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Association of Serum and Seminal Plasma Zinc Levels and Serum Testosterone Concentration in Oligospermic and AzospermicInfertile Men

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Abstract

Human semen contains high concentrations of Zinc (Zn) inbound and ionic forms. The presence of abnormal levels of Zinc and testosterone may affect spermatogenesis production, maturation, motility, and fertilizing capacity of the spermatozoa.

This study aimed to evaluate the levels of Zn in seminal plasma and serum and also to assess the serum testosterone concentration in different groups of males with infertility and to correlate their concentrations with sperm counts.

Association of Serum and Seminal Plasma Zinc Levels and Serum Testosterone Concentration in Oligospermic and Azospermic Infertile Menstudy conducted in Khartoum state. The study carried out from March to August 2017. Hundred fertile and infertile males, 35 from them, were oligospermic,35 were azoospermic, and 30 males were normospermic. The serum testosterone was estimated using Tosoh 360, while the atomic absorption spectrophotometer determined the Zinc concentration in separated seminal plasma of each infertile male and fertile control subject. The data were analyzed using SPSS version 25.

The age ranged from (18 to 40 years) with their average age was 29.11 ± 5.49 years. The serum testosterone was significantly lower ($p<0.001$) in azoospermic male compared with normospermic male and also serum and plasma seminal Zinc were highly significantly lower in azoospermic and oligospermic males compared with normospermic male ($p=0.000$). Positive correlation between seminal plasma and serum levels of Zinc and sperm count respectively, ($r= 0.935$, $P=0.000$), ($r= +0.824$, $P=0.000$), and also there was negative correlation between serum testosterone and sperm count ($r= -0.133$,($P\leq 0.447$).

In this study, the serum and seminal plasma zinc level was significantly decreased in azoospermia and oligospermia and were correlated with sperm counts and also serum testosterone was significantly decreased in azoospermia and was negatively correlated with

sperm counts. It indicates that Zinc has a possible role in spermatogenesis and zinc plasma seminal considered one of the factors of testicular function in male subjects.

Keywords: serum zinc,seminal plasma zinc, infertility, azoospermia, testosterone.

Introduction

The testicular plasma, that is the fluid composed of the secretions originating in the Seminiferous tubules, tubule recite, rite testis, and ductile efferent's, and the epididymal plasma serve as a nutrient medium in which maturation of the developing spermatozoa takes place .micro minerals are essential for testicular development spermatogenesis (7) Zinc in seminal plasma stabilizes the cell membrane and nuclear chromatin spermatozoa (8, 9). Zinc may also be the primary factor responsible for the antibacterial activity of the seminal plasma (10) and protect the male gone against the degenerative changes (11). It may also play a regulatory role in the process of capacitation and acrosome reaction (11). The low content of this metal (Zn) has been suggested to reduce fertility potential in males (4, 12).Marmar *et al* (1975) registered that the Zinc deficiency leads to gonadal dysfunction, decreases testicular weight, and causes shrinkage of seminiferous tubules called infertility.Infertility is reproductive defect depend on the gender, sexual history, a lifestyle of society, and the cultural background of people it affects (1).Barbara (2003) found that theinfertility represent approximately 8% to 12% of the world's population and in about half of cases, males are either the single cause or contribute the couple's infertility. Further,more than 90% of male infertility cases are due to low sperm counts, poor sperm quality, or both. In 30-40% of cases of sperm abnormalities, the cause is unknown. It may be the results related to one or more factors such as; chronic illness, malnutrition, genetic defects and structural abnormalities (4).The aims of this study were to evaluate the levels of Zn in seminal plasma and serum,to assess the serum testosterone concentration in different groups of male having infertility and addition to correlate their concentrations with sperm counts.

Materials and Methods

An analytical case-control hospital-based study conducted at Alshahied Ali Abdulfattah Hospital, Khartoum North, department of gynecology and obstetrics. The study carried out from March to August 2017. One hundred males were used in this study and divided into groups; group suffering from infertility (35 oligospermia and 35 azoospermia) and onegroup as control consist of 30 normospermic males were.

Inclusion and Exclusion criteria

One hundred fertile and infertile males, without any treatment, who had regular unprotected intercourse for at least one year without conception with their partners, were included inthis study. Smokers, Diabetic males, and males with thyroid disorders; were excluded from this study.

Sampling and Data collection

Semen samples were obtained by masturbation into (50) ml sterile containers, after an abstinence period of (3-7) days. Semen samples were analyzed according to WHO criteria. 5 ml of blood samples were taken from each subject in plain containers. All blood samples were allowed to clotand then centrifuged at (2500) rpm for 5 minutes for serum collection. One and a half ml of serum werekept frozen in eppendorf tubes at (-20) c until later used for zinc and

testosterone assays.The seminal plasma was collected after centrifugationof all semen samples at (3000) rpm for 10 minutes. The supernatant was transferred in labeled IMEC tubes and store at (-20) c until later used for Zinc assay. Questioner use to obtain information about ages, in addition to other diseases or behavior that affect fertility. Zinc concentrations were estimated using atomic absorption spectrophotometer and testosterone analysis by using Tosoh 360.

Ethical considerations

Personnel identification data kept secure, Patients were be excused and informed consent was signed by them after informing them by the aim and the benefit of the study.

Data analysis

The obtained laboratory tests results were being processed by statistical package of social science (SPSS) program version (25), Data was presented in the form of tables and figures, using one way ANOVA test.

Results

The study demonstrated that the mean value of serum testosterone was significantly lower in azoospermia patients (15.57±2.14) as compared to normospermic control group (18.99±4.49). On the other hand, there was no significant difference between oligospermia patients and normospermic group with serum testosterone. Moreover, the mean value of serum Zinc was showed significantly lower in azoospermia and oligospermia patients when compared with the control group (6.95±3.69), (7.43±2.89) and (14.52±2.76), respectively. Further, the mean value of Zinc in seminal plasma was obtained significantly higher in the control group as compared with oligospermia and azoospermia patients (1.45±0.38), (0.16±0.39) and (0.751±0.40), respectively. Pearson's correlation between seminal plasma levels of Zinc and sperm count; there was Positive correlation between them (r= 0.935); (P=0.000) was shown in figure 2. Pearson's correlation between serum levels of Zinc and sperm count; there was a positive correlation between them (r= +0.824); (P=0.000) was shown in figure 3. Pearson's correlation between serum testosterone and sperm count, there was a negative correlation between them (r= -0.133); (P≤ 0.447) was shown in figure 4. Pearson's correlation between seminal plasma Zinc and serum testosterone, there was no correlation between them (r= 0.063); (P≤ 0.7180) was shown in figure 5. Pearson's correlation between serum levels of Zinc and serum testosterone, there was no correlation between them (r= 0.22); (P≤ 0.205) was shown in figure 6. Pearson's correlation between serum levels of Zinc and serum testosterone, there was no correlation between them (r= 0.212); (P≤ 0.211) was shown in figure 7. Pearson's correlation between serum levels of Zinc and serum testosterone, there was no correlation between them (r= 0.234); (P≤ 0.176) was shown in figure 8.

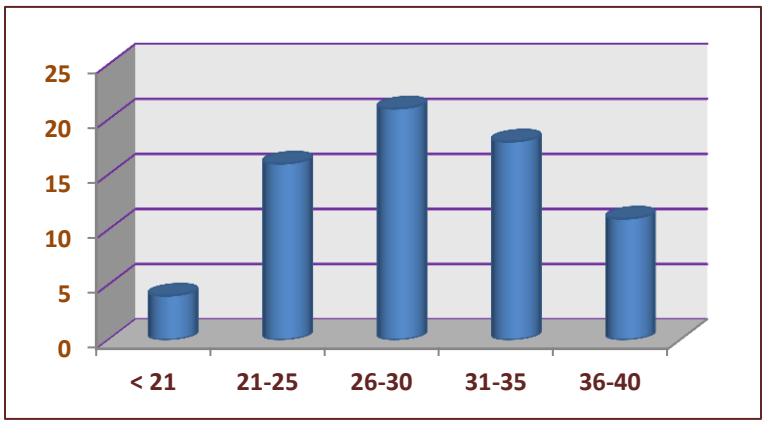

Figure (1): Age distribution of study population

Table (1): Mean differences of Zinc and testosterone among three groups

parameters	Study Population (n=100)			*P*. Value		
	Oligospermia (n=35) M+SD	Azoospermia (n=35) M+SD	Control (n=30) M+SD	Oligo and Control	Azooand Control	Azooand Oligo
Seminal Plasma Zinc	0.16±0.39	0.751±0.40	1.45±0.38	0.000	0.000	0.802
Serum Zinc	7.43±2.89	6.95±3.69	14.52±2.76	0.000	0.000	0.799
Serum Testosterone	17.40±3.66	15.57±2.14	18.99±4.49	0.168	0.001	0.081

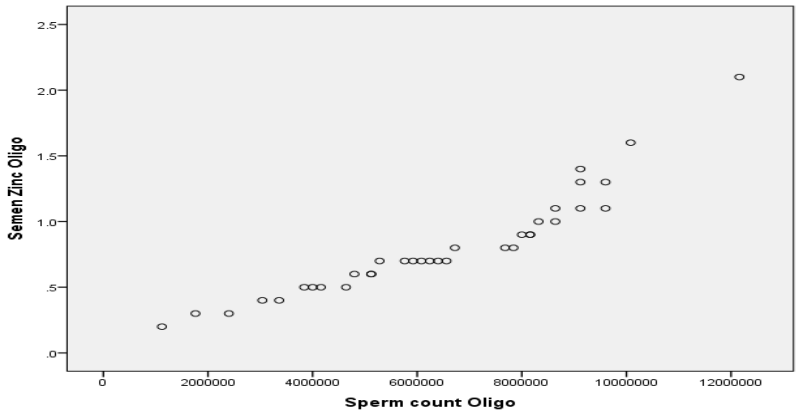

Figure (2): Correlation between levels of seminal plasma Zinc and sperm count

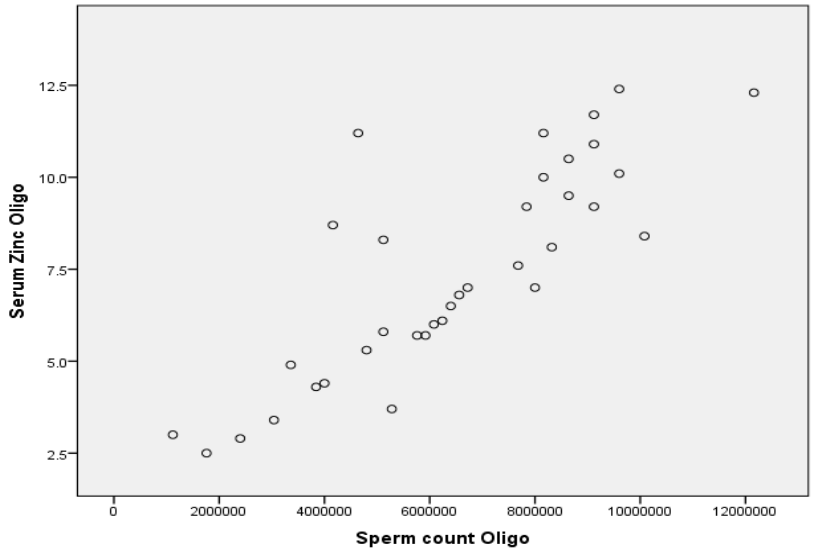

Figure (3): Correlation between levels of serum Zinc and sperm count

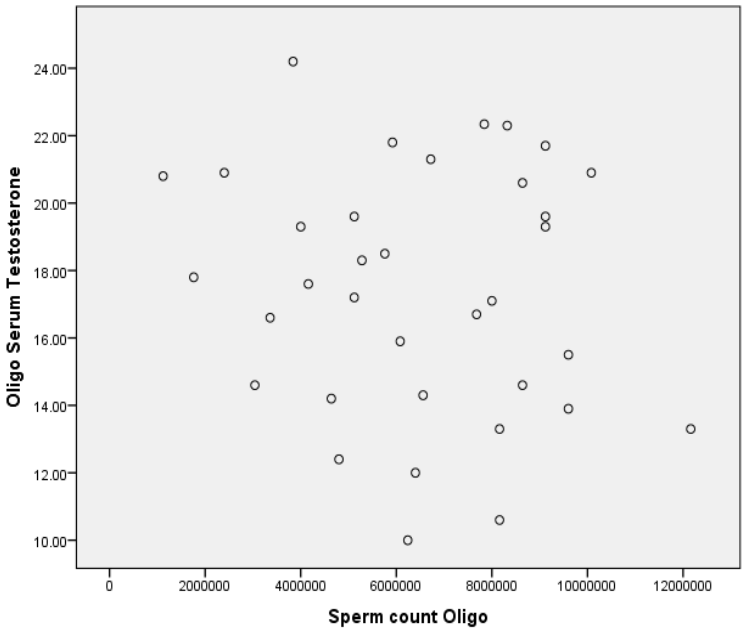

Fig (4): Correlation between levels of serum testosterone and sperm count

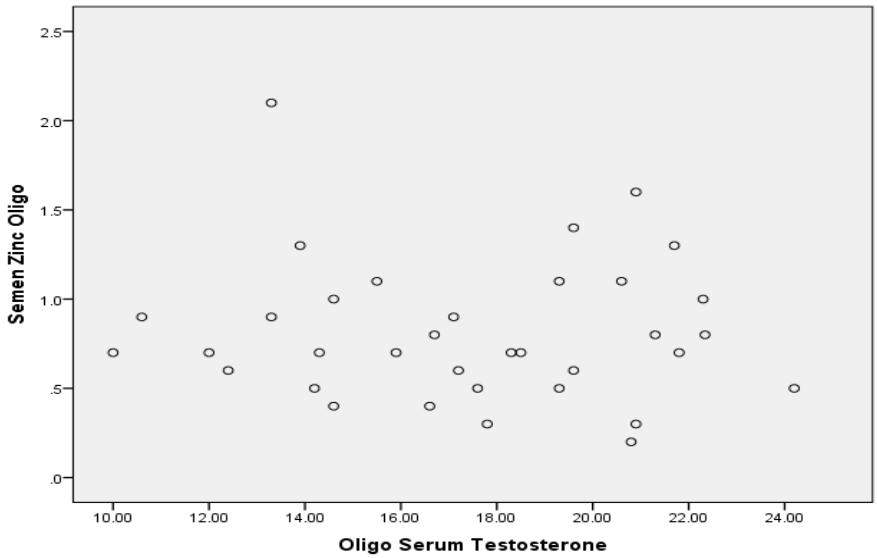

Fig (5): Correlation between levels of seminal plasma Zinc and serum testosterone in oligospermic group

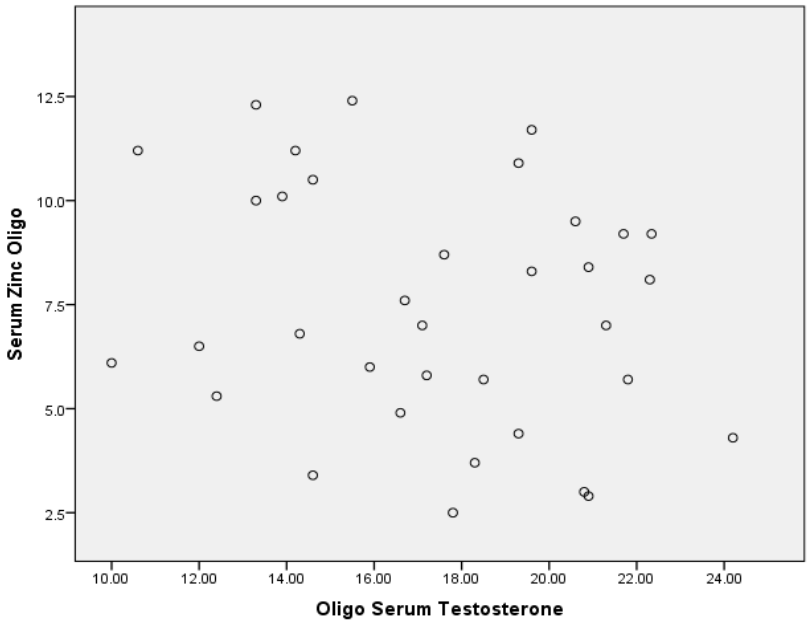

Fig (6): Correlation between levels of serum zinc and serum testosterone in oligospermic group

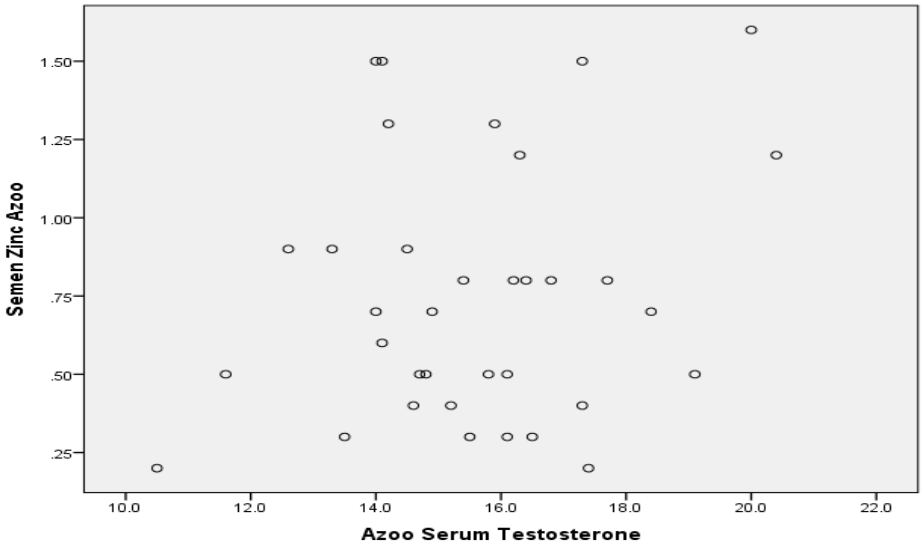

Fig (7): Correlation between levels of seminal plasma Zinc and serum testosterone in the azoospermic group

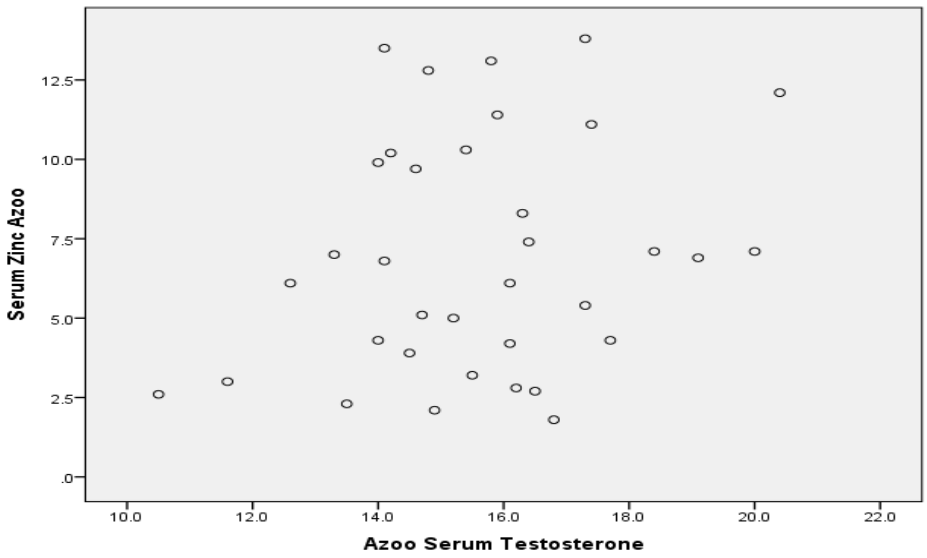

Fig (8): Correlation between levels of serum Zinc and serum testosterone in the azoospermic group

Discussions

The result of the present study showed that the serum testosterone was significantlylower inazoospermic male compared with normospermic male, and also serum and plasma seminal Zinc was highly significantly lower in azoospermic and oligospermic males compared with normospermic male. The positive correlation between seminal plasma and serum levels of Zinc and sperm count, respectively, and also,there was a negative correlation between serum testosterone and sperm count. Our study disagrees with Basseyetal.(14), who reported that plasma seminal zinc was notsignificantlydifferentin the infertility group compared with the control group. Our finding agrees with Alietal.(15), who reported that the mean value for testosterone was significantly low in azoospermic subjects and serum and seminal plasma zinc level was low in oligospermic and azoospermic subjects when compared with normothermic control groups. Although another study agrees with our finding reported that the mean values of seminal plasma Zn concentrations were significantly decreased in the two groups of infertile male subjects, azoospermic, and oligozoospermic compared with fertile males (16). This finding is in agreement with what reportedby Hasan *et al*. (17) and Cougar*et al.*(18), who observed significant decreases in seminal plasma Zn in oligozoospermic and azoospermic infertile males. Hasan *et al*. (17) reported that Zn concentration in seminal plasma should be considered as one of the factors responsible for decreased testicular function in infertile male subjects.In contrast, Fuse *et al*. (19) found no significant difference in the mean value of seminal plasma Zn between infertile individuals compared to fertile individuals. The result of seminal plasma Zn of the current study disagrees with the previous study reported by Akinloye*et al.*(20), who observed an inverse correlation between seminal Zn and sperm count. A

clinical study demonstrated that adult males experimentally deprived of Zinc showed a disturbance of testosterone synthesis in theLeydig cell. The authors concluded that adequate seminal concentration of the Zn is required for normal sperm function (20). Although our finding agreement with another study by Basil*et al.*(21) reported a significant decrease of seminal plasma Zn in oligosspermia ,the azoospermic infertile males than infertile males controls and significant correlation between seminal Zinc and sperm counts.Ali *et al*, (22), observed a significant decrease in seminal plasma Zn inoligozoospermic and azoospermic infertile males. Those authors concluded that Zn concentration in seminal plasma should be considered as one of thefactors responsible for decreased testicular function in infertile male subjects. However, the authors concluded thatadequate seminal concentration of the Zn is requiredfor normal sperm function. It has been demonstrated that Zn in human semen is derived from the prostate (23).Our study also demonstrated that seminal plasma Znconcentration was significantly correlated with sperm counts. This observation is agree with previous study results reported by other authors (23,24)and differs from the results of other studies (25). The human prostatic fluid causes the immotile sperm in the vesicular fluid to become motile and this change may be induced by Zn in prostatic fluid (26). Zinc has been detected inhuman sperm and this suggested its role in motility (27).Although, our finding is in agreementwith other study done by Karmaran*et al*., (28) who reported that, mean value of serum testosterone was significantly lower in infertile malesas compared to control group, and also Serum and seminal plasma zinc levels were lower in infertilemen when compared with normospermiccontrol group.Male fertility is influencedby Zinc in several different ways.Low zinc levels have a negative effect onserum testosterone concentration(29). Seminal plasma zinc concentration has beensignificantly correlated with sperm density,possibly contributing to a positive effect onspermatogenesis(30).Other studies have shown the effects ofzinc on sperm counts (31), emphasizing the mineral's role in flagella function. Infertile males have been shown to havelower levels of seminal plasma zinc thathave been associated with reduced levelsof Zinc in their blood(32).Similar results have been reported by Chia*etal*(30),Mohan *et al* (32).Koca*etal*(33).There was a significant difference betweenthemeanseminalplasmazinc concentrationsof the fertile and infertile groups.Carreras and Mendoza (28) have reported that Zinc in blood was significantlycorrelated with sperm count and sperm motility. Our study demonstrated that seminal plasma zinc concentrations were significantly correlated with sperm density and motility. These observations were supported by other studies that found zinc concentrations to increase with increasing sperm density. Fuse *et al*(35). Abasalt*et al*(34), reported a positive correlation between zinc levels and sperm motility. Zinc has been shown to have antioxidant activity and to maintain sperm viability by inhibiting DNA ase(36). Zinc appears tobe a potent scavenger of excessive superoxide anions produced by defective spermatozoa and/or leukocytes in human semen after ejaculation. Thus, it seems that seminal plasma, because of its high content of Zinc, exerts protective, antioxidant like activity sufficient to cope with the excessive amount of superoxide anions(37).Therefore seminal

plasma zinc level may affect the sperm testosterone. Our results are consistent with the results of other studies(38, 33).

Conclusions

In this study the serum and seminal plasma zinc level was significantly decreased in azoospermia and oligospermia and were correlated with sperm counts, and also serum testosterone was decreased considerably in azoospermia and was negatively correlated with sperm counts. Its indicates that Zinc has a possible role in spermatogenesis and zinc plasma seminal considered one of the factors of testicular function in male subjects.

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