic, environmental and nutritional factors. It has been proven that certain micronutrients, such as L-carnitine, L-arginine, zinc, vitamin E, selenium and glutathione, can have a positive effect on sperm count and motility and ultimately can positively affect fertility. Therefore, an optimal intake of antioxidants, trace elements and other micronutrients is recommended during sperm maturation.

Mechanisms of male infertility: the role of antioxidants

Sheweita SA, Tilmisany AM, Al-Sawaf H. *Mechanisms of male infertility: role of antioxidants*, Curr Drug Metab 2005; 6: 495–501.

Introduction

Male infertility is a complex disease which as a rule can be difficult to treat. In most cases infertility is attributed to impaired sperm function and is associated with various environmental factors as well as anatomical and genetic characteristics. For this reason, the factors leading to the impairment of normal sperm function must be identified. In this investigation, the influence of antioxidative stress on infertility is examined. The effect of biological antioxidants and their corresponding mechanisms of action in treating infertility are also examined.

Study results

The cause of male infertility is attributed to excessive production of reactive oxygen species (ROS) by immigrated leukocytes and abnormal spermatozoa. Environmental influences such as pesticides, oestrogen and heavy metals have a similarly negative effect on spermatogenesis and lead to decreasing sperm counts. Another factor associated with oxidative stress is age. ROS-induced damage can only be equalised to a limited degree by endogenous mechanisms. Oxidative stress can also be caused by urogenital infections or inflammations and can result in damage directly in the sperm cell, as the polyunsaturated fatty acids contained in high concentrations within the cells are attacked and oxidized by ROS. Thus, sperm development and motility as well as capacitation ability[1] and acrosome reaction[2] are impaired.

Nutritive therapies, such as the supply of L-carnitine, L-arginine, zinc and selenium, demonstrated that these substances can improve sperm count and motility. Similarly, the antioxidants vitamin E, glutathione and coenzyme Q_{10} yield a positive influence in the treatment of male infertility. They render free radicals harmless and protect the cells and organ systems of the body from their attacks.

Conclusion

Identification of environment-dependent factors as well as correction of possible nutritional deficiencies can positively affect sperm production and function and represent an optimal therapeutic approach in the improvement of male fertility.

[1] Sperm maturation in the female genital tract, without which fertilization of the ovum is not possible (Wikipedia 2008)
[2] Individual step in procreation, which enables the spermatozoon to penetrate the ovum (Wikipedia 2008)

Effects of Folic Acid on Seminal Plasma and Sperm Quality in Smokers and Non-Smokers

Wallock, L.M., Tamura, T., Mayr, C.A., Johnston, K.E., Ames, B.N., and Jacob, R.A., *Low seminal plasma folate concentrations are associated with low sperm density and count in male smokers and nonsmokers*, Fertil Steril 2001, 75, 252–259.

Introduction

Studies indicate that an adequate supply of folic acid is important for male reproduction. Treatment with folic acid antagonists leads to an impairment of male fertility. The aim of this investigation is to obtain the folic acid ratio in the seminal plasma of smokers and non-smokers. In addition, a connection between the folic acid ratio in the seminal plasma and the folic acid supply, as well as sperm quality, are to be identified. With this, a connection can be assumed between the folic acid ratio and male fertility. The negative influence of smoking on male fertility can also confirm a potential connection between the folate metabolism and smoking.

Methods and Design

The study was conducted by the U.S. Dept. of Agriculture using 24 healthy smokers (n=24) and 24 healthy non-smokers (n=24). The values were examined for folic acid in the seminal plasma, homocysteine (HPLC), total seminal plasma and sperm count and density. These were divided into 5-methyltetrahydrofolate (5-MTHF) and non-methyltetrahydrofolate (non-MTHF).

Results

There was a significant correlation between the folate concentration in the seminal plasma and that in the blood plasma (r=0.76). This was also 1.5 times higher. There was also a significant correlation between total folate and 5-MTHF in the sperm with the folate level (r=0.76) and the homocysteine level (r=0.43) in the plasma. The 5-MTHF correlated significantly with the total folate concentration in the seminal plasma (r=0.9). Of the non-MTHF, a low concentration correlated with the seminal density and the total sperm count (p=0.01). Smokers present a slightly decreased concentration of non-MTHF.

Conclusions

Both the total folate concentration and the concentration of 5-MTHF serve as reliable markers for evaluating folic acid supply. The non-MTHF concentration in the seminal plasma is linked to total sperm count and density. Thus, folic acid plays an important role in male fertility.

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Lipid peroxidation and sperm motility: the protective role of vitamin E

Suleiman SA., Ali ME, Zaki ZM, el-Malik EM, Nasr MA. *Lipid peroxidation and human sperm motility: protective role of vitamin E.*, J Androl 1996; 17:530–7

Introduction

Asthenozoospermia was identified as the main factor in male infertility at the Asir Infertility Centre in Abha, Saudi Arabia. It is well known that oxygen radicals have a toxic affect on sperm motility. Radicals can lead to a peroxidation of the phospholipids in the cell membrane and thus to sperm immotility. The supply of antioxidants such as vitamin E can have a positive influence on sperm motility by halting lipid peroxidation. This is why the treatment for asthenozoospermia with such antioxidants as vitamin E needs to be examined more closely. The aim of this investigation is to identify the extent of lipid oxidation in patients with asthenozoospermia as well as to determine the effect of vitamin E therapy on lipid peroxidation sperm motility and the probability of pregnancy.

Method and Study Design

A double-blind, randomised, placebo-controlled trial was carried out. The study included 110 men with asthenozoospermia and a sperm motility of <40%, as well as men with a normal sperm counts. In total, 87 patients received either 3 x 100mg vitamin E or a placebo daily. Administration was repeated (max. 6 months) until an improvement was seen in the sperm parameter (15% increase in sperm motility) or a partner became pregnant. The malondialdehyde (MDA) concentration in the spermatozoa was used as a parameter for the extent of the lipid peroxidation.

Study results

A group of 52 patients was given vitamin E and the other group of 35 patients was given a placebo. Compared with the patients with asthenozoospermia, the group of fertile men had a 1.7-fold higher MDA-concentration in their sperm which is also connected with reduced sperm motility. The supply of vitamin E could significantly reduce the MDA-concentration ($p<0.001$). Parallel to this there was a significant rise in sperm motility ($p<0.001$). No changes were observed in the placebo group. A highly significant correlation between the MDA concentration and sperm motility could be established after treatment with vitamin E ($r=0.79$). 11 partners of the men who had received vitamin E became pregnant. In contrast there were no pregnancies recorded in the control group.

Conclusion

Vitamin E leads to a reduction in lipid peroxidation and thus protects against a loss in sperm motility. Furthermore, vitamin E improves sperm motility in men with asthenozoospermia and increases the likelihood of pregnancy.

Effect of Zinc on Fertility in Oligozoospermia

Tikkiwal M., Ajemera R. L., Mathur N. K., Effect *of zinc administration on seminal zinc and fertility of oligospermic males*, Indian. J. Physiol. Pharmacol 1987. 31: 30–34.

Introduction

Zinc, an essential trace element necessary for the function of 80 metalloenzymes, plays an important role in the polymerization of macromolecules such as RNA and DNA, in protein biosynthesis, cell division and cell membrane stabilisation. Regarding reproduction, it is jointly responsible for spermatogenesis and the preservation of the germ epithelium. Beyond this, it plays an important role in the survival and normal function of spermatozoa as well as in fertilisation. Zinc deficiency can lead to a reduced sperm count and a low testosterone level.

The aim of this investigation was to determine the effect of oral zinc administration on the zinc levels in the seminal plasma and on other fertility factors in men with oligozoospermia and low concentrations of zinc in the seminal plasma.

Method and Study Design

The study included 14 men with oligozoospermia (sperm count <40 million/ml or a significantly subnormal percentage of spermatozoa with progressive motility or normal morphology). Sperm quality and phosphatase activity parameters in the seminal plasma were collected as part of the study. The zinc concentration was measured in plasma and seminal plasma using AAS (atomic absorption spectroscopy). To determine initial values, 2 spermiograms were taken with an interval of one month between. The patients subsequently received 220 mg zinc sulphate daily over 4 months.

Study results

Before beginning the study, the sperm count, percentage of spermatozoa with progressive motility and the phosphatase activity in the seminal plasma were below reference levels. The administration of zinc had no influence on the zinc plasma levels, whereas the zinc concentration in the seminal plasma increased significantly ($p<0.05$). Furthermore, the sperm count ($p<0.01$), sperm motility ($p<0.05$) and the proportion of normally formed spermatozoa ($p<0.01$) rose significantly.

Conclusion

Zinc is an important factor for androgen production in the testicles, for proliferation of germ cells and for sperm capacitation[1]. Supplementation of zinc therefore leads to a significant improvement in sperm quality and is thus an important factor in treating male infertility.

[1] Sperm maturation in the female genital tract, without which fertilization of the ovum is not possible (Wikipedia 2008)

Effect of zinc on testosterone, dihydrotestosterone and sperm count

Netter A, Hartoma R and Nahoul K. *Effect of zinc administration on plasma testosterone, dihydrotestosterone and sperm count*. Arch. Androl. 1981; 7: 69–73.

Introduction

In 1921 it had already been established that the concentration of zinc in the testicles of herrings was higher during the spawning period than during the rest periods. It was also established that the zinc concentration is also high in the testis and accessory sex glands in mammals and in humans. It can therefore be assumed that zinc plays an important role in reproductive physiology.

Method and Study Design

The study included 37 men aged between 20 and 40 years who presented with 5 years of infertility.
Over a period of 40 to 50 days they were given 120 mg zinc twice daily. Before and after the intervention, the zinc level in the blood plasma was determined using AAS (atomic absorption spectroscopy). Testosterone and dihydrotestosterone were measured by means of chromatography and subsequent radioimmune assay. Sperm count was also determined before and after the intervention.

Study results

For the evaluation, two groups were formed depending on testosterone level: the patients in the first group had a plasma testosterone level of <4.8 ng/ml and the patients in the second group had a testosterone level of >4.8 ng/ml.

In the patients in the first group, the levels of plasma zinc, testosterone and dihydrotestosterone and the sperm count rose significantly (in each case $p<0.01$). The second group saw a significant increase in the dihydrotestosterone level ($p<0.01$).

Throughout the treatment time, 9 partners of men in the first group became pregnant.

Conclusion

Supplementation of zinc is useful in men with idiopathic fertility disorders and a low testosterone level, as the sperm count can be increased as a result. A zinc-induced increase in the testosterone and dihydrotestosterone levels then also favourably affects spermatogenesis.

Male fertility is linked to the selenoprotein phospholipid hydroperoxide glutathione peroxidase

Foresta, C, Flohe, L, Garolla, A, Roveri, A, Ursini, F, and Maiorino, M. *Male fertility is linked to the selenoprotein phospholipid hydroperoxide glutathione peroxidase*. Biol. Reprod. 2002;67:967–971.

Introduction

Almost the entire selenium content in the human testis is found in the selenoprotein phospholipid hydroperoxide glutathione peroxidase (PGHPx). PGHPx, an active peroxidase in spermatozoa, is converted into an inactive oxidative protein in the matured sperm where it becomes a main component of the mitochondrial capsule in the midpiece of the spermatozoon. Male infertility, which develops due to impaired sperm motility via morphological changes in the sperm midpiece, is attributed to an insufficient concentration of PGHPx. In this study, the link between PGHPx activity and male fertility is examined.

Method and Study Design

An investigation of various fertility parameters in the semen samples of 75 infertile men and 37 healthy control subjects was conducted according to WHO criteria. The PGHPx activity was determined by analysing the remaining activity of the enzyme after forming a solution in a reducing agent.

Study results

In the infertile men, it was established that the measured PHGPx activity of 93.2 mU/ml in the spermatozoa was significantly less ($p<0.001$) than in the healthy subjects with 187.5 mU/ml. In the patients with oligoasthenozoospermia, it was clearly lower with 61.93 mU/ml.

There was a positive correlation between the remaining activity of the PGHPx and sperm vitality ($p=0.35$), intact morphology ($r=0.44$) and forward movement of the spermatozoa ($r=0.45$). The low PHGPx concentration in the group of infertile men is associated with a low sperm count ($p<0.01$), a higher percentage of morphological changes ($p<0.01$) and poorer sperm motility ($p<0.001$). Sperm motility correlated positively with PHGPx concentration in all study participants ($r=0.45$).

Conclusion

A sufficient concentration of the selenoprotein phospholipid hydroperoxide glutathione peroxidase is a requirement in humans for intact morphology of spermatozoa and for sperm motility and vitality.
Since the enzyme activity correlates with parameters relevant to fertility, it can be regarded as a prognostic factor for male fertility.

Coenzyme Q_{10} supplementation in idiopathic asthenozoospermia

Balercia G., Mosca F., Mantero F., et al. Coenzyme Q(10) supplementation in infertile men with idiopathic asthenozoospermia: an open, uncontrolled pilot study. Fertil Steril. 2004 Jan;81(1):93–8.

Introduction

Coenzyme Q_{10} functions as an antioxidant in the body and can also render reactive oxygen species (ROS), which affect sperm cell function, harmless. The reduced form of coenzyme Q_{10} (ubichinol) is present in sperm and in the seminal plasma in a high concentration and acts here as a free-radical scavenger. The study is intended to determine whether oral administration of coenzyme Q_{10} increases the concentration in the spermatozoa and thus whether parameters of sperm quality in idiopathic asthenozoospermia are improved.

Method and Study Design

The pilot study included 22 patients with idiopathic asthenozoospermia who took 200 mg coenzyme Q_{10} twice daily over a period of 6 months. Before and after the intervention a spermiogram was done to evaluate the function parameters, and the concentration of coenzyme Q_{10} in the spermatozoa and the seminal plasma was measured using HPLC (high performance liquid chromatography).

Study results

The concentration of coenzyme Q_{10} increased significantly both in the semen ($p<0.05$) and in the spermatozoa ($p<0.05$). The proportion of the sperm with forward motility (9.13% vs. 16.34%; $p<0.05$) as well as the speed (5.2 µm/s vs. 20.40 µm/s; $p<0.05$) increased significantly.

Conclusion

It could be established that coenzyme Q_{10} supplementation obviously has a positive effect within the treatment of asthenozoospermia. This can be attributed with high probability to both the function of coenzyme Q10 in mitochondrial energy production and to the antioxidative properties of this vitaminoid.

Combination of L-carnitine and L-acetylcarnitine in the treatment of asthenozoospermia

Lenzi A, Lombardo F, Sgro P, et al. *Use of carnitine therapy in selected cases of male factor infertility: a double-blind crossover trial*. *Fertil Steril* 2003; 79:292–300.

Introduction

It is well known that L-carnitine protects cell membranes and DNA from damage caused by free oxygen radicals. The highest concentration of L-carnitine is found in the human epididymis. The onset of sperm motility runs parallel to a rise in the concentration of L-carnitine in the testicle and the concentration of L-acetylcarnitine in the spermatozoa. This investigation seeks to determine the effect of a combined dose of L-carnitine and L-acetylcarnitine on the fertility of men with oligoasthenoteratozoospermia.

Method and Study Design

A double-blind, placebo-controlled trial which included 60 men with infertility was conducted. The study consisted of a two-month wash-out phase, a six-month administration of both substances (Group 1) or a placebo (Group 2) and a two-month follow-up phase. The carnitine group received 2 g carnitine and 1 g L-acetylcarnitine daily.

Study results

All sperm quality parameters exhibited improvements after the combined carnitine treatment. Sperm motility in particular improved in those patients with low absolute sperm count values at the beginning of the study ($<5 \times 10^6$). Significant improvements were particularly seen in forward motility (2.7×10^6 *vs.* 7.5×10^6 progressively motile sperm in the ejaculate; $p<0.043$) and overall motility (33.4×10^6 vs. 6.9×10^6 total motile sperm in the ejaculate; $p<0.038$). In Group 1 (carnitine combination), 4 partners of study participants became pregnant.

Conclusion

Combined treatment with L-carnitine and L-acetylcarnitine in this controlled effectiveness study proved effective and led to an improvement in sperm motility, particularly in those patients with low initial values in the spermiogram.

L-carnitine in Fertility and Infertility: Connection to Sperm Quality

Matalliotakis I., Koumantaki Y., Evageliou A. *L-carnitine levels in the seminal plasma of fertile and infertile men: correlation with sperm quality*. Int J Fertil Womens 2000 Med 45: 236–240

Introduction

L-carnitine, a naturally occurring vitamin-like substance (a vitaminoid), occurs in human tissues and cells and is important for the transport of long-chain fatty acids across the inner mitochondrial membrane where they are used for energy production via beta oxidation. L-carnitine appears in high concentration in the human epididymis. It has been established that an increase in L-carnitine and L-acetylcarnitine content in spermatozoa during the passage through the epididymis leads to an improvement in sperm motility. The aim of this study is to measure the concentration of L-carnitine in the semen of fertile and infertile men and to examine the connection with different parameters of sperm quality.

Method and Study Design

The study included 101 men aged 19 to 53 years. Semen samples were taken after 3–6 days of sexual abstinence. In accordance with WHO criteria, they were divided into a fertile and an infertile group. Sperm density, motility and morphology were determined as was the L-carnitine concentration in the semen.

Study results

The concentration of L-carnitine in the semen was significantly higher in fertile men at 478.4 µmol/l compared with 100.6 µmol/l in infertile men. There was also a positive correlation between L-carnitine concentration and sperm count (r=0.71), sperm motility (r=0.58) and sperm morphology (r=0.59).

Conclusion

The concentration of L-carnitine in the sperm was significantly less in infertile men than in fertile men and correlated with various quality parameters of the spermiogram. With higher concentrations of L-carnitine in men with good sperm quality, it can be assumed that L-carnitine would make a good marker for estimating sperm quality.

The Effect of L-carnitine on Idiopathic Sperm Anomalies in Smokers and Non-smokers

Khdemi A., Alleyassin A., Safdarian L., et al. *The effects of L-carnitine on sperm parameters in smoker and non-smoker patients with idiopathic sperm abnormalities.* J Assist Reprod Genet 2005 ; 22(11–12) :395–9

Introduction

One in every ten couples seeks medical assistance for fertility disorders. Half of these couples could be helped using targeted treatment. It is still being debated whether infertility is also dependent on various nutritional factors. For example, the administration of L-carnitine positively affects sperm quality in patients with asthenozoospermia and is also important for sperm metabolism. The aim of this investigation is to examine the effects of an L-carnitine supplement in patients with idiopathic infertility. The significance of smoking as a risk factor was also incorporated.

Method and Study Design

The study included 170 men with infertility (48 smokers, 122 non-smokers). Before L-carnitine was administered, 3 spermiograms were performed monthly and assessed using WHO criteria. The patients then took 1 g L-carnitine 3 times daily every 8 hours over a period of 3 months. At the end of the treatment period, 2 more spermiograms were done. Sperm concentration, motility and morphology were examined.

Study results

Prior to treatment, all the patients had teratozoospermia (<14% normal forms). No patient had motility within the normal range. Furthermore, oligozoospermia was established in 58 patients. The administration of L-carnitine over a period of 3 months led to a significant increase in overall motility ($p=0.02$) and the proportion of spermatozoa with linear progression ($p<0.001$) in non-smokers. The group of smokers showed an increase in normally formed spermatozoa ($p=0.03$).

Conclusion

L-carnitine leads to an effective improvement in the proportion of sperm in the semen with linear progressive movement as well as sperm with normal morphology. The positive effects in the group of non-smokers were particularly noteworthy.

Clinical Effectiveness of Glutathione Therapy in Male Infertility

Lenzi A., Culasso F., Gandini L., et al. *Placebo-controlled double blind, cross-over trial of glutathione therapy in male infertility*, Hum Reprod 1993;8(10):1657–62

Introduction

Glutathione protects cell membranes from lipid peroxidation. It has been established in more recent studies that reactive oxygen species (ROS) are responsible for sperm damage which can lead to infertility. It has also been shown that reactive oxygen species are formed, particularly in patients with unilateral varicocele or with non-specific inflammation in the area of the genital organs, which results in sperm alterations. The aim of this study is to examine the effect of glutathione in this regard.

Method and Study Design

A double-blind, randomised, placebo-controlled trial was conducted with 21 infertile men (with cross-over design). Prior to the study, 3 spermiograms were done on a monthly basis and during the study after 30, 60, 90 and 120 days. The patients received either 600 mg glutathione or a placebo daily. After the first study phase of 2 months, the groups were switched and received the other therapy. A standardised semen analysis and computer-assisted sperm motility analysis were also carried out before and during the treatment.

Study results

The supply of glutathione over a period of 2 months significantly increased sperm motility ($p<0.01$). In particular, the proportion of sperm with forward motility ($p<0.01$) and sperm morphology ($p<0.001$) showed clear improvements.

Conclusion

Treatment with glutathione has positive effects on sperm motility and morphology. The hypothesis can be confirmed that ROS play a role in the pathogenesis of a varicocele or a non-specific inflammation in the genital tract. Administration of glutathione is therefore suitable as an effective therapeutic measure in the treatment of patients with these diseases.

Glutathione and free sulphydryl concentration in seminal plasma in healthy medical students during and after exam stress

Eskiocak S., Gozen A.S., Yapar S.B., et al. (2005) *Glutathione and free sulphydryl content of seminal plasma in healthy medical students during and after*, Hum Reprod 2005;20(9):2295–600

Introduction

The extent to which stress-dependent changes influence fertility has not yet been completely clarified. It is assumed, however, that oxidative stress appears to be one of the causes of fertility disorders. Glutathione acts as a strong antioxidant. This study examines the effect of exam stress on the concentration of glutathione and free sulphydryl in the seminal plasma as well as on sperm quality.

Method and Study Design

The study included 34 healthy medical students, from whom semen samples were collected during the examination period and analysed. The first samples were taken shortly before their final examination (stress), and the second samples 3 months after the examination (no stress). The extent of the stress was surveyed based on the self-evaluation questionnaire, "State-Trait Anxiety Inventory". Once the standard parameters had been determined, the semen samples were analysed for their glutathione (HPLC) and free sulphydryl (HPLC) content.

Study results

It could be established that during exam stress the concentration of glutathione and free sulphydryl was significantly lower than without stress ($p<0.001$). The sperm motility index was significantly reduced and the percentage of sperm with morphological anomalies significantly increased ($p< 0.001$). A significant association was also observed between the glutathione content in the seminal plasma and the motility index ($p<0.05$ and $p<0.01$) both in the stress phase and the stress-free phase.

Conclusion

The study showed that the concentration of glutathione and free sulphydryl in the seminal plasma of healthy students under exam stress was lower. Poor sperm quality can be attributed to a loss of glutathione and free sulphydryl in the seminal plasma. Glutathione protects against oxidative damage to sperm.