

RELATIONSHIP OF ZINC CONCENTRATIONS IN BLOOD AND SEMINAL PLASMA WITH VARIOUS SEMEN PARAMETERS IN INFERTILE SUBJECTS

Hasan Ali¹, Masood Ahmed², Mukhtiar Baig³, Moazzam Ali⁴

ABSTRACT

Objective: To find out relationship of zinc concentrations in blood and seminal plasma with various semen parameters between fertile and infertile men.

Design: Prospective study.

Setting: This study was carried out in the Infertility Clinic of Jinnah Postgraduate Medical Center (JPMC), Karachi and Department of Biochemistry, Basic Medical Sciences Institute, JPMC, Karachi.

Subjects & Methods: Fifty eight primary infertile male subjects, without any treatment, who had regular unprotected intercourse for at least 12 months without conception with their partners, aged 20-40 years, were selected from Infertility Clinic Jinnah Postgraduate Medical Center, Karachi. After semen analyses they were grouped as, oligospermic (30), and azoospermic (28). Twenty five known fertile male selected from general population and after semen analysis were taken as normospermic control group. Semen analyzed according to WHO criteria. Serum and seminal plasma zinc were estimated by 5Br. PAPS Colorimetric method.

Results: This study showed significant difference in serum and seminal zinc levels in normospermic, oligospermic ($p < 0.05$) and azoospermic ($p < 0.005$) subjects. Seminal plasma zinc showed a positive correlation with sperm count and negative with sperm motility in normospermic and oligospermic and negative correlation with volume, pH, WBC concentration in all three groups. There was no correlation found with sperm morphology.

Conclusion: On the basis of the findings of this study and those of other reports, zinc may contribute to fertility through its significant effects on various semen parameters. It seems that the estimation of seminal plasma zinc may help in investigation and treatment of infertile males.

KEY WORDS: Seminal Zinc, Oligospermic, Azoospermic, Infertility.

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1. Dr. Hasan Ali MBBS, M. Phil, Assistant Professor, Department of Biochemistry,
2. Dr. Masood Ahmed MBBS, M. Phil, Professor, Department of Anatomy,
- 1-2: Baqai Medical University, Karachi.
3. Dr. Mukhtiar Baig MBBS, M.Phil Associate Professor, Department of Biochemistry, Liaquat National Medical College, Karachi.
4. Dr Moazzam Ali MBBS, M.Phil Professor, Department of Anatomy, Ziauddin Medical University, Karachi.

Correspondence:

Dr. Hasan Ali,
16-B, 5th Floor, Society Apartment,
Kashmir Road,
Karachi - Pakistan.

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INTRODUCTION

Infertility is complex and has multiple causes and consequences depending on the gender, sexual history, life style of society and cultural background of people it affects.¹ Infertility affects about 8% to 12% of the world's population and in about half of cases men are either the single cause of or contribute the couple's infertility.² In fact trace elements calcium, magnesium, copper, selenium, and zinc play very vital role in effecting various parameters of semen. Among trace elements increasing evidence of a direct relationship of zinc was found with seminal parameters.³ Zinc (Zn) in seminal plasma stabilizes the cell membrane and nuclear chromatin of spermatozoa.^{4,5} It may also have an antibacterial function⁶ and

protect the testis against the degenerative changes.⁷ It may play a regulatory role in the process of capacitation and acrosome reaction.⁸ The relationship of zinc to the routinely determined variables of semen quality is controversial. This study was designed to evaluate and compare blood and seminal plasma zinc level with various semen parameters among fertile and infertile male subjects.

SUBJECTS AND METHODS

This study was carried out in the Infertility Clinic Jinnah Postgraduate Medical Center, Karachi and Department of Biochemistry, Basic Medical Sciences Institute, JPMC, Karachi. Fifty eight primary infertile male subjects, without any treatment, who had regular unprotected intercourse for at least 12 months without conception with their partners, aged 20-40 years, were selected from Infertile Clinic, JPMC, Karachi. Wives of the infertile subjects included had no obvious causes of infertility like tubal blockage or ovulation disorders. At first clinic attendance, a detailed background history and physical examination were done on both husband and wife. The sperm count was used to group the infertile subjects as, oligospermic (28), and azospermic (30). The subjects having sperm count less than 20 million/ml were taken as oligospermic while azospermic having zero sperm count. Twenty five fertile male whose partners had conceived within a year and having sperm count more than 20 million/ml with motility more than

50%, were selected from general population and taken as normospermic control group.

Individuals who had undergone pelvic surgery of hernia repair, having diabetes or thyroid disease; patients who were on antipsychotic or antihypertensive drugs, or taking alcohol, nicotine, vitamin and mineral supplementation were excluded from the study.

Semen and serum sampling: Semen samples were obtained by masturbation into 50 ml sterile polystyrene jars after an abstinence period of 3 to 5 days. After liquefaction, samples were processed by conventional analysis to determine the volume, pH, sperm count, sperm motility and sperm morphology according to WHO criteria.⁹ The seminal plasma was collected after centrifugation at 2000 rpm for 15-20 minutes. Supernatant were transferred in fresh tubes and stored at -20°C until used for zinc assay. Informed consent was obtained and 5 ml of blood samples were taken from each subject in the morning after an overnight fasting. After centrifugation serum was kept frozen at 20°C until analyzed for the zinc. Serum and Seminal Plasma zinc was estimated by 5-Br PAPS colorimetric method using kit supplied by Spinreact SA Spain. The estimation of zinc is based on principle in which zinc react with specific complexant 5-Br PAPS forms a stable color complex. The color intensity is proportional to the amount of zinc present in the sample. Results were analyzed statistically using SPSS version 10.8 to analyze the data.

RESULTS

Results are expressed as mean \pm SEM for each parameter. Statistically significant differences among oligospermic, azospermic and normospermic control groups are indicated along with their significant values.

The Zn concentration in blood and seminal plasma in three groups are shown in Table-I. Serum and seminal Zn levels were significantly lower in oligospermic and azospermic infertile patients than normospermic, fertile males ($p < 0.05$, $p < 0.01$ respectively)

Table-I: Zinc concentration in blood and seminal plasma in three groups. The values are expressed as mean \pm SEM

Parameters	Normospermic (n=25)	Oligospermic (n=30)	Azospermic (n=28)
Serum Zn concentration ($\mu\text{g}/\text{dl}$)	82.63 \pm 3.90	70.18 \pm 4.20*	66.45 \pm 2.93†
Seminal plasma Zn concentration (mg/dl)	6.40 \pm 0.43	5.41 \pm 0.51*	4.65 \pm 0.33†

* $P < 0.05$ when oligospermic group is compared with normospermic.

† $P < 0.001$ when azospermic group is compared with normospermic.

Table-II: Correlation coefficient (r) of seminal plasma zinc concentration with semen parameters

Parameters	Control (n=25)	Oligospermic (n=30)	Azoospermic (n=28)
Volume (ml)	0.35	-0.49**	-0.45 *
pH	0.21	-0.59**	-0.41*
Sperm count (10 ⁶ /ml)	0.3	0.49**	0
Sperm morphology (%)	0.03	0.02	0
Motility (%)	0.27	-0.49 **	0
WBC per HPF	0.11	-0.49 **	-0.59 **

* p < 0.05

** p < 0.01

Correlation coefficient of seminal plasma zinc with various semen parameters in control, oligospermic & azoospermic males are depicted in Table-II. This study observed significant positive correlation of seminal plasma zinc concentration with sperm count in oligospermic and negative correlation with volume, pH, sperm motility & WBC concentration in oligospermic & azoospermic groups. Correlation coefficient of serum zinc with various semen parameters in control, oligospermic & azoospermic males are shown in Table-III. No significant correlation of serum zinc was observed with seminal plasma zinc concentration and other semen parameters.

DISCUSSION

In this study, there was significant low level of serum and seminal plasma zinc levels in oligospermic and azoospermic males. Similar results have been reported elsewhere.¹⁰⁻¹³ Our results are also incompatible with several studies.¹⁴⁻¹⁷

In the present study volume and pH of semen were found to be negatively correlated with the seminal plasma zinc in infertile subjects. These results are in accordance with several studies¹⁸⁻²¹ and contrary with other.¹⁷ When ejaculation occurs, sperms are released together with acidic prostatic fluid; which contains zinc, citric acid & acid phosphatase that make the acidic pH in the first fraction whereas the later fraction contains few sperm and consist mainly of an alkaline vesicular fluid rich in fructose and high molecular weight

Table-III: Correlation Coefficient (r) of Serum Zinc Concentration with Semen Parameters

Parameters	Control (n=25)	Oligospermic (n=30)	Azoospermic (n=28)
Volume (ml)	0.07	0.15	0.29
pH	0.211	0.06	0.13
Sperm count (10 ⁶ / ml)	- 0.004	- 0.16	0
Sperm morphology (%)	0.067	- 0.11	0
Motility (%)	0.19	0.05	0
WBC per HPF	0.11	0.007	0.27
Seminal Plasma Zn	0.34	0.39	0.09

ligands of seminal vesicular origin.¹⁹ If any abnormality lies in either prostate gland or in seminal vesicle, the pH would be reflected either increased or decreased respectively. A good correlation in a positive direction was noted between the sperm count and seminal plasma zinc concentration. These results are contrary to the finding of several studies^{17,18,21} and are in accordance with a few.^{22,23} A clinical study demonstrated that adult males experimentally deprived of zinc showed that the leydig cell synthesis of testosterone was disturbed.²² Since zinc plays an important role in 5 α reductase enzyme that is necessary for the conversion of testosterone into biologically active form 5 α dihydrotestosterone.²⁴ There was no correlation with sperm morphology with seminal plasma zinc concentration. This result is comparable with other studies.^{11,18}

The sperm motility was found to be negatively correlated with seminal plasma zinc levels in oligospermic subjects which differs from the result of several studies^{11,12,21} and are in accordance with similar results which have been reported elsewhere.^{8,25,26} In this study we found significant negative correlation of WBC with seminal plasma zinc concentration. The prostatic zinc may have antibacterial activity because *Trichomonas vaginalis* is readily killed at concentration of zinc that occur in the prostatic fluid of healthy men.⁶ There was no significant correlation of serum zinc with seminal plasma zinc and other semen parameters. Similar result were reported in few other studies.^{18,27}

CONCLUSION

On the basis of the findings of this and other reports, seminal zinc may contribute to fertility through its effect on various semen parameters. It seems that the estimation of seminal plasma zinc may help in investigation and treatment of infertile males.

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