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Coenzyme Q 10 in Infertile Men with Idiopathic Asthenozoospermia: A Single Blind Placebo-Controlled, Randomized Trial

Dr. Mitu Debnath[1]*, Dr. Farzana Deeba[2], Dr. Shakeela Ishrat[3], Dr. Farhana Karim Satu[4], Dr. Fahmida Chowdhury[5], Dr. Kazi Shamim Ara[6], Dr. Sohely Nazneen[7]

[1]Consultant, Department of Reproductive Endocrinology and Infertility, Babgabandhu Shekih Mujib Medical University (BSMMU), Dhaka, Bangladesh
[2]Associate Professor, Department of Reproductive Endocrinology and Infertility, Babgabandhu Shekih Mujib Medical University (BSMMU), Dhaka, Bangladesh
[3]Professor, Department of Reproductive Endocrinology and Infertility, Babgabandhu Shekih Mujib Medical University (BSMMU), Dhaka, Bangladesh
[4]Consultant, Department of Reproductive Endocrinology and Infertility, Babgabandhu Shekih Mujib Medical University (BSMMU), Dhaka, Bangladesh
[5]Consultant, Department of Reproductive Endocrinology and Infertility, Babgabandhu Shekih Mujib Medical University (BSMMU), Dhaka, Bangladesh
[6]Consultant, Department of Reproductive Endocrinology and Infertility, Babgabandhu Shekih Mujib Medical University (BSMMU), Dhaka, Bangladesh
[7]Assistant Professor, Department of Gynecology & Obstetrics, Institute of Child & Mother Health (ICMH), Matuail, Dhaka, Bangladesh

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***Corresponding author:** Dr. Mitu Debnath **Email:** mitu.debnath@yahoo.com
Consultant, Department of Reproductive Endocrinology and Infertility, Babgabandhu Shekih Mujib Medical University (BSMMU), Dhaka, Bangladesh.

Abstract **Original Research Article**

Background: Many studies have focused on male infertility. There is limited evidence about the influence of nutrition on quality of semen. Accumulating evidence suggests that oxidative stress plays an important role in the development of male infertility and recently antioxidants have been tried to treat men with idiopathic infertility. ***Objective:*** To evaluate the effectiveness of coenzyme Q-10 treatment in improving sperm motility in men with idiopathic asthenozoospermia. ***Methods:*** This randomized controlled study conducted in the Department of Reproductive Endocrinology and Infertility, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, from January 2021 to December 2021. Total 74 diagnosed cases of idiopathic asthenozoospermia were selected for medication was included in this study. Eligible man who gave their informed consent was allocated into either Group A (Coenzyme Q-10) or Group B (Placebo) on the basis of computer generated table. Group A received coenzyme Q-10 100 mg two times daily and Group B received placebo for same doses for 12 weeks. Then pretreatment and post treatment semen parameters, including sperm concentration, total motility, progressive motility and morphology was assessed. ***Results:*** Post treatment motility (37.8±11.1 vs 26.3±8.8%), progressive motility (30.0±7.9 vs 22.4±7.7) and total motile sperm count (33.5±24.4 vs 21.4±14.3 million) were significantly higher in coenzyme Q-10 group than placebo group ($p<0.05$). In coenzyme Q-10 group, motility (37.8±11.1 vs 25.2±8.1%), progressive motility (30.0±7.9 vs 22.5±7.0) and total motile sperm count (33.5±24.4 vs 20.0±13.6 million) were significantly increased in post treatment than pretreatment patients ($p<0.05$), but not found in placebo group. Improvement of sperm motility was significantly higher in coenzyme Q-10 group than placebo group (60.0% vs 5.6%). ***Conclusion:*** In conclusion, coenzyme Q10 administration, total motility, progressive motility and total motile sperm count were significantly increased in post treatment than pretreatment patients. Whereas, in placebo group, total motility, progressive motility and total motile sperm count were increased in post treatment but not significant. Improvement of sperm motility was significantly higher in coenzyme Q10 group than placebo group.

Keywords: Male infertility, Quality of semen, Oxidative stress, Coenzyme Q-10 treatment, Idiopathic asthenozoospermia.

INTRODUCTION

Infertility is defined as one year of regular unprotected intercourse without conception [1]. The prevalence of infertility has increased significantly in recent decades and around 15% of couple suffer from infertility which has become a global concern. Roughly 70 million couples suffer from infertility and male

factors contribute to almost half of cases [2]. Approximately 8% of men of reproductive age seek help for infertility [3]. Male sub fertility may be due to congenital anomaly, infections of the testes or tract, endocrine disturbances, genetic abnormalities and immunological factors. Idiopathic male sub fertility is commonly found in around 30% to 75% cases [4]. As many environmental, genetic and physiological factors including oxidative stress have implicated idiopathic male infertility [5], the pathogenesis of suboptimal of semen quality should be elucidated. Asthenozoospremia is a condition in which the percentage of progressively motile sperms <32% and total motility <40% [6]. Poor sperm motility in most cases suggests testicular or epididymal dysfunction, sperm autoantibodies, genital tract infections, partial obstruction of the ejaculatory ducts or at the site of a vasectomy reversal, varicoceles as well as prolonged abstinence intervals. Spermatozoa travel long distance to fertilize the oocyte. So sperm motility is requisite for normal fertilization. Free radicals or Reactive Oxygen Species (ROS) are highly reactive oxygen derived molecules identified via the presence of unpaired electrons in their outer valence orbital. ROS plays an important role in cell signaling and homeostasis, and are produced by the sperm cells in small numbers. ROS has beneficial effects on sperm capacitating, acrosomal reaction and ultimately fertilization [7]. Conversely, high ROS levels may exhibit paradoxical effects on sperm function, ultimately leading towards infertility. Increased DNA damage and lipid peroxidation are noticeable effects of exaggerated ROS levels in seminal plasma [8]. An imbalance between antioxidant capacity in seminal plasma and production of ROS results in oxidative stress (OS). Upon comparison to fertile men, up to 25% men had significant levels of ROS in their semen [9]. OS was also found to have a significant negative influence on semen parameters, fertilization rate, embryonic development, and pregnancy rate [9, 10]. Antioxidants are biological or chemical compounds that scavenge free radicals, neutralize their effect and halt the chain reaction leading to OS in body tissue. To overcome OS in infertile patients, antioxidants have been a common prescription for men seeking fertility supported by their relatively inexpensive and easily assessable nature. Coenzyme Q_{10} (CoQ_{10}) is a vital antioxidant omnipresent in almost all body tissues. It is particularly present at high concentrations in sperm mitochondria and component of the mitochondrial respiratory chain, playing a crucial role both in energy metabolism and as liposoluble chain-breaking antioxidants for cell membranes and lipoproteins. Coenzyme Q_{10} biosynthesis is markedly active in testis and high levels of its reduced form ubiquinol (QH_2) are present in sperm [11], suggesting a protective role as antioxidant. The mode of action of coenzyme Q10 in male infertility is not clear but may be useful for vitalizing cells by providing greater energy to mitochondria so improving motility and preventing oxidative damage through its actions as a free radical scavenger. In recent years, role of antioxidants in male infertility has been widely discussed. Studies like that of Balercia and colleagues as well as Safarinejad *et al*., on idiopathic infertile men with abnormal sperm motility show that treatment via coenzyme Q-10 does in fact improve the motility of sperm [12, 13]. Another study by Nadjarzadeh *et al*., (2011) [14] was a double blind placebo controlled study on infertile men with oligoasthenoteratozoospermia, treated by coenzyme Q-10. The trial resulted in non-significant changes in semen parameters such as density, motility and morphology in CoQ-10 group, whereas total antioxidant capacity was significantly increased ($p<0.05$). Finally, evidence shows that there may be a relation between CoQ-10 and key semen parameters like sperm concentration, motility and morphology owing to the improvement of the total antioxidant capacity. Therefore, the study was designed to test the hypothesis that treatment with coenzyme Q-10 is effective in infertile men with idiopathic asthenozoospermia.

OBJECTIVES

General objective:

The general objective of the study was to evaluate the effectiveness of Coenzyme Q-10 in idiopathic asthenozoospermia.

Specific objectives:

- To observe the change of sperm motility after treatment with coenzyme Q-10.
- To observe the effects of placebo on sperm motility.
- To compare the change of sperm motility in between two groups.

MATERIALS AND METHODS

This was a randomized controlled study, conducted at the department of Reproductive Endocrinology and Infertility, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. Bangladesh from January 2021 to December 2021. A total of 74 age between 20-40 yeas of male patients were recruited as study population. The patients selected by purposive sampling method.

Inclusion criteria:

- Age group between 20-40 years.
- Male patient.
- Sperm total motility <40% and or progressive motility (PR) <32% (WHO 2010).
- 2 sample 4 weeks apart.

Exclusion criteria:

- Severe oligo asthenoteratozoospermia(OATS).
- Teratozoospermia.
- Psycho-sexual abnormalities.
- Body mass index greater than 30 kg/m2.
- All medical and endocrine disorders. (DM, Thyroid disorder).

- History of chemotherapy or radiotherapy.
- History of genital diseases and surgery.
- Cigarette smoker.
- Drugs, alcohol or substance abuse.
- Patients have taken any antioxidant for at least 3 months before enrollment.

Study procedures and data analysis

The study was conducted in the department of Reproductive Endocrinology and Infertility, BSSMU. The study population was diagnosed case of male infertility with asthenozoospermia of aged 20 to 40 years attending the OPD of infertility at BSMMU. A total of 74 male patients were included in the study. A full assessment was done included demographic information, nature of infertility presence of impotency/erectile dysfunction / premature ejaculation, medical and surgical histories. As regular patients of OPD of REI, thorough physical examination including BMI and routine laboratory screening, CBC, TSH, FSH, testosterone and viral serology were done. The patient was briefed in details regarding the objective, rationality and potential benefits of the study. The patients were counseled regarding the drugs and unexpected side effects and an informed written consent was taken. Data was collected through interview, physical examinations and laboratory investigations. All the data was enrolled in the datasheet of this study. A baseline semen analysis for evaluation of male infertility was done. Ethical committee clearance was obtained from the institution. Eligible man who gave informed consent were allocated into either Group A (coenzyme Q-10) or Group B (placebo). Group A received coenzyme Q-10(100mg) two times daily with food and Group B received placebo same doses for 12 weeks. The participants were informed not to take other medications that could affect spermatogenesis during the study period. Then pretreatment and post treatment semen parameters, specially sperm concentration, total motility, progressive motility and morphology was assessed. The total motile sperm count (TMC=ejaculate volume x sperm concentration x motile fraction) was calculated. Statistical analyses were carried out by the SPSS program for Windows, version 23.0 (SPSS, Chicago, IL). The mean values were calculated for outcome variables. Data was tested using the unpaired t-test, paired t-test and chi-square test as appropriate. P values <0.05 was considered as statistically significant.

Ethical implications:

Ethical clearance was taken from the local Ethical Committee to perform investigation and study. The aims and objective of the study along with its procedure, alternative diagnostic methods, risk and benefits was explained to the patient in detail. Written consent was taken from the patient before collecting data. Privacy, anonymity and confidentiality were maintained during the study. It was assured that the medication was helpful for both the physician and patients in making rational approach regarding management of the case.

RESULTS

Total 74 diagnosed cases of idiopathic asthenozoospermia were selected for medication was included in this study according to inclusion & exclusion criteria. Among them 37 patients received Coenzyme Q-10 (Group A) & 37 patients received Placebo (Group B). Group A received coenzyme Q-10 and Group B received placebo for 12 weeks. 2 participants were dropped out in group A (Coenzyme Q-10) and 1 in group B (Placebo).

Table 1: Demographic characteristics of study population, (N=74)

Demographic characteristics	Group A (Co Q10) (n=37)		Group B (Placebo) (n=37)		P value
	n	%	n	%	
Age (In years)					
≤25 yrs.	0	0.0	1	2.7	
26-30 yrs.	10	27.0	7	18.9	
31-35 yrs.	14	37.8	18	48.6	
36-40 yrs.	13	35.1	11	29.7	
Mean ±SD	33.2±3.6		33.3±3.4		0.921^{ns}
Range (min-max)	26.0-29.0		25.0-40.0		
BMI (kg/m^2)					
18.5-24.9	9	24.3	13	35.1	
25.0-29.9	28	75.7	24	64.9	
Mean ±SD	26.7±2.5		25.9±2.6		0.191^{ns}
Range (min-max)	20.2-29.5		19.6-29.3		

Table 1 showed majority patients belonged to age group 31-35 years in both groups, that was 14(37.8%) in group A (Coenzyme Q10) and 18(48.6%) in group B (Placebo). The mean age was found 33.2±3.6 years in group A and 33.3±3.4 years in group B. Majority patients had BMI 25-29.9 kg/m^2 in both groups, 28(75.7%) in group A and 24(64.9%) in group B. Age, educational status, residence, monthly income

and BMI were not significant compared between two groups.

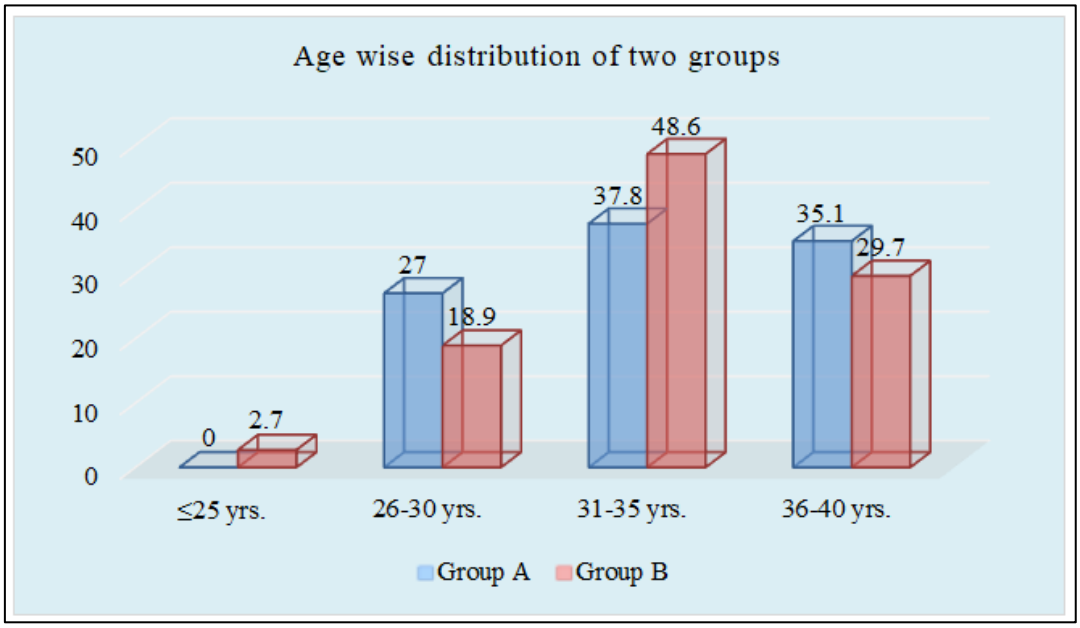

Figure I: Age group distribution of study population, (N=74)

Table 2: Distribution of study population according to infertility, (N=74)

Infertility	Group A (Co Q10) (n=37)		Group B (Placebo) (n=37)		P value
	n	%	n	%	
Primary	26	70.3	29	78.4	0.425^{ns}
Secondary	11	29.7	8	21.6	

Table 2 showed primary infertility was more common in both groups, that was 26(70.3%) in group A and 29(78.4%) in group B. However, the difference was not statistically significant between two groups (p=0.425).

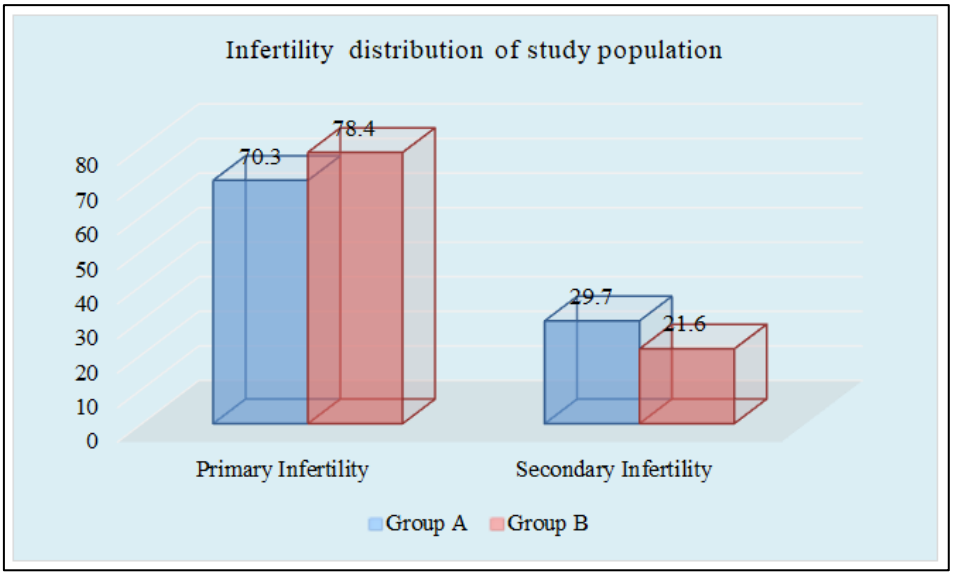

Figure II: Infertility distribution of study population, (N=74)

Table 3: Distribution of study population according to duration of infertility, (N=74)

Duration of infertility	Group A (Co Q10)	Group B (Placebo)	P value

	(n=37)		(n=37)		
	n	%	n	%	
<2 yrs.	8	21.6	6	16.2	0.553[ns]
2-5 yrs.	29	78.4	31	83.8	

Table 3 showed that majority patients had duration of infertility 2-5 years in both groups, that was 29(78.4%) in group A and 31(83.8%) in group B. The difference was not statistically significant between two groups (p=0.533).

Table 4: Pre and post treatment ejaculate volume, sperm count and sperm morphology in group, (n=37)

	Pre treatment (n=37)	Post treatment (n=35)	P value
	Mean ±SD	Mean ±SD	
Ejaculate volume(ml)	2.0±0.7	2.1±0.8	0.714[ns]
Sperm count (million/ml)	40.2±21.0	43.5±28.0	0.212[ns]
Sperm morphology	28.3±12.3	32.3±17.5	0.115[ns]

Table 4 showed that in group A, ejaculate volume, sperm count and sperm morphology were not statistically significant when compared between pretreatment vs post treatment patients.

Table 5: Pretreatment and post treatment of motility, progressive mortality and total motile sperm count in group A, (n=37)

	Pre treatment (n=37)	Post treatment (n=35)	P value
	Mean ±SD	Mean ±SD	
Motility	25.2±8.1	37.8±11.1	0.001[s]
Progressive mortality	22.5±7.0	30.0±7.9	0.001[s]
Total motile sperm count	20.0±13.6	33.5±24.4	0.001[s]

Table 5 showed that in group A, motility (37.8±11.1 vs 25.2±8.1%), progressive motility (30.0±7.9 vs 22.5±7.0%) and total motile sperm count (33.5±24.4 vs 20.0±13.6) were significantly increased in post treatment than pre treatment patients (p<0.05).

Table 6: Pre and post treatment ejaculate volume, sperm count and sperm morphology in group B, (n=37)

	Pre treatment (n=37)	Post treatment (n=36)	P value
	Mean ±SD	Mean ±SD	
Ejaculate volume	1.9±0.7	2.0±0.5	0.686[ns]
Sperm count (million/ml)	37.4±16.0	39.8±21.4	0.226[ns]
Sperm morphology	28.2±13.0	29.5±15.2	0.591[ns]

Table 6 showed that in group B, ejaculate volume, sperm count and sperm morphology were not statistically significant when compared between pretreatment vs post treatment patients.

Table 7: Pretreatment and post treatment of motility, progressive mortality and total motile sperm count in group B, (n=37)

	Pre treatment (n=37)	Post treatment (n=36)	P value
	Mean ±SD	Mean ±SD	
Motility	25.3±8.1	26.3±8.8	0.063[ns]
Progressive mortality	22.1±7.4	22.4±7.7	0.058[ns]
Total motile sperm count	18.1±9.7	21.4±14.3	0.055[ns]

Table 7 showed that in group B, motility, progressive motility and total motile sperm count were not statistically significant when compared pretreatment and post treatment patients (p>0.05).

Table 8: Pretreatment ejaculate volume, sperm count and sperm morphology in two groups, (N=74)

	Group A (Co Q10)	Group B (Placebo)	P value

	(n=37)	(n=37)	
	Mean ±SD	Mean ±SD	
Ejaculate volume	2.0±0.7	1.9±0.7	0.796^{ns}
Sperm count (million/ml)	40.2±21.0	37.4±16.0	0.507^{ns}
Sperm morphology	28.3±12.3	28.2±13.0	0.956^{ns}

Table 8 showed that ejaculate volume, sperm count and sperm morphology were not statistically significant compared between two groups (p>0.05).

Table 9: Pretreatment of motility, progressive mortality and total motile sperm count in two groups, (N=74)

	Group A (Coenzyme 10) (n=37)	Group B (Placebo) (n=37)	P value
	Mean ±SD	Mean ±SD	
Motility	25.2±8.1	25.3±8.1	0.966^{ns}
Progressive mortality	22.5±7.0	22.1±7.4	0.810^{ns}
Total motile sperm count	20.0±13.6	18.1±9.7	0.493^{ns}

Table 9 showed that pretreatment of motility, progressive motility and total motile sperm count were not statistically significant compared between two groups (p>0.05).

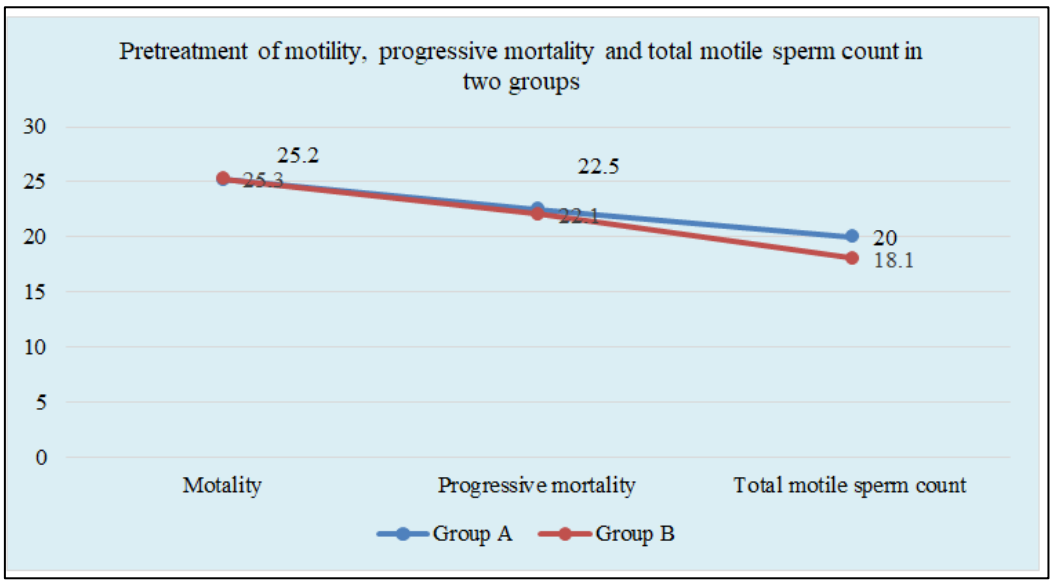

Figure III: Pretreatment of motility, progressive mortality and total motile sperm count in two groups, (N=74)

Table 10: Post treatment comparison ejaculate volume, sperm count and sperm morphology in two groups, (N=71)

	Group A (Co Q10) (n=35)	Group B (Placebo) (n=36)	P value
	Mean ±SD	Mean ±SD	
Ejaculate volume	2.1±0.8	2.0±0.5	0.718^{ns}
Sperm count (million/ml)	43.5±28.0	39.8±21.4	0. 529^{ns}
Sperm morphology	32.3±17.5	29.5±15.2	0.481^{ns}

Table 10 shows that post treatment of ejaculate volume, sperm count and sperm morphology were not statistically significant compared between two groups (p>0.05).

Table 11: Post treatment of motility, progressive mortality and total motile sperm count in two groups, (N=71)

	Group A (Coenzyme Q10)	Group B (Placebo)	P value

	(n=35)	(n=36)	
	Mean ±SD	Mean ±SD	
Motility (%)	37.8±11.1	26.3±8.8	0.001[s]
Progressive mortality (%)	30.0±7.9	22.4±7.7	0.001[s]
Total motile sperm count	33.5±24.4	21.4±14.3	0.013[s]

Table 11 showed that post treatment of motility (37.8±11.1 vs 26.3±8.8%), progressive motility (30.0±7.9 vs 22.4±7.7%) and total motile sperm count (33.5±24.4 vs 21.4±14.3 million) were significantly higher in group A than group B (p<0.05).

Table 12: Distribution of study population according to improvement of sperm motility, (N=71)

Improvement of sperm motility	Group A (Coenzyme Q10) (n=35)		Group B (Placebo) (n=36)		RR (95% CI)	P value
	n	%	n	%		
Yes	21	60.0	2	5.6	10.80 (2.73-42.66)	0.001[s]
No	14	40.0	34	94.4		

RR=Relative risk
CI-Confidence interval

Table 12 showed that improvement of sperm motility was significantly higher in group A than group B (60.0% vs 5.6%) with relative risk 10.80, 95% CI 2.73-42.66%.

DISCUSSION

CoQ10 has been found in measurable level in human semen. It exhibits essential metabolic and antioxidant functions as well as playing a vital role in mitochondrial bioenergetics. Thus coenzyme Q may be a key player in the maintenance of biological redox balance. CoQ10 concentrations in seminal plasma directly correlate with semen parameter, specially sperm count and motility [15]. Levels of CoQ10 in seminal plasma and sperm cells of infertile men with idiopathic and varicocele-associated asthenozoospermia were reduced significantly [12]. On the basis of this finding, CoQ10 likely contributes to the total antioxidant buffer capacity of semen, and a decrease in levels is deleterious in terms of dealing with oxidative stress. A previous open uncontrolled study from the group has provided evidence that the administration of CoQ10 may play a positive role in treatment of infertile men affected by idiopathic asthenozoospermia, probably related both to its role in the mitochondrial respiratory chain and to its antioxidant role [16]. The aim of this study is to evaluate the effectiveness of coenzyme Q-10 treatment in idiopathic asthenozoospermia. In the present study it was observed that majority patients belonged to age group 31-35 years in groups. The mean age was found 33.2±3.6 years in group A(CoQ1o) and 33.3±3.4 years in group B(placebo). The difference was not statistically significant (p>0.05) between two groups. In a study done by Alahmar (2019) [17] showed that the mean age was 26.23±7.22 and 29.45±8.61 years in groups 1 (received 200 mg single dose of oral CoQ10) and 2 (received 400 mg single dose of oral CoQ10) respectively (p=0.094). The another study conducted by Gopinath *et al*., (2013) [11] found mean age was 30.74 years, range: 24-45 years affected by idiopathic oligoasthenozoospermia. The above findings were almost similar in this study. This study showed primary infertility was common in both groups, that is 26(70.3%) in group A (CoQ10) and 29(78.4%) in group B(placebo). However, the difference was not statistically significant between two groups (p=0.425). Alahmar (2017) [18] reported that patients with primary infertility constituted 71.8%, whereas those with secondary infertility formed 28.2%. This finding was consistent with the current study. Regarding the duration of infertility in this study it was observed that majority patients had duration of infertility 2-5 years in both groups, that is 29(78.4%) in group A(coQ10) and 31(83.8%) in group B (placebo). The difference was not statistically significant between two groups (p=0.533). Alahmar (2019) [17] had observed that mean duration of infertility was 4.34±3.64 and 4.91±4.17 years in groups 1(CoQ10 200mg) and 2(Coqq10 400mg) respectively (p=0.54). Kobori *et al*., (2014) [19] also found that the mean duration of infertility was 2.3 years. In this study it was observed that in group A (Coenzyme Q10), ejaculate volume, sperm count and sperm morphology were not statistically significant when compared between pretreatment and post treatment patients. In a study conducted by Alahmar (2019) [17] it was found that mean ejaculate volume was 2.38±1.30 mL pretreatment and 2.51±1.42 mL after treatment. Normal morphology was 22.17±6.08% pretreatment and 23.67±7.45% after treatment. The difference was not statistically significant (p>0.05) compared between pretreatment and post treatment group. Alahmar *et al*., (2021) [15] observed that seminal fluid CoQ10 levels did not show any correlation with sperm concentration or morphology. Alahmar (2017) [18] reported that normal sperm morphology, however, did not alter significantly in infertile patients after treatment (33.8±8.33 vs

34.5±6.50% respectively). The above study findings were almost similar in this study. In this present study it was observed post treatment of ejaculate volume, sperm count and sperm morphology were not statistically significant compared between two groups (p>0.05). In a study done by Safarinejad *et al*., (2012) [13] showed that mean semen volume did not differ significantly between the 2 groups (p=0.1). But at the end of the 26-week treatment phase ubiquinol (17.6%±4.4%) was significantly more effective than placebo (14.8%±4.1%) in improving strict morphology (p=0.01). The present study showed that in group A (Coenzyme Q10), motility (37.8±11.1 vs 25.2±8.1%), progressive motility (30.0±7.9 vs 22.5±7.0%) and total motile sperm count (33.5±24.4 vs 20.0±13.6 million) were significantly increased post treatment when compared to pretreatment patients (p<0.05). Alahmar *et al*., (2021) [15] showed CoQ10 treatment for three-months improved sperm concentration (p<0.05), progressive motility (p<0.05), and total motility (p<0.01) compared to the baseline. The earliest study evaluating the effect of CoQ10 supplementation on seminal parameters was the pilot study by Balercia and co-workers (2004) [16], which included 22 subjects with idiopathic asthenozoospermia who underwent supplementation with CoQ10 200 mg/day twice a day. After 6 months, a significant difference was found in the forward motility of sperm cells (from 9.13±2.50 to 16.34±3.43%, p< 0.05). Likewise, the authors observed an increase in sperm cells total and forward motility (from 33.14±7.12 to 39.41±6.80, p<0.0001), and (from 10.43±3.52 to 15.11±7.34%, p<0.0003, respectively), again confirmed by CASA. Moreover, ubiquinol levels in seminal plasma and sperm cells also increased after treatment [12]. The above findings are consistent with this study. Present study showed post treatment of motility (37.58±11.1 vs 26.3±8.8%) progressive motility ((30.0±7.9 vs 22.4±7.7) and total motile sperm count (33.5±24.4 vs 21.4±14.3) were significantly higher in group A than group B (p<0.05). An almost similar study conducted by Safarinejad *et al*., (2012) [13] where a significant increase in the percentage of motile sperm was observed in the ubiquinol group (35.8%±2.7%) compared to the placebo group (25.4%±2.1%) (p=0.008) after 26 week's treatment. Alahmar *et al*., (2021) [15] showed that CoQ10 treatment for three months significantly improved sperm concentration (p<0.05), progressive motility (p<0.05), total motility (p<0.01), and seminal fluid CoQ10 concentration (p<0.001). Gopinath *et al*., (2013) [11] reported that statistically significant improvement in sperm count (increase from 14.8 to 26.35 in Arm 1), via FDC tablet containing Co-Q10, L-carnitine, Zinc, Lycopene; and (14.37 to 24.8 million/ml in Arm 2), via FDC tablet and placebo; (p<0.0001) and sperm motility (39.2-51.6% in arm 1 and 38.4-50.1% in arm 2, p<0.0001) in both treatment arms, at day 90 as compared to their baseline value at day 0, whereas small improvement in seminal parameters was also seen in Arm 3 placebo group that is almost similar to this study. Festa *et al*., (2014) [20] investigated the effect of 100 mg CoQ10 daily supplementation on semen parameters of 38 patients with varicocele-related male infertility. After a 12-week period of treatment, they measured a significant increase in sperm density ($35.5\pm3.4\times10^6$/mL vs. $42.6\pm4.5\times10^6$/mL, p=0.03) and forward motility (20.1±4.5% vs. 28.4±4.9, p=0 .03). Seminal plasma total antioxidant capacity (TAC) also increased significantly after treatment (106.6±8.7 s vs. 148.4±12.6 s, p<0.01). Alahmar (2017) [18] investigated that there was no significant change in semen volume after treatment (2.6±0.91 vs 2.8±0.68 mL respectively). Sperm concentration increased in patients with idiopathic oligoasthenozoospermia after 3 months of treatment with means of sperm concentration of 9.13±4.29 and $11.3\pm6.05 \times 10^6$/mL respectively (p<0.05). Progressive sperm motility significantly increased in patients after treatment (18.1±8.68 vs 24.6±10.2% respectively, p<0.01). Moreover, total sperm motility also increased from 28.4±8.71 to 34.4±11.7% after treatment (p<0.01). The above study findings were supportive of this study. Similarly, a significant improvement of sperm total motility (from 33.14%±7.12% to 39.41%± 6.80%, P<.0001) and forward motility (from 10.43%±3.52% to 15.11%±7.34%, P=.0003) was observed in the treated group after 6 months of CoQ10 administration [12]. These observations also fall in line with the current study. Treatment with CoQ10 (200 mg or 400 mg per day) resulted in a significant increase in sperm concentration from baseline (8.22±6.88 to 12.53±8.11 million/mL, p=0.019; 7.58±5.41 to 12.33±6.1 million/mL, p=0.002, respectively), as well as improvements in progressive motility (16.54%±9.26% to 22.58%±10.15%, p=0.011; 14.22%±12.85% to 26.1%±14.52%, p=0.001, respectively), and total motility (25.68%±6.41% to 29.96% ±8.09%, p=0.016; 23.46%±12.59% to 34.82%±14.17%, p=0.001, respectively). These changes were greater in the group treated with 400 mg of CoQ10 [15]. In this study motility was also increased significantly in coenzyme Q10 group than placebo group after 200 mg CoQ10 treatment. Present study observed that improvement of sperm motility was significantly higher in group A (CoenzymeQ10) than group B (placebo) (60.0% vs 5.6%), ten times more improvement of sperm motility seen with coenzyme Q10 group over the placebo group. Similarly, Safarinejad *et al*., (2012) [13] reported that the percentage of patients in the treatment group who showed improvement and deterioration in sperm motility was 57% and 16%, respectively. Cheng *et al*., (2018) [21] showed that after treatment, the combination group (L-carnitine plus CoQ10), as compared with the L-carnitine (LC), CoQ10 and control groups, showed significantly higher sperm motility and percentage of progressively motile sperm (P<0.05). Moreover, endogenous CoQ10 is significantly related to sperm count motility as one could expect considering its bioenergetic role in mitochondrial function and its important cellular compartmentalization. Its distribution

between intracellular and extracellular compartments seems to be an active process, which is profoundly disturbed in patients with varicocele [22]. The data of this placebo-controlled, double-blind randomized trial confirm a significant improvement of sperm motility features after 6 months of administration of CoQ10, on the basis of both manual and computer-assisted evaluation [12].

CONCLUSION

In conclusion, coenzyme Q10 administration, total motility, progressive motility and total motile sperm count were significantly increased in post treatment than pretreatment semen parameter. Whereas, in placebo group, total motility, progressive motility and total motile sperm count were also increased but not significant. Improvement of sperm motility was significantly higher in coenzyme Q10 group than placebo group. The administration of CoQ10 may play a positive role in the treatment of asthenozoospermia, probably related both to its involvement in the mitochondrial respiratory chain and to its antioxidant properties.

LIMITATIONS OF THE STUDY

The present study was conducted at a very short period of time with a small sample size in a single hospital, so it might not represent the whole community. The study and follow up period were short in comparison to other studies with a limited resources and facilities. Data collection, follow up was challenging due to COVID 19 situation.

RECOMMENDATIONS

Further community based or multicenter studies can be undertaken by including large number of patients. More studies are needed to establish the optimal CoQ10 dosage and the possible superiority of co-administration with other molecules compared to monotherapy. For well-structured studies are required to determine the impact of CoQ10 supplementation on pregnancy rate and live birth rate. Supplementation with CoQ10 may enhance the fertility potential and reproductive outcomes of men with idiopathic infertility.

REFERENCES

1. Taylor, H. S., Pal, L., & Seli, E. (2019). 'Speroff's Clinical Gyecological Endocrinology and infertility', Part-4, South Asian Edition, 9th edition, Chapter 25, Wolters Kluwer Health, p.973.
2. Alahmar, A. T. (2018). The effects of oral antioxidants on the semen of men with idiopathic oligoasthenoteratozoospermia. *Clinical and Experimental Reproductive Medicine*, *45*(2), 57-66.
3. Centers for Disease Control and Prevention: Vital and Health Statistics, Series 23, No. 26. Available at http://www.cdc.gov.
4. Dohle, G. R., Jungwirth, A., Colpi, G., Giwercman, A., Diemer, T., & Hargreave, T. B. (2012). European Association of Urology. Guideline on male infertility.
5. Moslemi, M. K., & Tavanbakhsh, S. (2011). Selenium–vitamin E supplementation in infertile men: effects on semen parameters and pregnancy rate. *International journal of general medicine*, 99-104.
6. WHO. (2010). WHO laboratory manual for the Examination and processing of human semen, 5th edition, Switzerland; pp. 1-271.
7. Montanino Oliva, M., Minutolo, E., Lippa, A., Iaconianni, P., & Vaiarelli, A. (2016). Effect of myoinositol and antioxidants on sperm quality in men with metabolic syndrome. *International journal of endocrinology*, *2016*, 1-5.
8. Brooker, R. J. (2011). *Genetics: analysis and principles*, 4th ed. McGraw-Hill Higher Education; Ohio, USA.
9. Agarwal, A., Sharma, R. K., Nallella, K. P., Thomas Jr, A. J., Alvarez, J. G., & Sikka, S. C. (2006). Reactive oxygen species as an independent marker of male factor infertility. *Fertility and sterility*, *86*(4), 878-885.
10. Tremellen, K. (2008). Oxidative stress and male infertility—a clinical perspective. *Human reproduction update*, *14*(3), 243-258.
11. Gopinath, P., Kalra, B., Saxena, A., Malik, S., Kochhar, K., Kalra, S., & Zaveri, H. (2013). Fixed dose combination therapy of antioxidants in treatment of idiopathic oligoasthenozoospermia: results of a randomized, double-blind, placebo-controlled clinical trial. *Int J Infertil Fetal Med*, *4*(4), 6-13.
12. Balercia, G., Buldreghini, E., Vignini, A., Tiano, L., Paggi, F., Amoroso, S., ... & Littarru, G. (2009). Coenzyme Q10 treatment in infertile men with idiopathic asthenozoospermia: a placebo-controlled, double-blind randomized trial. *Fertility and sterility*, *91*(5), 1785-1792.
13. Safarinejad, M. R., Safarinejad, S., Shafiei, N., & Safarinejad, S. (2012). Effects of the reduced form of coenzyme Q10 (ubiquinol) on semen parameters in men with idiopathic infertility: a double-blind, placebo controlled, randomized study. *The Journal of urology*, *188*(2), 526-531.
14. Nadjarzadeh, A., Sadeghi, M. R., Amirjannati, N., Vafa, M. R., Motevalian, S. A., Gohari, M. R., ... & Shidfar, F. (2011). Coenzyme Q 10 improves seminal oxidative defense but does not affect on semen parameters in idiopathic oligoasthenoteratozoospermia: A randomized double-blind, placebo controlled trial. *Journal of endocrinological investigation*, *34*, e224-e228.
15. Alahmar, A. T., Calogero, A. E., Sengupta, P., & Dutta, S. (2021). Coenzyme Q10 improves sperm parameters, oxidative stress markers and sperm DNA fragmentation in infertile patients with

idiopathic oligoasthenozoospermia. *The world journal of men's health*, *39*(2), 346.

16. Balercia, G., Mosca, F., Mantero, F., Boscaro, M., Mancini, A., Ricciardo-Lamonica, G., & Littarru, G. (2004). Coenzyme Q10 supplementation in infertile men with idiopathic asthenozoospermia: an open, uncontrolled pilot study. *Fertility and sterility*, *81*(1), 93-98.
17. Alahmar, A. T. (2019). The impact of two doses of coenzyme Q10 on semen parameters and antioxidant status in men with idiopathic oligoasthenoteratozoospermia. *Clinical and Experimental Reproductive Medicine*, *46*(3), 112.
18. Alahmar, A. T. (2017). Effect of vitamin C, vitamin E, zinc, selenium, and coenzyme Q10 in infertile men with idiopathic oligoasthenozoospermia. *Int J Infertil Fetal Med*, *8*(2), 45-49.
19. Kobori, Y., Ota, S., Sato, R., Yagi, H., Soh, S., Arai, G., & Okada, H. (2014). Antioxidant cosupplementation therapy with vitamin C, vitamin E, and coenzyme Q10 in patients with oligoasthenozoospermia. *Archivio Italiano di Urologia e Andrologia*, *86*(1), 1-4.
20. Festa, R., Giacchi, E., Raimondo, S., Tiano, L., Zuccarelli, P., Silvestrini, A., ... & Mancini, A. (2014). Coenzyme Q10 supplementation in infertile men with low-grade varicocele: an open, uncontrolled pilot study. *Andrologia*, *46*(7), 805-807.
21. Cheng, J. B., Zhu, J., Ni, F., & Jiang, H. (2018). L-carnitine combined with coenzyme Q10 for idiopathic oligoasthenozoospermia: A double-blind randomized controlled trial. *Zhonghua nan ke xue= National Journal of Andrology*, *24*(1), 33-38.
22. Mancini, A., Milardi, D., Conte, G., Bianchi, A., Balercia, G., De Marinis, L., & Littarru, G. P. (2003). Coenzyme Q10: another biochemical alteration linked to infertility in varicocele patients?. *Metabolism*, *52*(4), 402-406.