Increased Efficacy Led by Composition Upgradation of Standard Co Q10 Based Male Fertility Supplement in Sperm Cell Count and Motility

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Abstract- This review is focused upon the increased efficacy led by composition upgradation of standard COQ10 supplement for male fertility, with Ubiquinol – the reduced form of coenzyme Q10. The rates of male infertility in less industrialized nations are markedly higher and infectious diseases are responsible for a greater proportion of infertility. Dietary supplementation with CoQ10 results in increased levels of Ubiquinol within circulating lipoproteins and increased resistance of human low-density lipoproteins to the initiation of lipid peroxidation. Supplementation with CoQ10 at pharmacological doses was capable of improving sperm functions by increasing sperm cell motility, thereby increasing male fertility. Finally, the findings on the implications of CoQ10 in seminal fluid integrity and sperm cell motility are summarized
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Key words: coenzyme Q10, aging, mitochondrial activity, Male infertility, sperm cell motility

Introduction

According to the International Committee for Monitoring Assisted Reproductive Technology, World Health Organization (WHO), infertility is a disease of reproductive system defined by failure to achieve the clinical pregnancy after 12 months or more of regular unprotected sexual intercourse[1]. Male infertility refers to a male's inability to result pregnancy in a fertile female[1]. Male infertility is commonly due to the lack of cellular production of energy in the form of ATP.

Table 1. Etiology of Infertility

Factors	*Percentage*
Combined factors	40
Male factors	26 to 30
Ovulatory dysfunction	21 to 25
Tubal factors	14 to 20
Other (e.g., cervical factors, peritoneal factors, uterine abnormalities)	10 to 13
Unexplained	25 to 28

Information from references 5 through 8.

Table shows male infertility, based on various studies reporting male or female infertility globally[1]

	Males that are reported infertile	**Couples that are reported infertile**	**Couples in which the male factor is one of multiple factors involved**
North America	4.5-6%	15%	50%

	Males that are reported infertile	Couples that are reported infertile	Couples in which the male factor is one of multiple factors involved
Middle East	Unknown	Unknown	60%-70%
Sub-Saharan Africa	2.5%-4.8%	12.5%-16%	20-40%
Europe	7.5%[a]	15%	50% of all infertile couples
Australia	8%; 9%	15%	40%
Central/Eastern Europe	8%-12%	20%	56%
Asia	Unknown	Unknown	37%
Latin America	Unknown	Unknown	52%
Africa	Unknown	Unknown	43%

[a]Percentages were calculated from data reported on female infertility, using the assumption that 50% of infertility cases are due to females only, and 20-30% are due to male factor only.

[b]Study states that 60-70% of all men presenting to IVF clinics in the Middle East have some involvement in the cause of infertility.

Effectiveness of COQ10 on Male Fertility

CoQ 10 levels showed a significant correlation with sperm count and with sperm motility. CoQ10 measurement could represent an important examination in infertile patients; moreover, from these results a rationale might arise for a possible treatment with exogenous CoQ10 in dyspermic patients[2]. The energy for movement and all other energy-dependent processes in the sperm cell depend on the availability of CoQ10. The reduced form of CoQ10-ubiquinol acts as an antioxidant, preventing lipid peroxidation in sperm membranes. Administration of Coenzyme Q10 supplement in the individuals results in the improvement in sperm count and sperm motility.

Coenzyme Q10 (CoQ10) is an antioxidant molecule, component of the respiratory chain. Recently there has been growing interest in identifying reversible causes of male infertility, and numerous studies have been performed to investigate whether supplementing infertile men with antioxidants can improve seminal parameters[4].

This review is focused upon the role of coenzyme Q(10) in male infertility in the light of a broader issue of oxidative damage and antioxidant defence in sperm cells and seminal plasma. Males with sperm parameters below the WHO normal values are considered to have male factor infertility. CoQ(10) concentrations and sperm motility strongly support a cause/effect relationship. From a general point of view, a deeper knowledge of these molecular mechanisms could lead to a new insight into the so-called unexplained infertility.[7] Administration of CoQ(10) may play a positive role in the treatment of asthenozoospermia, possibly related to not only to its function in the mitochondrial activity but also to its antioxidant properties.[8]

CO Q10 AND AGING

All the physiological processes that require physical exertion need coenzyme Q10. With age, physical effort, stress, the quantity of Ubiquinol decreases. CoQ10 is produced in all living organisms and is an essential coenzyme for energy synthesis in the mitochondria and an important scavenger of reactive oxygen species.[5]

The antioxidant protection conferred by CoQ_{10} is associated with skeletal muscle performance during aging as evidenced by the fact that a high $CoQ_{10}H_2/CoQ_{10}$ ratio is accompanied by an increase in muscle strength. Older individuals given a combination of selenium and CoQ_{10} over a 4-year period reported an improvement in vitality, physical performance, and quality of life. Furthermore,

CoQ_{10} supplementation confers health benefits in elderly people by preventing chronic oxidative stress associated with cardiovascular and neurodegenerative diseases .Despite these evidences, more reliable clinical trials focusing on the elderly are needed before considering CoQ_{10} as an effective anti-aging therapy.[6]

For these reasons, CoQ appears suitable for use in the treatment of different diseases. Here, we present recent advances in CoQ_{10} treatment of human diseases and the slowing down of the aging process, and highlight new strategies aimed at delaying the progression of chronic diseases by CoQ_{10} supplementation.[6]

Increased Bioavailability of Ubiquinol Compared to that of Ubiquinone

Ubiquinol has a much greater bioavailability than the Ubiquinone used in conventional CoQ10 supplements. Ubiquinol has far greater water solubility and much better absorption into the bloodstream after ingestion. The oral bioavailability of Ubiquinol has been reported to be greater than that of Ubiquinone in healthy adults. The basis for this influence of redox state of coenzyme Q (CoQ) on bioavailability has been investigated using the coupled in vitro digestion/Caco-2 cell model. Data obtained from the study[9], suggested the enhanced bioaccessibility and bioavailability of Ubiquinol compared to Ubiquinone results from reduced coenzyme being more efficiently incorporated into mixed micelles during digestion and its greater uptake and basolateral secretion in a glutathione-dependent mechanism.

Ubiquinol Supplementation Affecting Sperm Parameters

Ubiquinol is a powerful anti-oxidant that protects the body against the damage caused by free radicals that provide protective effects on lipids, proteins, DNA and the LDL cholesterol. Administration of CoQ_{10} improves semen parameters in the treatment of idiopathic male infertility. Additionally, CoQ_{10} supplementation (200–300 mg/day) in men with infertility improves sperm concentration, density, motility, and morphology.[6] The decrease in mitochondrial activity associated with CoQ_{10} deficiency probably affects the granulosa cells' capacity to generate ATP.

Improvement in Male Fertility With L-Arginine Supplementation

According to a study[10], the clinical efficacy of L-Arginine as a supplement, showed improvement in the motility of spermatozoa without any side-effects.

But it is reported that the supplementation with L-Citrulline can be more beneficial than L-Arginine supplementation as L-Citrulline can increase the L-Arginine levels more than the Arginine itself.

L-Citrulline and L-Arginine are the raw materials for Nitric Oxide production which impacts human sperm motility considerably, according to a study[11]. Therefore supplementation with these two components helps in the improvement of male fertility.

Conclusion

The efficacy of COQ10 supplement on male fertility improves with Ubiquinol – the reduced form of coenzyme Q10 and its composition upgradation with other potent components like L-Arginine and L-Citrulline. The composition upgradation of pharmacological doses is found to be capable of improving male fertility by increasing sperm cell quality and motility. Therefore, the composition requires to be in constant study and time-to-time upgradation for increasing efficacy of male fertility supplements.

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