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Correlation Between Semen Zinc Concentration and Semen Parameters of Infertile Men

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ABSTRACT

Background: Infertility is a big problem all over the world. There are different factors in the semen quality which determines the success of fertilization. Zinc is a micronutrient, essential for normal physiology of male reproductive tract. It plays vital role in various biochemical mechanisms. A lot of controversy exists in determining the role of zinc concentration in semen quality. **Objective:** To find the correlation between semen zinc concentration with sperm count and sperm motility in male patients presenting with infertility. **Study Design:** Cross-sectional study. **Settings:** Department of Urology, Allied Hospital, Faisalabad. **Duration:** 21/11/2016 to 20/5/2017. **Methodology:** In this study non-probability consecutive sampling technique was used. Informed consent was obtained and demographic details were also noted. Then patients were subjected to semen samples collection by masturbation. Samples were collected at biochemistry department of this hospital. The zinc concentration was determined via Atomic Absorption Spectrometry. Then sperm count and sperm motility were also noted. SPSS v20 was used to analyze the collected data and results were generated. **Results:** A total number of 100 male infertile individuals were included in this study. The mean age of the subjects was 30.48±5.99 years. Primary infertility was noted in 55(55%) patients and secondary infertility was noted in 45(45%) patients. Correlation was also calculated in the patients below the age of 30 years and above the age of 30 years. Strong positive correlation was found between the zinc concentrations with sperm motility. **Conclusion:** Strong positive relationship was noted among zinc concentration with sperm motility while week positive relationship was noted among zinc concentration with sperm count.

Keywords: Zinc concentration, Sperm count, Sperm motility, Infertility.

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INTRODUCTION

Seminal ejaculate in a male adult individual is composed of sperms and seminal plasma. Pituitary gonadal hormonal axis plays a vital role in producing the sperms from the testis. Sperms pass through maturation process on their way through epididymis getting their nutrition and other survival support from seminal vesical and prostate. There are certain ingredients of the seminal plasma which enhance capability of sperms to induce conception with egg from the female partner resulting in pregnancy. Sperm count and sperm motility are very important factors in this regarding semen quality. There are some trace elements like zinc, magnesium, copper and iron have some effects on these two parameters. Approximately 8-12% of couples are suffering from infertility and male factor is the dominant cause of infertility in the couples facing problem of infertility.[1]

Zinc is a micronutrient, essential for normal physiology of male reproductive tract. It plays vital role in various biochemical mechanisms. It acts as antioxidant with well-known protecting effect on human spermatozoa to prevent the free radical injury. About 1-3 g of zinc is present in adult human body, out of which approximately 0.1% is replenished daily. Many authors have reported high level of zinc in human seminal plasma (the mean ranges from 78.9 to 274.6 mg/L). The prostate gland is thought to be the major contributor of zinc in seminal plasma. High concentration of zinc ions in the prostatic secretions comes in contact with sperm after their functional maturation. Instantly after ejaculation, vaginal and cervical secretions are involved to dilute the seminal zinc ions. Whether the function of sperm is affected or not by the high levels of zinc in the semen is yet not clear. Efforts are being done in linking the level of seminal zinc with parameters of semen over the years, but the results are questionable. It needs to build a consensus on association of seminal plasma zinc level and the semen quality. Inconsistent results regarding role of zinc in quality of semen are revealed by different studies.[3-5] Studies have revealed that seminal plasma zinc deficit is associated with low sperm quality and may be attributed to idiopathic male infertility.[2] Adequate sperm count, their motility and other serum parameters play important role in conception and for a fertile family. So, adequacy in semen parameters plays important role in fertility of males.[6]

There is no local evidence found in literature which could help us in confirming the evidence from literature. Ambiguous results have been noticed in literature, which also create controversy, whether zinc concertation is positively related to sperm count and motility. Rationale of this study was to find the correlation between semen zinc concentration with sperm count and sperm motility in male patients presenting with infertility.

OBJECTIVE

To find the correlation between semen zinc concentration with sperm count and sperm motility in male patients presenting with infertility

METHODOLOGY

Study Design: It was a cross-sectional study.

Settings: Department of Urology and Kidney Transplantation, Faisalabad Medical University and Allied Hospital, Faisalabad-Pakistan.

Duration: Six months i.e. from 21/11/2016 to 21/5/2017.

Sample Size: One hundred infertile males participated in this study. It was calculated with 5% type I error, 10% type II error and taking magnitude of correlation i.e. r=0.29 between semen zinc concentration and sperm motility in infertile males.

Sampling Technique: Non-probability consecutive sampling.

Operational Definitions

1. Infertile Male: A male who was unable to induce conception after having frequent unprotected sexual intercourse for ≥1 year with normal female partner.

2. Zinc Concentration: It was assessed in semen of infertile male in terms of mg/L. Semen analysis with abnormalities was included.

3. Sperm count: It was assessed as total number of sperms present in semen in given sample after masturbation

4. Sperm motility: Total number of immotile sperms are subtracted from the total sperm count to calculate the number of functional Motile Sperms.

Inclusion criteria:

Male patients of 20-40 years of age, presenting with infertility

Exclusion criteria:

1. Males with a history of sexually transmitted diseases (on history), mumps-related orchitis (on history), diabetes mellitus (BSR>186mg/dl), testicular injury (on USG), small testicles (<10mL), varicocele (on clinical assessment)
2. History of use of alcohol, abnormalities of reproductive endocrine (on medical record) and fever including typhoid fever in of 3 months duration in the past on history.

Data Collection Procedure: One hundred male infertile individuals fulfilling selection criteria were enrolled in the study from Department of Urology, Allied Hospital, Faisalabad. This study was approved by the ethical review committee of Faisalabad Medical University, Faisalabad. Informed consent was obtained and demographic details like name, age, BMI, type of infertility were also noted. Detailed history and physical examination and routine lab investigations were completed. Then patients were subjected to semen samples collection by masturbation, sexual abstinence of 3-5 days was observed before this collection. Semen samples were collected at biochemistry department of the hospital. Semen of each patient was allowed to liquefy at 37°C for 30 minutes. Samples were analyzed within 60 mints of collection to describe semen parameters. A portion of the semen sample was centrifuged at 5000rpm for 10 minutes and the supernatant was kept at -20°C to measure the zinc level in the semen. The zinc concentration was determined via Atomic Absorption spectrometry. Then sperm count and sperm motility were also noted (as per operational definition). Information collected from all the patients were recorded through proforma.

Statistical Analysis: Data was analyzed using SPSS version 20. Quantitative variables like age, BMI, zinc concentration, sperm count and sperm motility was calculated as mean and standard deviation (SD). Categorical variables like type of infertility (primary / secondary) was calculated as frequency and percentage. Correlation was also calculated in the patients below the age of 30 years and above the age of 30 years. The relationship between zinc concentration and sperm count & sperm motility was assessed by calculating Pearson's correlation coefficient. P-value≤0.05 was considered as significant. Data was stratified for age, BMI, type of infertility (primary / secondary) and smoking status. Post-stratification, Pearson's correlation coefficient was calculated to measure relationship between zinc concentration and sperm count & sperm motility for each stratum. P-value≤0.05 was considered as significant.

RESULTS

In our study total 100 cases were enrolled. The mean age of the patients was 30.48±5.99 years with minimum and maximum ages of 20 and 40 years respectively.

In our study the mean value of BMI of the patients was 24.39±2.85 kg/m^2 with minimum and maximum value of 20 & 29.77 kg/m^2 respectively.

Fifty-two (52%) patients were smokers and 48(48%) patients were non-smokers.

Primary infertility was noted in 55(55%) patients and secondary infertility was noted in 45(45%) patients.

In this study the mean value of zinc concentration was 121.90±47.78 with minimum and maximum values of 60.50±200.00 respectively.

The study results showed that the mean value of sperm count was 114.27±49.88 million with minimum and maximum values of 31.00 & 200.00 million respectively.

Mean value of sperm motility was 37.74±12.40 with minimum and maximum values of 20.00 & 69.00 respectively.

Weak positive correlation was noted between the zinc concentrations with sperm count (million). i. e r=0.201 Figure 1.

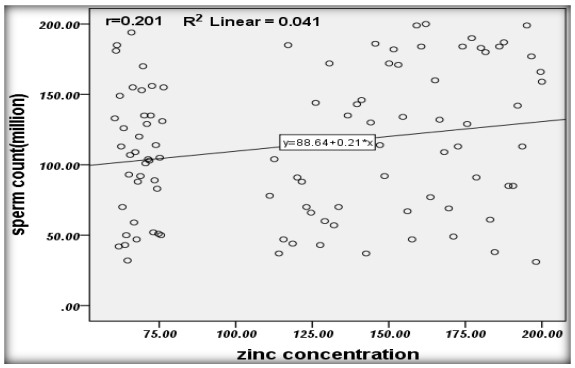

Figure 1: Correlation between the zinc concentration with sperm count (million)

Strong positive correlation was noted between the zinc concentrations with sperm motility. i. e r=0.568 Figure 2

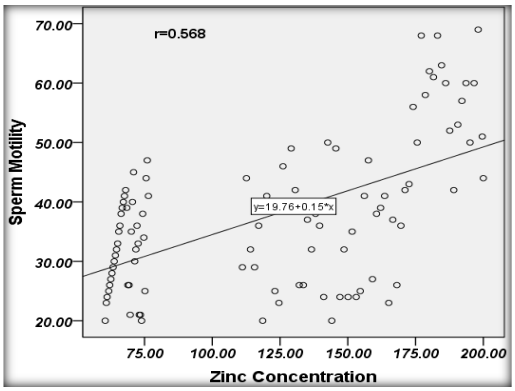

Figure 2: Correlation between the zinc concentrations with sperm motility

Weak positive correlation was noted between the zinc concentrations with sperm count (million) in primary infertility patients. i. e r=0.165. Figure 3

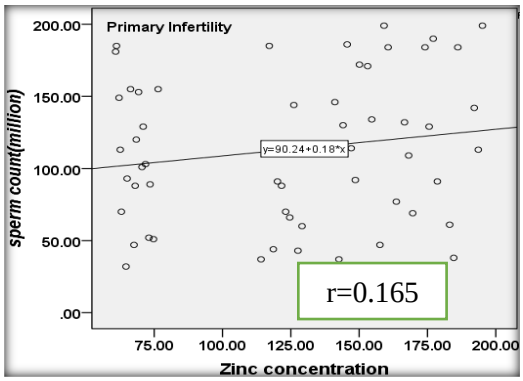

Figure 3: Correlation between the zinc concentrations with sperm count (million) in primary infertility patients

Weak positive correlation was noted between the zinc concentrations with sperm count (million) in secondary infertility patients. i. e r=0.249. Figure 4

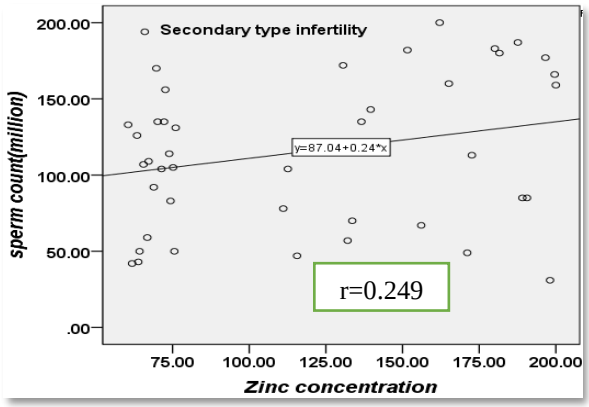

Figure 4: Correlation between the zinc concentrations with sperm count (million) in secondary infertility patients

Strong positive correlation was noted between the zinc concentrations with sperm motility in primary infertile patients. i. e r=0.513. Figure 5

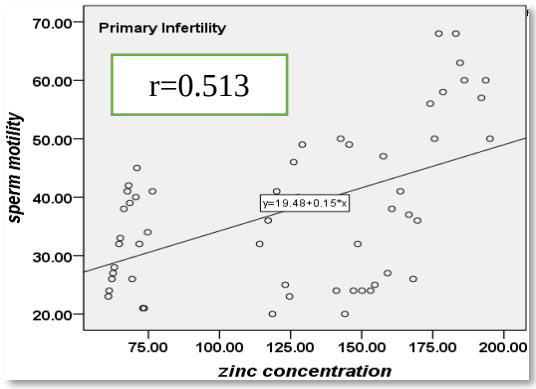

Figure 5: Correlation between the zinc concentrations with sperm motility in primary infertile patients

Strong positive correlation was noted between the zinc concentrations with sperm motility in secondary infertile patients. i. e r=0.648. Figure 6

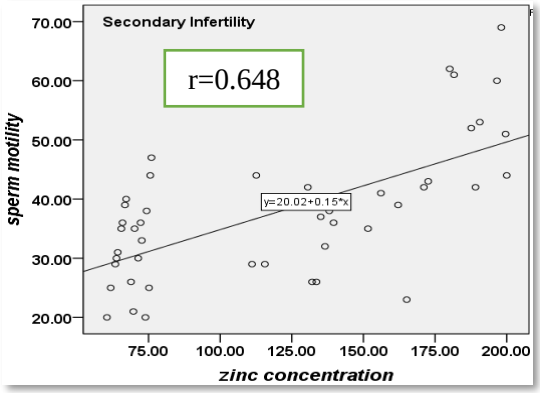

Figure 6: Correlation between the zinc concentrations with sperm motility in secondary infertile patients

DISCUSSION

Fertility results from the conception of the sperms from the male and eggs from the female after intercourse. For the successful fertilization pituitary gonadal axis should be normal anatomically as well as physiologically. Infertility is defined as "the lack of ability to conceive within one year of unprotected intercourse with the same partner".[1] If no pregnancy at all in one year then it is primary infertility and when one couple has one or more kids and they are not able to conceive in spite of the desired attempts in one year then it is secondary infertility. Nearly 8–12% of couples are infertile in general. Male factor is the main cause in approximately 30–40% of cases. Males having normal pituitary gonadal axis result in producing sperms in the testis. Still these sperms are not adequately ready for giving rise to pregnancy. Sperms passes through different stages of maturation and get required environment and nutrition in the ejaculate. By this way

a standard semen ejaculate is formed which is required for the conception with the egg. There are different factors (trace elements) which effects the normal composition of the ejaculated semen which determine about fertility or infertility in spite of the regular intercourse of a normal male with a normal female partner.[2]

Zinc is an essential trace mineral in maintaining normal functioning of the male reproductive system. Inconsistent results have come from the results of various studies regarding relationship between male infertility and seminal plasma zinc. This subject is under investigation since long. It has been reported in a number of studies that the zinc concentrations in seminal plasma from infertile men were significantly lower in infertile men as compared to normal men while different other studies have negated it.

Several studies have put the emphasis of the research on establishing correlation between zinc levels and semen quality parameters in the last decade. Zhao Jiang (2016) concluded in a meta-analysis of 2600 cases that the seminal plasma zinc levels were significantly low in infertile males as compared to fertile males. Zinc supplementation could significantly improve semen parameters.[7]

The study made by Stankovic and Mikac-Devic (1976) also reported increase in motility in similar patients.[8] Saaranen et al. (1987) found increased zinc concentrations with resulting in increased sperm numbers.[9] Kvist et al. (1990) reported lower seminal zinc concentrations in patients with idiopathic infertility.[10]

One study showed that the concertation of zinc concentration in semen is significantly correlated with sperm count and with sperm motility, although very weak relationship had been reported, showing that decreased level of zinc in semen can cause decreased sperm count and motility.

Guzikowski W et al., (2015) found high concentration of zinc, nickle and cobalt in men having infertility.[12]

In Pakistan, Khan et al., (2011) concluded that decreased seminal zinc level affects the sperm count, while increased seminal plasma zinc concentration results in low sperm motility.[13]

Hashemi et al., (2018) concluded after a study on this subject that different levels of zinc have no effect on quality and motility of sperms.[14]

A weak correlation between increased zinc concentrations and decreasing sperm motility was detected by Danscher et al. in 1978.[15] Eliasson and Lindholmes (1971)[16] studies the above parameters and could not prove any correlation in the above variables and parameters. A study by Haidar M. Jawad (2013) evaluated that the seminal plasma level of ASA and detected that the level is decreased significantly ($P < 0.001$, $P < 0.002$) in zinc sulfate treatment group in comparison to the control group (67.5 ± 2.64 vs. 71.6 ± 2.5, 66.94 ± 3.24 vs. 71 ± 2.54), respectively.[17] There is significant decrease in prednisolone treatment group in comparison higher ($P < 0.001$) to the zinc sulfate treatment group (57.3 ± 6.30 vs. 67.5 ± 2.64, 56.5 ± 6.83 vs. 66.94 ± 3.24), respectively. Another study showed negative relationship between zinc concentration and sperm count ($r = -0.078$, $p>0.05$) and sperm motility ($r = -0.122$, $p>0.05$). While in our study the week correlation was found between the zinc concentrations with sperm counts (million) whereas strong positive correlation was found between the zinc concentrations with sperm motility in couples with primary as well as secondary infertility. This may be due to decreased anti-oxidants levels resulting in increased oxidative stress to the sperms. Smokers did not show any significant low zinc levels as compared to non-smokers in this study which are contrary to the results of the study by Weisberg (1985). The crux of these studies is that there are some other factors as well which affect the quality of sperm in the semen making them favorable enough for the pregnancy.

LIMITATIONS

Anti-sperm antibodies and sperm DNA fragmentation should have been study which could not be accomplished due to un-availability of the facility at our institution.

CONCLUSION

According to our study strong positive relationship was noted among zinc concentration with sperm motility while weak positive relationship was noted among zinc concentration with sperm count.

SUGGESTIONS

A more detailed studies comprising of fertile vs infertile male individuals should be conducted. The levels of other trace elements and other factors like anti sperm antibody and sperm DNA fragmentation affecting quantity and quality of sperms should be evaluated.

CONFLICT OF INTEREST

This study was conducted in the Department of Urology & Kidney Transplantation, Faisalabad Medical University, Faisalabad and no sponsorship were involved in this study.

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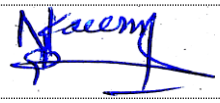
Dr. Naeem Iqbal Khan Medical Officer, Urology DHQ Hospital, Faisalabad	Data Collection, References & Discussion writing, Data Analysis	
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