



The Effect of Antioxidant Supplementation on Male Reproduction - Mini Review

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Short Communication

In organism, there is a lot of Reactive Oxygen Species (ROS), which are important in energy metabolism, immune reaction and are signal molecule of cell regulation [1]. ROS regulate contraction of muscles, blood clotting, control vasoconstriction and vasodilation and participate in gene transcription [2]. To ensure appropriate fertilization, concentrations of ROS (low and controlled physiological levels) play a vital role in normal physiological processes like sperm-oocyte fusion, acrosome reaction, capacitation, and hyper activation [3]. But under certain circumstances, they could be toxic and could significantly damage or kill the organism [1]. An excessive production of free radical species is called oxidative stress. Higher amount of ROS are produced during physical or psychical stress [4]. Approximately half of all infertile men show oxidative stress which is a typical and common pathology [5]. Mitochondria a fundamental cell organelle for development and locomotion of sperm additionally serves as power house of cell is influenced by free radicals [6]. ROS could cause decrease of sperm motility and increase of amount of morphologically abnormal sperm and could also decrease hormonal production [7]. Hand in hand with this degraded quality of sperm here could be also decreased libido [8]. In pigs, because of their low thermoregulation system there is so called "seasonal infertility in boars", during the summer months [9]. During the oxidative stress, augmented production of ROS overwhelms the body's antioxidant defences [10]. To protect sperm cells against oxidative damage, we can add the antioxidants into diet. By halting the oxidative chain reaction, natural compounds such as antioxidants can affect production, elimination, reduction and taking up of ROS [11]. Bases upon their action they are divided in to two types: [1] Metal chelators or binding proteins which are preventive antioxidants, for example, lactoferrin and transferrin can prevent the formation of ROS; and [2] Vitamins C and E which are scavenging antioxidants will remove the ROS that is already present [12]. In addition, measuring the effect of any single one alone is extremely challenging because antioxidants work co-operatively [10].

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The most known antioxidants, which are important in reproduction, are:

Vitamin E (α -tocopherol) is a chain-breaking antioxidant found in the sperm's cell membrane and acts by neutralizing H_2O_2 and quenching free radicals [11], hence halting chain reactions that produce lipid peroxides and protecting the membrane from the damage induced by ROS [12]. Moreover, the activity of other scavenging oxidants also improves [13]. Hence from all of these ways, vitamin E is helpful in preserving morphology and mobility of sperm [14].

Vitamin C (ascorbate) is another significant antioxidant (up to 65%) crucial for combating oxidative stress in the seminal plasma [10]. It protects viability and motility of sperms by reacting with free radicals in the extracellular fluid [12]. Moreover, vitamin C has no significance within the cell as it is the only weak ROS scavenger in the cell membrane [15].

Selenium is part of enzyme glutathione peroxidase, main part of antioxidant chain [13]. When it is used as an adjunct to vitamin E, it protects DNA of sperm and cell membranes. Hence it is an important component in regular development and maturation of the testes [16]. Selenium deficiency causes lower sperm concentration and higher amount of morphologically abnormal sperm [17].

Zinc is an important metal chelator and is a part of various enzymes, especially the super oxidismutase, which is important during the antioxidant process (it binds ROS). It also affects development of reproductive system and its function [10,18]. Zinc deficiency causes insufficient development of Leydig cells and decreased susceptibility to luteinizing hormone [19].

L-carnitine is the vitaminous amino-acid-like compound synthesized from lysine and methionine in liver, kidney and brain [20]. L-carnitine plays an significant role in lipid metabolism.

It brings long-chain fatty acids into the mitochondria for beta-oxidation, thus producing energy (ATP) necessary for proper sperm functioning [21]. By preventing lipid oxidation and assisting in free fatty acid utilization, l-carnitine serves as a fuel source in sperm motility [13]. Therefore, carnitine maintains the sperm viability and motility by protecting the sperm DNA and membranes from oxidative damage [10].

Taurine is an aminoethanesulfonic acid which is found in high millimolar concentrations in spermatozoa and seminal plasma [22]. Inositol is non-enzymatic antioxidant known to enhance GSH activity and preserve normal sperm morphology, while taurine is an antioxidant that scavenges ROS [11].

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