Original Article

Impact of Seminal Zinc on Sperm Morphology

The Impact of Seminal Zinc on Sperm Morphology in Infertile Pakistani Patients

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ABSTRACT

Objective: The present study was designed to assess the impact of seminal Zinc on sperm morphological abnormalities in infertile patients.

Study Design: Descriptive analytical study

Place and Duration of Study: This study was conducted at the Department of Reproductive physiology/Health, Public Health Laboratories Division, National Institute of Health, Islamabad and compiled in the Department of Biochemistry, Bannu Medical College, Bannu from March 2016 to March 2017.

Materials and Methods: Total 1181 subjects were included in the study, out of which 353, 535, 159, 37 were oligozoospermic, asthenozoospermic, oligoasthenozoospermic, teratozoospermic, along 97 proven fathers as control.

Results: The results of the study showed that seminal zinc was 598.48 ± 12.95, 617.54± 9.55, 542.29± 22.75, 710.36± 7.87, and 762.06± 8.99 in oligozoospermic, asthenozoospermic, oligoasthenozoospermic, teratozoospermic, and proven fathers groups respectively, while, head, neck & tail defects in these groups were 26.42□0.97, 6.64□0.41 & 6.60□0.35, 23.40□0.86, .4.86□0.29, & 8.89□□0.49, 31.69□1.47, 10.82□0.73 & 8.49□0.62, 75.43□2.99, 4.32□0.89 & 10.08□1.39, 11.32□0.87, 1.92□0.23, & 4.24□0.62 respectively, showing significant ($p<0.05$) decline trend in seminal Zinc level whenever, the overall sperm abnormalities gets increased. Out of sperm abnormalities among these groups, the head abnormalities are more prominent as compared to neck & tail defects

Conclusion: It is concluded, that decrease level of seminal Zinc, not only causes hypogonadism, and arrest of spermatogenesis, but also affect the quality and quantity of sperms, and ultimately leads to male infertility.

Key Words: Semen Zinc, sperm morphology, male infertile patients.

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INTRODUCTION

Adult human being contains 1400 – 2300 mg of zinc normally, and plays a vital role in normal testicular development, spermatogenesis and sperm motility[1] and has been reported to be an essential cofactor for more than 200 metallo-enzymes in a variety of animal species[2]. zinc, the most crucial trace element for male sexual function is involved in male reproduction[3,4,] and its deficiency has been documented with male infertility. Deficiency of zinc occurring in certain diseases had also been reported to affect adversely testicular function[5-6].

Complete Semen analysis is a keystone in the clinical workup of the infertile patient. The physiological state that represents a low sperm concentration of less than 20 million/ml is referred as oligozoospermia

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The oligozoospermia can further be classified into mild oligozoospermia (10-20 million/ml), moderate oligozoospermia (5-10 million/ml) and severe oligozoospermia (1-5 million/ml), motility less than 50% is asthenozoospermia, sperms having disturbed morphology of more than 30% of normal is called teratozoospermia, while the semen sample having progressive activity more than 25 percent (overall motility>50%) with sperm concentration within the range of 20 to 250 million/ml were classified as normozoospermia[7].

Sperm morphology is assessed routinely as part of standard laboratory analysis in the diagnosis of human male infertility and it is evident that sperm morphology is significantly different in fertile compared to infertile man. There is an ongoing debate on which criteria should be applied to define normal spermatozoa and which classification of abnormal forms is most appropriate. The definition of a normal spermatozoon as described by World health Organization (WHO) in 1992 is different from that used by other authors[8-9]. The evaluation of the morphology of human spermatozoa varies widely between and sometimes even within laboratories. Standardized analysis is difficult because of the use of different staining techniques, which are not always suitable for optimal examination from head to tail[10].

In certain cases of unexplained infertility where, both male and female partners of the infertile couple present a normal picture; six variables, i.e, age of the women, history of pelvic surgery, duration of menstrual cycles, types of infertility, duration of infertility and sperm morphology are responsible for infertility [11]**.** Among these, only sperm morphology is a male factor variable. So, the present study was designed to assess the impact of seminal zinc on sperm morphology in infertile patients, as by searching literature survey, on the role of seminal zinc with sperm morphology in infertile patients, very few studies have been searched on the mentioned topic.

MATERIALS AND METHODS

The present Descriptive analytical study was carried out in the Department of Reproductive physiology/Health, Public Health Laboratories Division, National Institute of Health, Islamabad, and compiled in the Department of Biochemistry, Bannu Medical College, Bannu from March 2016 to March 2017.

Sample size: Total 1181 subjects were included in the study, out of which 353, 535, 159, 37 were oligozoospermic, asthenozoospermic, oligoastheno-zoospermic, teratozoospermic, along 97 proven fathers as control.

Inclusion & Exclusion criteria: Patients with primary and secondary infertile males without treatment and having no relatable cause of male infertility were included in the study. While, the subjects, who had undergone pelvic surgery or hernia, repair, patients with diabetes mellitus, thyroid disease and subjects who were on medicine were not included in this study.

Semen examination: Semen examination of the patients was carried out according to the standardized method of the world's Health Organization [12].

Determination of Seminal Zinc: Seminal Zinc was estimated by colour 5 Br.PAPS method using order No. ZF 01000050 obtained from centronic GmbH-Germany[13].

Statistical analysis: Statistical analyses were performed by using SPSS (Version 16.0 for windows) software, and the results are presented in the form of table and graphs.

RESULTS

The results of the study are tabulated at table 1 and figure 1.

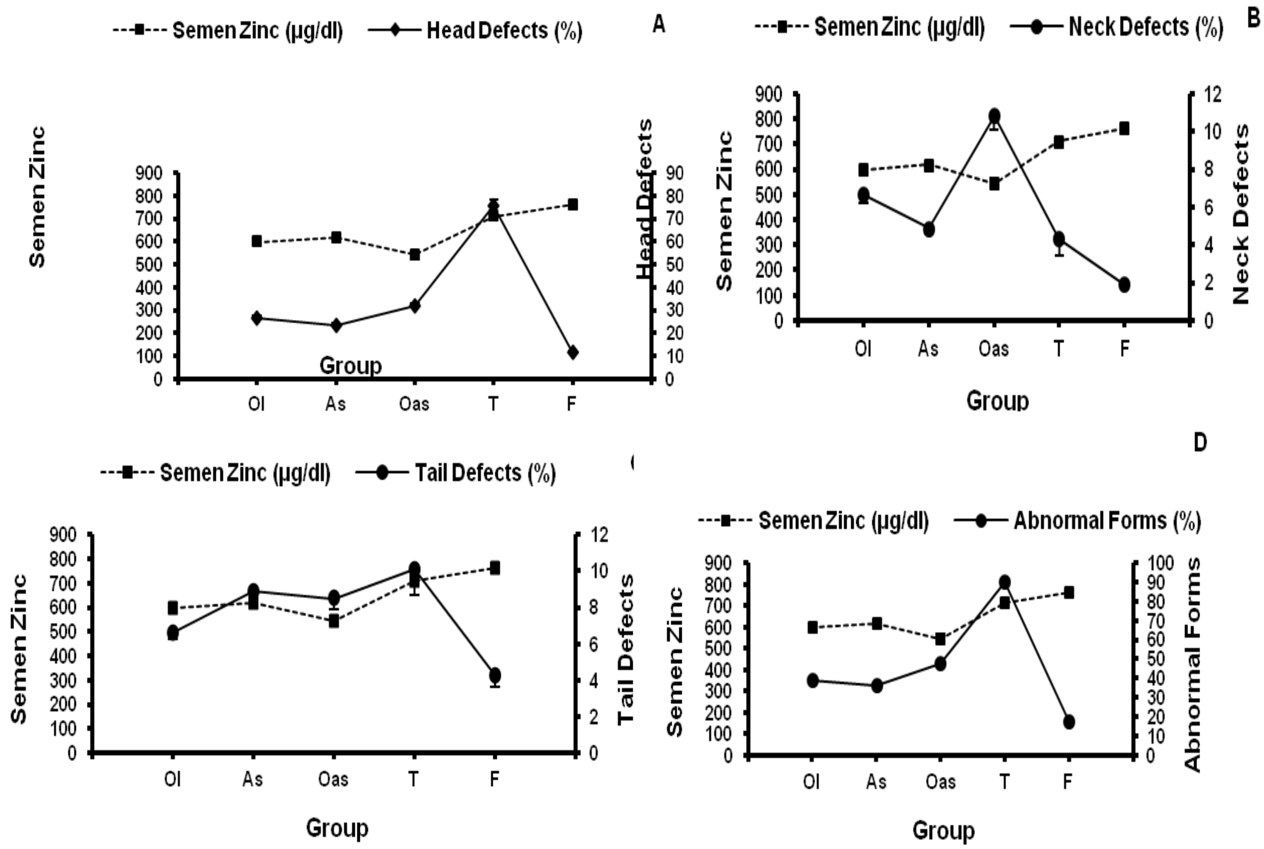

Figure No.1: Serum Zinc details

Table No.1: Semen morphology in relation to Semen Zinc levels. Means sharing a common letter do not differ significantly, others differ significantly (p < 0.05).

Group	N	Semen Zinc (µg/dl)	Head Defects (%)	Neck Defects (%)	Tail Defects (%)	Abnormal Forms(%)
Ol	353	598.48 □ 12.95 b	26.42 □ 0.97 b	6.64 □ 0.41 B	6.60□ 0.35 b	38.54 □ 1.22 B
As	535	617.54 □ 9.55 bc	23.40 □ 0.86 c	4.86 □ 0.29 C	8.89□ 0.49 c	36.46 □ 1.00 Bc
Oas	159	542.29 □ 22.75 d	31.69 □ 1.47 d	10.82 □ 0.73 D	8.49□ 0.62 cd	47.79 □ 1.76 D
T	37	710.36 □ 7.87 ae	75.43 □ 2.99 e	4.32 □ 0.89 ce	10.08□ 1.39 cde	89.84 □ 1.29 E
F	97	762.06 □ 8.99 g	11.32 □ 0.87 f	1.92 □ 0.23 H	4.24□ 0.62 fg	17.46 □ 0.00 H

The results of the study showed that seminal zinc was 598.48 ± 12.95, 617.54± 9.55, 542.29± 22.75, 710.36± 7.87, and 762.06± 8.99 in oligozoospermic, asthenozoospermic, oligoasthenozoospermic, teratozoospermic, and proven fathers group respectively, while, head, neck & tail defects in these groups were 26.42□0.97, 6.64□0.41 & 6.60□0.35, 23.40□0.86, 4.86□0.29, & 8.89□□0.49, 31.69□1.47, 10.82□0.73 & 8.49□0.62, 75.43□2.99, 4.32□0.89 & 10.08□1.39, 11.32□0.87, 1.92□0.23, & 4.24□0.62 respectively, showing significant($p<0.05$)decline trend in seminal Zinc level whenever, the overall sperm abnormalities gets increased.

Out of sperm abnormalities among these groups, the head abnormalities are more prominent as compared to neck & tail defects. Moreover, highest values were recorded in cases of proven fathers, where normal sperm morphology of more than 80% were noted, and low levels of semen zinc were noted in all other groups having disturbed morphology.

DISCUSSION

The association between semen morphology and male infertility has been known for more than half decade. Having reviewed the literature, it seems clear that strict morphology has a clinical relevance, being an excellent biomarker of sperm fertilizing capacity, in vivo and in vitro, independent of motility and concentration[14]. Sperm morphology evaluation is considered to be a highly subjective procedure because, unlike the blood cells, it is difficult to classify sperm morphology because of the existence of large variety of abnormal forms found in the semen of infertile and fertile men, in which, only certain types of sperm abnormality are of clinical interest[10]. Sperm aberrations mainly occur during either production of sperm or during the storage of sperms in the epididymus. In epididymal dysfunction and in frequent ejaculations, the increased number of immature spermatozoa has been reported. Similarly, large number of spermatozoa with tapered head, cytoplasmic droplets and bent tail are found in cases of varicocele[15], whereas in the present study, 37 (3.13%) patients with teratozoospermia was found, having predominantly head defect abnormalities.

Testicular hypofunction due to zinc deficiency was characterized by decreased function of the leydig cells causing decreased serum androgens, increase serum gonadotrophin which resulted oligozoospermia, in animals and human subjects,[5,16]. Furthermore, zinc supplementation has been used to increase plasma testosterone level and sperm count in infertile males[16-17]. Our results showed that more sperm morphological abnormalities were recorded in patients where low level of seminal zinc were found, which can be seen in oligoasthenozoospermic, asthenozoospermic and oligozoospermic groups, with, some exception in teratozoospermic group.

Gonadotropins output and consequent fall of androgen production, with altered sperm morphology have been documented in dietary zinc deficient male rats. Clinical studies with adult males experimentally deprived of zinc showed decrease leydig cell synthesis[17,18]. It is well documented that zinc has a marked inhibitory effect upon the respiratory chain of isolated mitochondria [(19)] and inhibit electron transport, and perhaps affect sperm morphology.

In this study, low levels of semen zinc with altered sperm morphology was obtained in cases of teratozoospermia, asthenozoospermia and oligoasthenozoospermia, which are similar findings to other earlier study, in which when 107 infertile men & 103 fertile men were compared, it was found that except semen volume, all the other semen parameters of infertile men were significantly lower than those of fertile group and the geometric means of the seminal plasma zinc concentrations were significantly lower in the infertile group compared with those in the fertile group[20]. Similarly, a significant ($p<0.01$) inverse correlation was observed between zinc and sperm count[21] and morphology[22,] which is an agreement to our study.

Comparing values of semen zinc in various groups, the results of the study showed that highest values were recorded in cases of proven fathers, where normal sperm morphology (>80%) were noted with respect to other groups, whereas, low levels of semen zinc were noted having disturbed morphology and semen zinc levels of all groups varied significantly ($p<0.05$) with proven fathers. When semen zinc relation with respect to sperm abnormalities of head, neck and tail defects in various infertile groups were compared, it was seen, that semen zinc showing significant($p<0.05$) decline trend whenever, the overall sperm abnormalities gets increased. The decrease was correlated more with the head abnormalities in these groups. Comparing the low values of semen zinc with respect to head abnormalities within the various groups, it was noted that it decreased more in teratozoospermia followed by oligozoospermia and then asthenozoospermia respectively, while, in cases of neck abnormalities; it was decreased more in oligozoospermic and oligoasthenozoospermic patients. Similarly, more prominent tail abnormalities were noted in terato, oligoastheno & asthenozoospermic groups respectively.

CONCLUSION

In conclusion, it has been observed in our study that decreased concentration of seminal zinc do affect the sperm morphology also, besides its established role in reproduction, particularly sperm count and sperm motility, which is evident from these results that there is decline trend in seminal zinc, whenever, the overall sperm morphology gets disturbed. So, it is concluded that the measurement of seminal zinc level, may be considered as useful marker in male infertile patients having disturbed morphology, in addition to other parameters in assessing male infertility.

Author's Contribution:

Concept & Design of Study:	Mohammad Shoaib Khan
Drafting:	Rafat Ullah
Data Analysis:	Muhammad Ashraf
Revisiting Critically:	Mohammad Shoaib Khan, Rafat Ullah
Final Approval of version:	Mohammad Shoaib Khan

Conflict of Interest: The study has no conflict of interest to declare by any author.

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