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Clinical Trails and Bioavailability Research
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ISSN: 2836-5836 REVIEW ARTICLE

The use of L-carnitine in male reproductive abnormalities: The available evidence

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Received: 10 December 2022; **Accepted:** 20 December 202; **Published:** 29 December 2022.

Citation: Aamir Jalal Al-Mosawi (2022). The use of L-carnitine in male reproductive abnormalities: The available evidence. Journal of Clinical Trials and Bioavailability Research (JCTBR).1(1). DOI: 10.58489/2836-5836/005.

Abstract

Dietary health supplements have been increasingly used in the prevention and treatment of chronic disorders. During the previous decades, l-carnitine has been reported to have beneficial effects on male reproductive functions. L- carnitine, a non-protein amino acid produced endogenously in the human body from the essential amino acids lysine and methionine or obtained from exogenous dietary sources. The main natural forms of L-carnitine are Acetyl-L- carnitine and propionyl-L-carnitine. The aim of this paper is to review l-carnitine research findings relevant to its use in male reproductive abnormalities. Treatment of reproductive male abnormalities caused by abnormalities of idiopathic semen quality including oligozoospermia, asthenospermia, and azoospermia include hormonal therapies (Clomiphene citrate, tamoxifen, recombinant FSH, and testosterone undecanoate). Non-hormonal therapies include pentoxifylline, and dietary health supplements including carnitine. Carnitine has the additional advantage of improving associated erectile dysfunction. There is convincing research evidence suggesting that l-carnitine can improve male reproductive and can be useful in the treatment of some form's male infertility and erectile dysfunction.

Keywords: *L-carnitine, male reproductive abnormalities, research evidence.*

Introduction

Oligozoospermia is diagnosed when a sperm count is less than 15 million/1 milliliter of semen, or less than 40 million sperm per ejaculate. It is associated with infertility (difficulty to conceive naturally). Limpaseni and colleagues (1980) reported a study which showed that infertile semen has a lower carnitine acetyltransferase than fertile semen because of lower sperm density [1].

Azoospermia is the total absence of sperm in the semen. Obstructive azoospermia occurs when the entry produced sperm to the ejaculate is blocked by an obstruction in the epididymis. Non obstructive azoospermia occurs when testicular sperm production is reduced. Soufir (1985) emphasized that the human semen contains acid phosphatase, citrate, zinc which are secreted by the prostate, fructose which is secreted by the seminal vesicles, and free carnitine which is secreted by the epididymis [2].

Lewin et al (1981) emphasized that very low level of free carnitine and acyl-carnitine in semen indicates epididymal obstruction and the ejaculate is primarily of prostatic origin. Low level of free carnitine and acyl-carnitine is also observed in vas deferens obstruction where the epididymal secretion is not ejaculated.

Low acyl-carnitine level and normal levels of free carnitine is commonly seen patients with testicular failure [3].

Asthenozoospermia (asthenospermia) occurs when there is reduction of **sperm** motility. Soufir (1985) [2].

Lewin and colleagues (1976) reported a study which showed that very low carnitine level of less than 100 mug/ml occurs in patients having defective epididymis and defective seminal vesicle. Therefore, a role of carnitine in sperm maturation was suggested [4].

Soffer et al (1981) studied 399 infertile semen samples and found that 30 (7.5%) had low carnitine level.14 patients were azoospermic and 16 patients had severe oligozoospermia. Of the 399 infertile semen samples, here were 19 azoospermic samples (58%) and 51 samples with severe oligozoospermia (79%) did not have low carnitine level. Therefore, reduction of semen carnitine does not occur in all cases of azoospermia and severely oligozoospermia [5].

Tanphaichitr (1977) reported that acetyl carnitine can increase mobility of ejaculated sperms in vitro. The stimulating effect of carnitine sperm motility was no associated with an increase in ionic strength nor a change in ATP level [6].

Kohengkul et al (1977) found that the majority of the body's L-carnitine is present in the seminal plasma, with a 10-time higher level than that its level in blood plasma. Approximately 50% of the L-carnitine in the seminal plasma is acetylcarnitine. Kohengkul et al reported that males with oligospermia and azoospermia had considerably lower L-carnitine levels in the seminal plasma than in normal males (p.0005). They suggested that L-carnitine has an important relation with sperm density [7].

The preliminary work of Sade et al (1977) suggested that L-carnitine can have a role in the management of azoospermia [8].

Menchini-Fabris et al (1984) found very low levels of L-carnitine in semen of patients with agenesis of the vas deferens, and was also low in the semen of patients who had azoospermia resulting from testicular failure. In hypogonadotropic eunuchoids patients, treatment with gonadotropin was associated with an increase in the level. Menchini-Fabris et al also reported a correlation between semen carnitine level and sperm motility and sperm count [9].

L-carnitine, a non-protein amino acid produced endogenously in the human body from the essential amino acids lysine and methionine or obtained from exogenous dietary sources. The main natural forms of L-carnitine are Acetyl-L-carnitine and propionyl-L-carnitine [10].

Moncada et al (1992) from Italy treated 20 patients with idiopathic oliogasthenospermia with Acetylcarnitine 4000 mg daily for two months. The main effect of treatment was a marked and sustained increase in progressive sperm motility. The increase in sperm motility was 40% or more in twelve patients (mean increase 2.7-fold). However, sperm motility returned to basal level 4 months following stopping the treatment. Five pregnancies were achieved during treatment period and only two pregnancies were achieved during the 4 months follow-up after stopping treatment [11].

Lenzi et al (2004) from Italy reported a study which included sixty patients (aged 20-40 years with infertile semen (Semen count less than 40 million/ml, forward motility, less than 15%, total motility from 10% to 40%, and atypical forms. The patients were treated for six months with either l-carnitine 2000 mg daily plus l-acetyl-carnitine 1000 mg daily or received placebo.56 of the enrolled patients completed the study. Treatment was associated with an increase in all sperm parameters, but enhancement of sperm motility (Forward and total) was the most important [12].

Balercia (2005) from Italy reported a double-blind controlled study which included sixty infertile male aged 20 to 40 years with idiopathic asthenozoospemia and infertile semen (Sperm count more than 29 million/ml, forward motility less than 50%, and normal sperm morphology more than 30%. The patients were treated for six months with L-carnitine 3000 mg daily or L-acetyl-carnitine 3000 mg daily or L-carnitine 2000 mg daily plus L-acetyl-carnitine 1000 mg daily or received placebo. 59 of the enrolled patients completed the study. The study showed that treatment with L-acetyl-carnitine and L-carnitine was associated with an improvement of sperm kinetics and improvement in oxyradical scavenging capacity of the seminal fluid [13].

Li et al (2005) from China reported a study which included 150 male patients with infertility associated with oligoasthenozoospermia. Ninety patients were treated for three months with L-carnitine 2000 mg daily plus acetyl-L-carnitine 1000 mg twice.

Sixty patients received vitamin E 100 mg plus vitamin C 100 mg, three times daily for three months.

85 patients out of 90 of patients who received carnitine completed three months of treatment. Treatment was associated with considerable improvement in number of motile sperms and forward sperm motility. Ten patients (11.6%) reported the occurrence of pregnancy.

53 patients of the 60 patients who received vitamin E 100 mg plus vitamin C completed three months of treatment. Treatment was associated with slight in number of motile sperms and forward sperm motility, and two pregnancies (3.7%) were reported [14].

Cheng et al (2018) reported a study which included 262 infertile male patients with idiopathic oligoasthenozoospermia. 62 patients were treated with L-carnitine 10 ml twice daily, 63 patients were

treated with coenzyme Q10 20 mg three times daily, 63 patients were treated with L-carnitine plus coenzyme Q10, and 74 patients were treated with a placebo (vitamin B1).

After three months of treatment, patients received L-carnitine plus coenzyme Q10 achieved considerably higher sperm motility and percentage of progressively motile sperm (P <0>

Cavallini et al (2003) from Italy reported a six months-controlled study which included 120 patients aged 60 to 74. (Mean: 66 years). Forty patients received testosterone undecanoate 160 mg daily, forty patients received propionyl-L-carnitine 2000 mg daily plus acetyl-L-carnitine 2000 mg daily, and forty patients received starch as a placebo. Carnitine supplementation and testosterone considerably improved erectile function and other symptoms associated with aging. Carnitine supplementation proved was considerably more active than testosterone in improving erectile function [16].

Gentile et al (2004) reported a study which showed that the addition of oral propionyl-L-carnitine to sildenafil for the treatment of erectile dysfunction associated with diabetes, enhanced the effectiveness of sildenafil in patients who were unresponsive to treatment with sildenafil alone [17].

Treatment of reproductive male abnormalities caused by abnormalities of idiopathic semen quality including oligozoospermia, asthenospermia, and azoospermia include hormonal therapies (Clomiphene citrate, tamoxifen, recombinant FSH, and testosterone undecanoate). Non-hormonal therapies include pentoxifylline, and dietary health supplements including carnitine [18,19]. Carnitine has the additional advantage of improving associated erectile dysfunction [16, 17].

Conclusion

Treatment of reproductive male abnormalities caused by abnormalities of idiopathic semen quality including oligozoospermia, asthenospermia, and azoospermia include hormonal therapies (Clomiphene citrate, tamoxifen, recombinant FSH, and testosterone undecanoate). Non-hormonal therapies include pentoxifylline, and dietary health supplements including carnitine. Carnitine has the additional advantage of improving associated erectile dysfunction.

Conflict of interest

None.

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