

## The Relationship Between Serum Zinc Concentration , Serum Testosterone Concentration and Semen Parameters In Infertile Men

Sajeda S . Al – Chalabi<sup>1</sup> , Yasir T.AL-Wattar<sup>2</sup>

<sup>1</sup> Dept. of physiology , College of medicine , University of Mosul , Mosul , Iraq .

<sup>2</sup> Al-Jumhory Teaching Hospital , Mosul , Iraq .

( Received 19 / 1 / 2009 , Accepted 23 / 5 / 2010 )

### Abstract

**Objective :** to find out the relationship of zinc concentrations in blood and serum testosterone concentrations with various semen parameters between fertile and infertile men .

**Design :** prospective study

**Setting :** this study was carried out in infertility clinic of Al – Batool teaching Hospital in Mosul .

**Subjects and Methods :** one hundred infertile male subjects without any treatment aged 25 – 50 years , were selected from infertility clinic at Al – Batool Teaching Hospital. After semen analysis they were grouped as oligospermic. Fifty known fertile male selected from general population and after semen analysis they were taken as normospermic control group . Blood samples were taken from each subject in the morning for serum zinc and testosterone estimation. Serum zinc was estimated using atomic absorption , serum testosterone was was estimated using minividus technique .

**Result :** Anon – significant negative correlation between serum zinc and semen volume in infertile subjects was found , while a significant positive correlation was found between serum zinc and sperm count ,motility, morphology and serum testosterone. Also we found that serum zinc level and serum testosterone level were significantly lower in infertile men as compared to control men.

**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 and testosterone concentrations . It seems that the estimation of serum zinc may help in investigation and treatment of infertile male .

**Key words:** serum zinc , oligospermic , infertility ,testosterone .

### Introduction

Zinc is a micronutrient abundantly present in meat and sea food . It is the second most abundant trace element in the body totaling nearly 2 g , essential for normal functioning of the male reproductive system ,numerous biochemical mechanisms are zinc dependant, including more than 200 enzymes in the body<sup>(1)</sup>. Zinc is a natural aromatase enzyme inhibitor. Aromatase enzymes cause the body to block the pituitary gland from releasing lutein and follicle stimulation of hormones which stimulate the production of testosterone , aromatase enzyme converts testosterone into estrogen and result in lower amounts of available testosterone<sup>(1)</sup>. Zinc is not only vital in the production of testosterone, it also works to maintain healthy semen volume and has been implicated in testicular development and sperm maturation<sup>(1)</sup>.

Zinc in seminal plasma stabilizes the cell membrane and nuclear chromatin of spermatozoa<sup>(2)</sup> and protects the testis against the degenerative changes<sup>(3)</sup>. It may play a regulatory role in the process of capacitation and acrosome reaction<sup>(4)</sup>. It contributes to the stable attachment of sperm head to tail and its removal induces head \_ tail detachment<sup>(5)</sup>.

Zinc have antioxidant property that counteract reactive oxygen species (ROS), it affects apoptosis and has antiapoptotic properties<sup>(6,7)</sup> therefore it may have substantial effect on reproduction. It serves as a cofactor for more than 80 metalloenzymes involved in DNA transcription and protein synthesis, because DNA transcription is a major part of germ cell development<sup>(8)</sup>. Furthermore, zinc finger proteins are implicated in the genetic expression of steroid hormone receptors<sup>(9)</sup>.

Kvist et al 1990 found that zinc concentration in seminal plasma were lower in men with idiopathic subfertility compared with fertile controls<sup>(10)</sup>.

Zinc deficiency is associated with decreased testosterone level and sperm count<sup>(11)</sup>.

**Aim of the study:** Since zinc concentration in blood affects spermatogenesis, we conducted this study to find the relationship between serum zinc concentration ,serum testosterone concentration and semen analysis in infertile men.

### Subjects and methods :

This study was carried out in the infertility clinic at Al-Batool Teaching Hospital for the period from April 2009 – July 2009. One hundred infertile male subjects, without any treatment who had regular intercourse for at least 12 months without conception with their partners, aged 25 – 50 years, were selected from infertility clinic. A detailed background history and physical examination were done .

The subjects were considered oligospermic according to the sperm count less than 20 million / ml.

Fifty males. who had sperm counts more than 20 million/ml and whose partners conceived within a year, with motility more than 50% were selected from general population and taken as normospermic control group.

Subjects who had undergo surgery of hernia repair, medical disease as D .M, U.T.I. thyroid disease, patients who were on antipsychotic or anti hypertensive drugs or taking alcohol, vitamin and mineral supplementation were excluded from the study.

Semen samples were obtained by masturbation after an abstinence period of 3 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.

10 ml of blood samples were taken from each subject in the morning. After centrifugation, serum was kept frozen at -20 c until analyzed for testosterone and zinc, serum zinc was estimated using atomic absorption, serum testosterone was estimated using Minividus technique.

### Result :

Results are expressed as mean  $\pm$  S.D for each parameter . Statistically significant differences among oligospermic & normospermic control groups are indicated along with their significant values.

The zinc concentration in blood & serum testosterone concentration in blood in the two groups are shown in table-1. Serum zinc & serum testosterone concentrations were significantly lower in oligospermic infertile patients than normospermic , fertile males ( $p < 0.05$ ) .

**Table (1) : serum zinc concentration and serum testosterone concentration in infertile and control groups . The values are expressed as mean  $\pm$  S.D .**

parameters	Infertile (n=100)	Control (n=50)	p- value
Serum zinc concentration( $\mu$ g/dl)	69.57 $\pm$ 1.48	81.73 $\pm$ 2.29	< 0.05
Serum testosterone concentration (ng/ml)	2.59 $\pm$ 0.64	4.79 $\pm$ 1.46	<0.05

Correlation coefficient of serum zinc with various semen parameters in control, oligospermic males are depicted in table -2. This study observed a non significant negative correlation of serum zinc concentration with semen

volume in oligospermic men & a significant positive correlation of serum zinc concentration with sperm count, motility & morphology in oligospermic men.

**Table (2) : correlation coefficient (r) of serum zinc concentration with semen parameters and serum testosterone**

parameters	Infertile(n=100)	Control(n=50)
Volume(ml)	- 0.114	0.490
Count(million/ml)	0.469	0.673
Motility%	0.444	0.495
Morphology%	0.454	0.418
Testosterone(ng/ml)	0.298	0.778

Data analyzed by using pearson correlation , negative correlation with semen volume while positive correlation with sperm count , motility morphology & serum testosterone was noticed , ( $p < 0.05$ ) .

### Discussion

The most important male hormone produced by the testis is testosterone (a steroid that stimulates the development of sex characteristics ) . The essential mineral zinc , is important in prostate gland function and growth of the reproductive organs . Moderate to severe zinc deficiency produces regression of the testes , mild deficiency leads to low sperm count <sup>(12)</sup> .

Male infertility is influenced by zinc in several different ways , low zinc levels have a negative effect on serum testosterone concentration and semen volume <sup>(13)</sup> .

Our finding of low serum testosterone in zinc deficient subjects was in agreement with other searchers <sup>(14)</sup> who found that zinc deficient animals develop impairment of testicular growth , low serum testosterone and elevated FSH & LH. A clinical study demonstrated that adult males experimentally deprived of zinc showed that the Leydig cell synthesis of testosterone was disturbed <sup>(15)</sup> . The role of zinc in testicular testosterone production is

### References

1. Steven Sinclair. Male infertility: nutritional and environmental considerations. *Alternative Medicine Review* 2000; 5 (1) : 28-38 .
2. Hasan A, Masood A, Mukhtiar B, Moazzam A, Relationship of zinc considerations in blood and seminal plasma with various semen parameters in infertile subjects . *Pak J Med Sci* 2007; 23 (1) : 111-114 .
3. Batra N, Nehru B, Bansal MP. Reproductive potential of male portan rats exposed to various levels of lead with regard to zinc status . *Br J Nutr* 2004; 91 : 387 -91.
4. Riffo M, Leiva S, Astudillo J , Effect of zinc on human sperm motility and acrosome reaction. *Int J Androl* 1992; 15 : 229-37 .
5. Bjorndahl L, Kjellberg S, Kivist V, Ejaculatory sequence in men with low sperm chromatin zinc. *Int J Androl* 1991 ; 14 : 174-8 .
6. Chimienti F, Aouffen M, Favier A and Seve M . Zinc homeostasis – regulating proteins : new drug targets for triggering cell fate. *Curr Drug Targets* 2003; 4: 323–338 .
7. Zago MP, and Oteiza PI. The antioxidant properties of zinc : interactions with iron and antioxidants. *Free Radic Biol Med* 2001 ; 31 : 266 – 274 .
8. Ebisch I. M.W, Thomas C.M.G, Peters W.H.M , Braat D.D.M, and Steegers–Theunissen R.P.M. The importance of folate , zinc and antioxidants in the pathogenesis and prevention of subfertility. *Human Reproduction Update* 2007 ; 13 (2) : 163 -174 .
9. Masayuki Kaji .Zinc in endocrinology, *International pediatrics* 2001; 16 (3) : 3 -7.
10. Kvist U, Kjellberg S, Bjorndahl L, Soufir J and Arver S. Seminal fluid from men with agenesis of the wolffian ducts : zinc – binding properties and effects on

sperm chromatin stability. Int J Androl 1990; 13: 245 - 252 .

11. Madding CI, Jacob M, Ramsay VP, Sokol RZ. Serum and zinc levels in normozoospermic and oligozoospermic men . Ann Nutr Metab 1986; 30 : 213 -218 .

12. Hendler S. The Doctors Vitamin and Mineral Encyclopedia, Simon and Schuster 1990.

13. Hunt C D, Johnson PE, Herbel J, Mullen LK. Effects of dietary zinc depletion on seminal volume and zinc loss, serum testosterone concentration and sperm morphology on young men .Am J Clin Nut 1992; 56:184-157 .

14. Gomez F, Dela Cueva R, Wauters JP and Lemarchand BT. Endocrine abnormalities in patients

undergoing long term hemodialysis. Am J Med 1980; 68: 522 -530 .

15. Netter a, Hartoma R, Nahail K. Effects of zinc administration on plasma testosterone and dihydrotestosterone and sperm count. Arch Androl 1981; 7 : 69 -73 .

16. Abbasi AA, Prasad AS, Rabbani P , Dumouchelle E. Experimental zinc deficiency in man. Effect on testicular function . J Lab Clin Med 1980; 96: 544 -550.

17. Valle BL, Falchuk KH . The biochemical basis of zinc physiology .Physiol Rev 1993; 73: 79 – 118 .

18. McClain CJ, Gavalier JS, Van –Thiel DH. Hypogonadism in the zinc deficient rat: localization of the functional abnormalities . J Lab Clin Med 1984; 104: 1007 -1015.

## العلاقة بين مستوى الزنك في مصل الدم ومستوى هرمون التستوستيرون وخصائص المنى لدى الرجال

### العقيمين

ساجدة سعيد الجلي<sup>١</sup> ، ياسر طليع الوتار<sup>٢</sup>

<sup>١</sup> فرع الفلسفة الطبية ، كلية الطب ، جامعة الموصل ، الموصل ، العراق

<sup>٢</sup> مستشفى الزهراوي التعليمي في الموصل ، الموصل ، لعراق

( تاريخ الاستلام: ٢٠١٠ / ١ / ١٩ ، تاريخ القبول: ٢٠١٠ / ٥ / ٢٣ )

### الملخص

**اهداف البحث :** لمعرفة العلاقة بين مستوى الزنك في الدم ومستوى هرمون التستوستيرون في الدم وكذلك مستوى الزنك في الدم مع خصائص المنى المختلفة للرجال العقيمين والرجال الخصيين .

**التصميم :** دراسة مستقبلية .

**مكان اجراء البحث والاطار الزمني له :** اجري البحث في عيادة العقم في مستشفى .البترول التعليمي في الموصل للفترة من نيسان ٢٠٠٩ -تموز ٢٠٠٩ .

**الطرق المتبعة :** اجريت فحوصات السائل المنوي وقيلس مستوى الزنك في الدم وقياس مستوى هرمون التستوستيرون في الدم لمئة من الرجال العقيمين اللذين تتراوح اعمارهم بين ٢٥ - ٥٠ سنة تم اختيارهم من عيادة العقم في مستشفى البترول التعليمي في الموصل وخمسون من الرجال الخصيين تم اختيارهم من عامة الناس كعينة سيطرة .

**النتائج :** اظهرت هذه الدراسة انخفاض في مستوى الزنك في الدم وانخفاض في مستوى التستوستيرون في الدم لدى الرجال العقيمين عندما تمت مقارنتهم مع الرجال الخصيين (عينة السيطرة) .

كما لوحظ ارتباط سلبي غير معنوي بين مستوى الزنك في الدم وحجم السائل المنوي لدى الاشخاص العقيمين بينما لوحظ ارتباط ايجابي بين مستوى الزنك في الدم ومستوى هرمون التستوستيرون في الدم وكذلك ارتباط ايجابي بين مستوى الزنك في الدم وعدد النطف وحركة النطف وشكل النطف .

**الاستنتاج :** على اساس ما توصلنا اليه في هذه الدراسة من الممكن اعتبار عنصر الزنك له علاقة بالخصوبة من خلال تاثيراته على خصائص المنى ومستوى هرمون التستوستيرون ويبدو ان قياس مستوى الزنك ممكن ان يساعد في تشخيص ومعالجة الرجال العقيمين .