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Role of nutrition and associated factors in oligospermia (Low sperm count)

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Abstract

Prevalence of infertility gravitates to increase due to different factors. Causes of male infertility could be varicocele, idiopathic infertility, testicular insufficiency, obstruction, ejaculation disorder, medicine-radiation effect, undescended testis, immunological mechanisms, endocrine dysfunction such as diabetes, excessive taking of alcohol, smoking and environmental toxins such as pesticides, mercury and lead. It is furthermore understood that person, obesity, be deficient in of nutrition and habits of utilizing time for example too much use of, laptop, mobile phones, computers and sauna, etc., as for women, age, smoking, too much consumption of alcohol, having a skinny or overweight body and having been exposed to physical or mental stress fruition in amenorrhea might be the causes of infertility. The progress in infertility prevalence draws attention to the effects of factors such as lifestyle, dietetic habits and environmental factors. Male infertility originates from mostly as a result of the association between oxidative stress and antioxidants. A review of these areas will provide researchers with a more noteworthy understanding of the compulsory participation of these nutrients in male reproductive processes. This review also caustic out gaps in recent studies which will require further investigations.

Keywords: Nutrition; spermatogenesis, oligospermia, infertility, antioxidants, reproductive

Introduction

An approximately six per cent of adult males are thought to be infertile. Infertility is defined by most authorities as the inability to accomplish a pregnancy after one year of unprotected intercourse ^[1]. About 15% of couples desiring pregnancy are in these occurrences globally and male incident infertility is constrained for not less than 50% of the cases ^[2]. Remarkable factors such as radiation, smoking, varicocele, infection, urinary tract infection, environmental factors, nutritional deficiencies and oxidative stress impart to male infertility. While certain cases of male infertility are due to anatomical abnormalities such as varicoceles, ductal obstructions, or ejaculatory disorders, an estimated 40-90 per cent of cases are due to insufficient sperm production of unidentifiable original factor infertility is generally seen as an alteration in sperm concentration and/or motility and/or morphology in at least one sample of two sperm analyses, collected between 1 and 4 weeks apart Oligozoospermia. While 45% of the issue originates from women, 30% of it originates from men. 20% of it originates from both genders and 5% of the problem originates although there is no reason ^[3]. A low sperm count is also describing oligospermia. An entire absence of sperm is called azoospermia ^[1]. Infertility could also develop as a result of lifestyle, nutritional practice and environmental factors. Infertility frequently affects the sperm count (concentration) of the semen, its motility and morphology. Therefore, in this review, the effect of the factors related to nutrition which affect infertility is studied state characterized by low sperm count and quality is constrained for 90% of male infertility ^[4].

Methodology

Review literature described to scientific research related to infertility related with nutrition revealed through web database such as Science Direct, Google scholar, Pubmed. The reference articles were finding from databases using keywords such as male infertility, nutrition, nutrient, health effects/beneficial effects/health benefits to bring together existing information.

Main factors of low sperm count

Medical Causes

Oligospermia term use for low down sperm count main health issues, the main reason is following -

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Varicocele: Quantity of sperm less than 50% cause of infertility. Varicoceles have been correlated to lower testosterone levels, sexual function affect by testosterone level. Testicular inflammation, swollen veins in the scrotum, and unusually developed testicles can cause unusualsperm ^[5].

Infection: Sometimes infections can obtain in the way with sperm fabrication or sperm health or can origin scarring that blocks the passageway of sperm. These comprise inflammation of the epididymis (epididymitis) or testicles (Orchitis) and a number of sexually transmitted infections, with gonorrhea or HIV. Testicular tissue damage by infection and affect sperm quantity ^[5].

Ejaculation problems: Retrograde ejaculation occurs when semen enters the bladder during orgasm as an alternative of emerging out of the tip of the penis. A variety of health situation can origin retrograde ejaculation or be deficient in of ejaculation, together with diabetes, prostate or urethra, spinal injuries, and surgery of the bladder ^[5].

Antibodies that assault sperm: Anti-sperm antibodies are immune system cells that mistakenly recognize sperm as harmful invaders and attempt to destroy them ^[5].

Defects of tubules that transport sperm: Numerous dissimilar tubes bring sperm. They be capable of be blocked-up due to a variety of causes, together with unintentional injury from surgery, such as with cystic fibrosis or similar inherited situation, prior infections, trauma or abnormal development ^[5].

Tumors: Cancers and non malignant tumors can affect the male reproductive organs unswervingly, through the glands that discharge hormones connected to reproduction, such as the pituitary gland, or through unidentified causes. Surgery, radiation or chemotherapy to extravagance tumors also can affect fertility ^[6].

Undescended testicles: During fetal maturity, one or both testicles occasionally not succeed to descend from the abdomen into the sac that usually contains the testicles (Scrotum). Reduced fertility is more probable in men with this circumstance ^[5, 7].

Hormone imbalance: The hypothalamus, pituitary and testicles fabricate hormones that are essential to generate sperm. Imbalance in these hormones, as well as from other systems such as the thyroid and adrenal gland, may make worse sperm production ^[8].

Inherited disorders: Chromosome defects such as Klinefelter syndrome in which a male is born with two X chromosomes and one Y chromosome as a substitute of one X and one Y — cause atypical development of the male reproductive organs. Other genetic syndromes connected with infertility incorporate cystic fibrosis, Kartagener's syndrome and Kallmann's syndrome ^[9].

Celiac disease: A gastrointestinal disease originated from sensitivity to gluten, celiac disease can reason male infertility because it interferes nutrients absorption. Fertility may get better after adopting a gluten-free diet ^[5].

Certain therapy: Testosterone substitution therapy, long-term anabolic steroid recourse, cancer medications (chemotherapy some ulcer medications, certain antifungal and antibiotic medications and other medications can impair sperm production and decrease male fertility) ^[5].

Surgeries: Unavoidable surgeries force delay from having sperm in the ejaculate, as well as, scrotal or testicular surgeries, vasectomy, inguinal hernia repairs prostate surgeries, and large abdominal surgeries carried out for testicular and rectal cancers, surrounded by others. Occasionally, surgery may be resultant to either reverse these blockages or to retrieve sperm form from the epididymis and testicles ^[5].

Environmental Causes

Sperm manufacture or role can be affected by overexposure to definite environmental elements, including:

Industrial chemicals: Extended exposure to pesticides, organic solvents, benzenes, toluene, xylene, herbicides, painting materials and lead contributor to low sperm counts ^[5, 10].

Heavy metal exposure: Exposure to, mercury, cadmium, lead or other toxic heavy metals develop into the cause of infertility ^[5, 9].

Radiation or X-rays: Exposure to radiation can decline sperm production. It can receive several years for sperm production to return to normal. With high doses of radiation, sperm construction can be permanently reduced ^[11].

Overheating the testicles: Elevated temperatures harm sperm construction and utility. Although researches are inadequate and are inconclusive, recurrent use of saunas or hot tubs might provisionally impairment sperm count ^[5].

Sitting: Sitting for extensive periods, wearing stretched clothing or functioning on a laptop computer for extensive stretches of time also might amplify the temperature in scrotum and to some extent decrease sperm production ^[5].

Health, lifestyle and other causes

Drug use: Anabolic steroids consuming to stimulate muscle strength and growth can cause the testicles to shrink and sperm production to reduce. Use of cocaine or marijuana might decline the number and quality of your sperm as well ^[11].

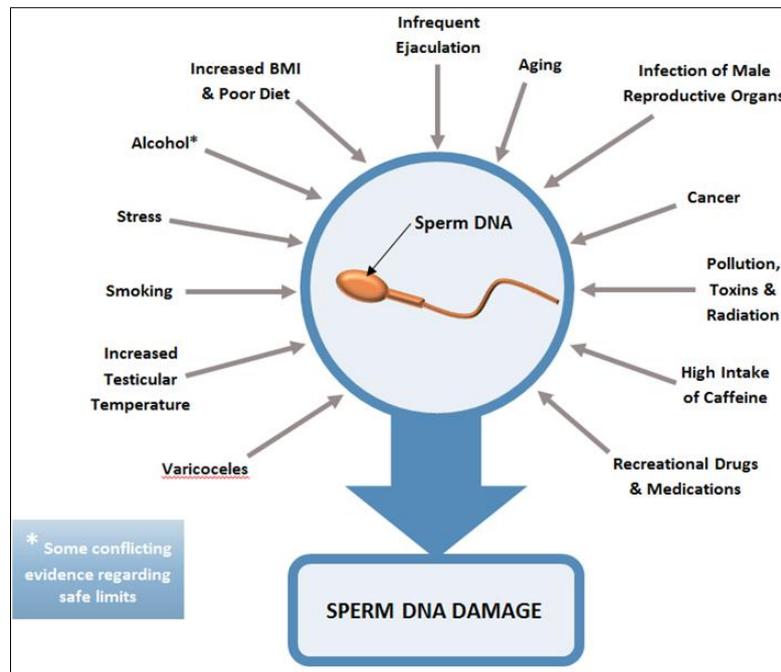
Alcohol use: Ingestion alcohol can lower testosterone levels and caused diminished sperm production ^[5].

Occupation: Certain occupations, job profile might be simultaneous with a risk of infertility, including welding or those connected with prolonged sitting, such as, computer operator, truck driving ^[5].

Tobacco Consuming: Tobacabo consuming any form chewing, smoke studies reported that have an inferior quantity as well as quality sperm count than do those who don't consuming ^[12].

Emotional Stress: Severe or long term emotional stress, including stress about fertility, might interfere with hormones desired to produce sperm. Stress build up when the permanence between the manufacture of reactive oxygen species and antioxidant defense deteriorates. As sperms basic constituents of polyunsaturated fatty acids in elevated concentration and due to their capacity to generate reactive

oxygen species (ROS) such as superoxide anion and hydrogen peroxide at the start, they are prone to peroxidative injure. Lipid peroxidation in spermatozoa and semen is evaluated by malondialdehyde concentrations. Asthenozoospermic and oligoasthenozoospermia individuals have twice additional sperm MDA concentration than usual people [13, 14].



Sources- <https://fertilitysolutions.com.au/sperm-dna-fragmentation>

Inflammation: Inflammation is a natural host response to a microbial attack or tissue injury which ultimately results in restoration of tissue vasculature and functions. Neutrophils are the first immune cells to reach the site of infection but macrophages play a major role in inflammatory response. The high amount of prostaglandins PGE2, cytokines and nitric oxide (NO) are secreted by the macrophages and other stimulated inflammatory cells. However, inflammation has been suspected to affect steroidogenesis and spermatogenesis. Sharp decreases in blood levels of testosterone and luteinizing hormone have been associated with inflammation. In a study in which inflammation was stimulated by lipopolysaccharide (LPS), a significant decrease in testosterone levels was observed. This was attributed to the low activity of a major regulator of steroidogenesis commonly referred to as Steroid Acute Regulatory (StAR) protein [15].

Obesity and Infertility

Obesity is caused primarily by an imbalance between energy consumed and energy utilized. In other words, overweight and obesity are defined as the accumulation of abnormal or excess fat that may injures health. The commonest and simplest way to measure obesity is through the determination of BMI (Body Mass Index). Other methods are weight hip ratio (WHR), skinfold measurement, waist circumference and bioelectric impedance analysis. BMI is the ratio of weight to height that is commonly used in classifying overweight and obesity in individuals and adult population. A BMI above to 25 Kg/m2 is considered overweight while a figure greater than 30 Kg/m2 is categorized as obese. Obesity is associated with several chronic disorders such as non-insulin dependent diabetes mellitus, cancer, high cholesterol, heart disease,

hypertension, Sleep apnea and renal failure [16].

Depression: Being depressed may negatively affect sperm concentration [5].

Sperm testing issues: Inferior than normal sperm counts can consequence from testing a sperm sample that was engaged too almost immediately after last ejaculation; was taken too soon after an sickness or traumatic event, or didn't contain all of the semen [5].

Dietary Pattern and Infertility

Excessive intake of carbohydrate: A high carbohydrate diet is one of the most common food habits of Asian society. A positive relationship has been found between the consumption of too much carbohydrate and unusual sperm motility. High carbohydrate diet scientific research found damage the genetic molecule DNA in the sperm and its mobility, morphology or the nature of the sperm and the number of sperm created [17].

Excessive consumption of sweet junk food and drinks

Scientists were revealed to junk food is major factor the sperm count to decline. The energy proportion of a diet ingestion from saturated fat is in excess of 10% was asserted to lead to a diminish in the sperm count. In condition any person consuming saturated fat frequently were revealed to have 38% inferior sperm concentration and 41% lesser sperm count compared to the ones who eat it less [18].

Nutrients and infertility

Antioxidant vitamins (vitamins A, C and E): Free radical

generation impact on sperm life span. Free radical generated by oxidative stress. Oxidative stress is the amplify of the rate of cellular injury triggered by oxygen and oxygen-based oxidants recognized as reactive oxygen species. A number of stressful circumstances such as chronic diseases, ageing, being exposed to toxins, physical injuries and being exposed to certain types of nutrition may speed up the oxidative process and antecedent cell damage. Vitamins A, C and E (carotenoids, α -tocopherol, and ascorbic acid) are competent to sustain the prooxidant-antioxidant balance and by prevent the oxidative injure in the sperm DNA, they preserve the genetic steadfastness of sperm cells [19].

As polyunsaturated fatty acids (PUFA): Fatty acid is basic and vital component of plasma membrane its help to protect free radicals, oxidative stress damage plasma membrane of every cell and polyunsaturated fatty acid protected to free radicals. Also, the PUFA is essential for the plasma membrane fluidity and normal physiological role of sperm. Polyunsaturated fatty acids participate an significant role in ion transport and sperm membrane fluidity, research has support to PUFA works as antioxidant and protect sperm life span. In a study revealed that ω -3 fatty acid had encouraging effects in rat testis tissue by preventing oxidative damage and increasing the level of testosterone [1].

Coenzyme Q10 (Ubiquinol): Coenzyme Q10 is a vitamin-like substance which fat soluble and it is found in eukaryotic cells as it plays a role in mitochondrial respiratory chain [34]. In sperm cells, coenzyme Q10 (CoQ10) vital role are as energy promoting agent and antioxidant. Coenzyme Q10 is intense in the mitochondria of the midpiece part, so that the energy for association and all other energy-dependent regulates in the sperm cell also influenced on the ease of use of CoQ10. The concentrated form of CoQ10-ubiquinol also takes action as an antioxidant, protecting lipid peroxidation in sperm membranes. In studies founded on CoQ10, it was stated that CoQ10 supplement used in the treatment of male infertility improved sperm concentration and motility [1].

The relationship of certain minerals and infertility

Selenium: Selenium is vital for testosterone biosynthesis as well as the proper development of sperms. It was also observed that seminal plasma selenium levels simultaneous with sperm morphology and motility, viability. Testicular tissues frequently consist of high level of glutathione peroxides as selenium. The association well studied between selenium, sperm superiority and male infertility. Since glutathione peroxidase is the most important determiner of the sperm's centre piece construction, it is liable for the shield of sperm cells from oxidative DNA damage [20].

Zinc: Observational studies elucidated that low zinc dietary intake or deficiency is associated with deprived testosterone levels, poor sperm quality and higher risk of male infertility. Physiologically important role of zinc are vitality and its potentials in quality of sperm, and fertilization. Investigation showed that Zn having numerous unique functions in human. Zinc has antioxidants property that is very effective in who suffered infertile and smokers influence. Zinc as hormone equilibrium assists hormones such as testosterone, prostate and vitality and performances zinc affects obstructs spermatogenesis, sperm deformity and deprived serum testosterone concentration [20].

Folate: Folate is an essential micronutrients for the genetic material naturally having in green leafy vegetables, DNA synthesis is an imperative element of spermatogenesis, and folate is of high significance for the permanence of Ifertility [1].

Other Nutritional Elements

Caffeine (1, 3, 7- Trimethylxanthine): Caffeine (1, 3, 7-trimethylxanthine) is naturally occurred in coffee, tea, soft drinks (particularly cola-containing drinks) and chocolate. It without difficulty crosses biologic membranes. The caffeine molecule is easily attentive by humans. Caffeine has a number of biologic effects, together with central nervous system stimulation, increased secretion of catecholamine, relaxation of smooth muscles and stimulation of heart rate. Coffee, caffeine intake has been connected with high levels of testosterone and sex hormone binding globulin (SHBG). Caffeine affects Sertoli Cells glycolytic and oxidative profile, meddling with male's reproductive potential [21].

Carnitine: Carnitine is originates in the metabolism as L-Carnitine (LC) or acetylcarnitine (LAC) and it acting an imperative function in β -oxidation for cellular energy of long chain fatty acids in lipid metabolism. It protect the co-cellular membrane and the DNA from the injure of free oxygen radicals. Carnitine plays an vital role initiating sperm motility as well as supporting sperm maturation and sperm fertilizing, but also in regulating Sertoli cell functions and protecting sperms against oxidative damage, delay apoptosis of spermatogenic cells and preventing sperms aggregation [21].

N-Acetylcysteine (NAC): N-acetyl-L-cysteine (NAC), an antioxidant that scavenges free radicals, is medicated a supplement to alleviate glutathione (GSH) exhaustion during oxidative stress. NAC is a considered form of the amino acid L-cysteine. It has prevailing antioxidant effects. It helpful to protect sperm and boosts overall semen quality. Studies explained that NAC supplementation can decline oxidative stress in semen. This helps to enhance sperm motility, count, and quality. L-cysteine is a semi essential amino acid. Foods rich in L-cysteine include soy, eggs, poultry and nuts. However, in its modified form, NAC is more potent. NAC has a stronger positive influence on semen parameters than L-cysteine [22].

Conflict of interest: The author(s) declares (s) that there is no conflict of interest.

Conclusion

Role of nutrition and nutrients on fertility is not definite it is still a portion of research that how's it effects thus, a greater consideration of such interactions is required to identify the vital function of dietary intake pattern of the person who is suffering from oligozoospermia. Identifying the function of oxidative stress in the pathogenesis of several serious chronic diseases, reducing the oxidative burden in affected men is probable to benefit sperm quality and fertility as well as their overall vitality in the longer term. Sperm therapeutic with these nutrients could be definitely helpful and beneficial during semen preparation for *in vitro* fertilization procedures. The helpful effects of this curative on sperm functionality could be of helpful for all those couples who have obscurity conceiving a child in a natural way.

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