ORIGINAL ARTICLE

Co-enzyme Q-10 Supplementation on Serum Anti-Müllerian Hormone Levels in Young Infertile Women with Diminished Ovarian Reserve: A Dose-Response Study

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ABSTRACT

A quasi-experimental study was conducted at the Reproductive Endocrinology and Infertility Unit (under the Department of Obstetrics & Gynaecology) of Dhaka Medical College Hospital, Dhaka, Bangladesh, between January and December of 2022, to evaluate the effect of two different doses of co-enzyme Q10 on serum anti-Müllerian hormone (AMH) levels in young infertile women with diminished ovarian reserve. A total of 76 infertile women aged between 18 and 35 years with serum AMH <1.2 ng/ml were enrolled in this study. Participants were allocated into two groups: group A received CoQ10 100 mg three times daily for two months, while group B received CoQ10 200 mg three times daily for the same duration. Serum AMH levels were measured before and after treatment. Baseline characteristics and pre-treatment AMH levels were comparable between the groups. Although the serum AMH increased significantly in both groups after treatment ($p<0.001$), the mean increase in AMH was significantly higher in group B compared to group A (1.32±0.96 ng/ml vs. 0.48±0.47 ng/ml; $p<0.001$). Post-treatment AMH levels were also significantly higher in group B than group A (1.93±1.02 ng/ml vs. 1.09±0.65 ng/ml; $p<0.001$). No serious adverse effect was reported in either group. Our data suggests that co-enzyme Q10 supplementation significantly increases serum AMH levels in young infertile women with diminished ovarian reserve and the 200 mg regimen was more effective than 100 mg regimen.

Keywords: Anti-Müllerian hormone, diminished ovarian reserve, coenzyme Q10, infertility, antioxidant

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INTRODUCTION

Infertility affects a substantial proportion of couples worldwide and remains a major reproductive health issue.[1] Diminished ovarian reserve (DOR) poses a particular challenge in women of reproductive age.[2] Ovarian reserve refers to the number of follicles remaining in ovaries at any given point of time. A girl child is born with all the ovarian follicles she would ever have, and that number gradually declines steadily throughout life. Ovarian reserve is one of the key factors that determines fertility potential.[3] Diminished ovarian reserve leads to reduced fertility potential characterized by a reduction in both the quantity and functional competence of oocytes.[2] Serum anti-Müllerian hormone (AMH), secreted by granulosa cells of pre-antral and small antral follicles, has emerged as a dependable biomarker for evaluating ovarian reserve.[2,4]

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Oxidative stress has been increasingly recognized as a key contributor to ovarian aging and follicular depletion. Excess reactive oxygen species can impair mitochondrial activity, resulting in compromised oocyte quality and reduced reproductive outcomes. Mitochondria play a central role in oocyte maturation and energy metabolism, and their dysfunction is closely linked to declining ovarian function.[5,6]

Coenzyme Q10 (CoQ10) is an endogenous, lipid-soluble molecule that participates in the mitochondrial electron transport chain acting as a potent antioxidant. Reduced CoQ10 availability may exacerbate oxidative damage and impair mitochondrial efficiency. Supplementation with CoQ10 has therefore been suggested as a means to enhance ovarian function and improve markers of ovarian reserve.[5-8] While those studies have reported favorable effects of CoQ10 on reproductive parameters, optimal dosing strategies remain uncertain.[6,7] Moreover, to our knowledge, no human study was done in our country on the biological effects of CoQ10 on ovarian reserve that could be reflected through changes in the serum anti-Müllerian hormone (AMH) levels. Taking all those facts into our considerations, we proposed this study to compare the effects of two different doses of CoQ10 on serum anti-Müllerian hormone (AMH) levels in young infertile women with diminished ovarian reserve.

METHODS

Study design, setting, and sample population: This quasi-experimental study was conducted at the Reproductive Endocrinology and Infertility Unit (under the Department of Obstetrics & Gynaecology) of Dhaka Medical College Hospital, Dhaka, Bangladesh, from January to December of 2022. A total of 76 infertile women aged between 18 and 35 years with documented diminished ovarian reserve (DOR), as defined by the serum anti-Müllerian hormone (AMH) level below 1.2 ng/ml, were included in this study. However, we excluded patients with previous ovarian surgery, chemotherapy, or radiotherapy, endometriosis, premature ovarian insufficiency, use of hormonal or antioxidant supplements affecting ovarian reserve within the preceding three months of the study commencement. The patients were divided into two groups according to the intervention status. Group A received CoQ10 100 mg three times daily for two months, and group B received CoQ10 200 mg three times daily for the same duration. Participants were advised to avoid concurrent use of any other fertility-related supplements during the study period. The primary outcome measure was the change in serum AMH levels (in ng/ml) from baseline to the end of the intervention period in both groups.

Data collection and analysis: Baseline demographic and clinical data were obtained using a structured questionnaire. Serum AMH levels were assessed at baseline and after two months of supplementation using standard laboratory techniques. The collected data was stored in excel sheet, and necessary cleaning was done. Then data was exported to IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk, NY, USA) for final analysis. Continuous variables were expressed as mean±standard deviation (SD). Student's t-test and Chi-square test were used for comparison. We measured on 95% confidence interval for statistical decision; statistical significance was set at $p<0.05$.

RESULTS

Table 1 shows that majority patients belonged to age group 26-35 years in both groups that was 35 (92.1%) in group A and 32 (81.5) in group B. There was no difference of age between these two groups. Most of the patients completed HSC and above in both groups. Group B is almost significantly had less monthly income compared to the other group. Group A patients were significantly overweight and obese compared to group B. The duration of infertility was almost similar between the two groups (6.62±4.80 years vs. 7.08±4.30 years). Age, educational status, residence and duration of infertility were not different between the two groups. Baseline characteristics, including age, body mass index, type and duration of infertility, and pretreatment serum AMH levels, did not differ significantly between the two groups. Table 2 shows that primary infertility was more common in both groups: 24(63.2%) in group A and 26(68.4%) in group B. However, the difference was not statistically significant between two groups ($p=0.63$). Table 3 depicts the pre- and post-treatment comparison of serum AMH level. It shows that the intervention with CoQ10 (100 mg) significantly increased the AMH level by 0.48 units ($p<0.001$) in group A; improvement

in group B with intervention of CoQ10 (200 mg) was more pronounced than that of group A, as the increase was 1.32 units on average after intervention (p<0.001). Table 4 represents that higher dose CoQ10 (200 mg) improved the serum AMH level better compared to lower dose CoQ10 (100 mg) (p<0.001). Though it was not our initial objective, we did not encounter any adverse effect of CoQ10 in the patients. Hence, we consider the supplement and the dose as safer adjuncts.

Table 1: Demographic characteristics of the study patients (N=76)

Variables	Group A (n=38) (Mean±SD)	Group B (n=38) (Mean±SD)	p-value
Age (in years)	30.29±3.153	29.50±3.45	0.30
Monthly income (in BDT)	25105.26 ±15838.36	22026.32 ±10063.28	0.32
BMI	25.97±2.76	24.36±3.28	0.02
Duration of infertility (in years)	6.62±4.80	7.08±4.30	0.66
	Frequency (Percentage)	Frequency (Percentage)	
Age group (in years)			
≤ 25	3 (7.9)	7 (18.4)	0.30
26-30	16 (42.1)	17 (44.7)	
≥31	19 (50.0)	14 (36.8)	
Education			
Illiterate	2 (5.3)	3(7.9)	0.97
≤SSC	12(31.6)	12(31.6)	
≤HSC	13(34.2)	12(31.6)	
Graduate and above	11(28.9)	11(28.9)	
Monthly income (in BDT)			
≤15000	9 (23.7)	4 (10.5)	0.06
15000–25000	16 (42.1)	26 (68.4)	
>25000	13 (34.2)	8 (21.1)	
Residence			
Urban	27 (71.1)	27 (71.1)	1.00
Rural	11 (28.9)	11 (28.9)	
BMI			
Normal	14 (36.8)	26 (68.4)	0.02
Overweight	20 (52.6)	09 (23.7)	
Obese	04 (10.5)	03 (7.9)	

Table 2: Distribution of study population according to type infertility (N=76)

Types of infertility	Group A (n=38)	Group B (n=38)	p-value
Primary	24 (63.2%)	26 (68.4%)	0.63
Secondary	14 (36.8%)	12 (31.6%)	

Table 3: Comparison of pre- and post-intervention of serum AMH levels (N=76)

Groups	Pre-intervention Serum AMH Mean±SD	Post-intervention Serum AMH Mean±SD	p-value
Group A (n=38)	0.61±0.43 ng/ml	1.09±0.65 ng/ml	<0.001
Group B (n=38)	0.61±0.40 ng/ml	1.93±1.02 ng/ml	<0.001

Table 4: Comparison of post-intervention serum AMH levels between two groups (N=76)

Group A (n=38) (Mean±SD)	Group B (n=38) (Mean±SD)	p-value
1.09±0.65 ng/ml	1.93±1.02 ng/ml	<0.001

DISCUSSION

The findings of this study indicate that CoQ10 supplementation leads to a significant improvement in serum anti-Müllerian hormone (AMH) levels in young infertile women with diminished ovarian reserve. Importantly, a higher dose of CoQ10 produced a noticeable increase in serum AMH compared to a lower dose. These findings are consistent with previously published studies evaluating antioxidant therapy in women with reduced ovarian reserve.[5-8]

Observed improvement in our study may be explained by the role of CoQ10 in enhancing mitochondrial bioenergetics and reducing oxidative stress within ovarian follicles. Improved mitochondrial efficiency in granulosa cells may support follicular development and AMH secretion. Experimental and clinical studies have demonstrated that CoQ10 supplementation improves mitochondrial function and ovarian responsiveness, particularly in younger women with compromised ovarian reserve.[5,6]

Nutritional and antioxidant supplementation offers a potentially cost-effective adjunct to conventional infertility management in low-resource settings like Bangladesh, where access to advanced assisted reproductive technologies may be limited. Several previous studies have shown relationship of micronutrient supplementation like CoQ10 and ovarian reserve markers.[5-10] Different beneficial effects have been reported based on enhancement of ovarian follicles and follicular fluid elevation following oral administration of coenzyme Q10.[5-9] In this study, we demonstrated the similar effects through raised anti-Müllerian hormone (AMH) levels. Our results support the supplementation of specified patient groups with CoQ10 in lower and late reproductive status.

However, our study has some limitations. The study was conducted at a single tertiary care center with a relatively small sample size, which may limit the generalizability of the findings. Pregnancy-related outcomes were not evaluated, and biochemical markers of oxidative stress were not assessed. Nonetheless, the study focused on an important intervention aspect that can be translated into practice in a resource constraint setting like Bangladesh to increase the serum AMH.

CONCLUSION

Our study established that CoQ10 supplementation is increases serum anti-Müllerian hormone (AMH) levels in young infertile women with diminished ovarian reserve. To increase serum AMH level, a higher dose appears to be more effective than that of a lower dose. CoQ10 proved itself as a safe and affordable adjunct therapy in the management of diminished ovarian reserve.

Conflict of Interest: The authors declared that they had no competing interest, either personal or financial, which could influence this work.

Funding statement: No funding was received from any public, commercial, or non-profit organization.

Ethical Approval: Ethical approval was obtained from the Ethical Review Committee of Dhaka Medical College, Dhaka, Bangladesh. Written informed consent was obtained from all participants prior to enrollment, and confidentiality was maintained throughout the study.

Authors' Contribution: UN and FR conceptualized and designed the study, UN, FR, FR and NJ were involved in patient selection, data collection and compilation, UN and SMBB did data analysis, FR was the supervisor of this study. All the authors were equally involved in the manuscript preparation, editing and final submission.

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