

Trace Elements in Serum and Seminal Plasma and Their Relationship to Infertility in Iraqi Males

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Abstract

Background: Environmental chemicals are thought to adversely affect human reproductive function.

Objective : To estimate the concentration of cadmium(Cd) , lead (Pb) and Zinc (Zn) in serum and seminal plasma among infertile men .

Methods: A sample of 70 infertile men was investigated. The relationship of trace elements concentration in serum and seminal plasma was studied in relation to sperm density, motility and sperm count.

Results: Except for Zinc the concentration of (Pb) and (Cd) were generally higher in serum than in seminal plasma. The mean concentration of (Zn) in seminal plasma was more than

25 times higher than in serum There were no statistical significant differences observed in the serum and seminal plasma levels of trace elements among the normospermic , oligospermic and azoospermic.

Conclusion: It seems that no significant relationship between these trace elements and the clinical classification of the infertile men was noted. Without considering environmental conditions of life and work, way of nutrition smoking and other possible factors, this study does not present great value.

Key words: Trace elements, infertility, seminal plasma

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Introduction:

There is increasing interest in the possible adverse effects of environmental factors on reproduction capacity in men, which is mainly due to a decrease in sperm density noted in the general population over the past decades⁽¹⁾. Until very recently, the identification of male infertility depends principally on semen analysis (sperm count & motility).

Semen could vary qualitatively and quantitatively with age, illness, sexual activity, and diet of the subject, many recent studies have been concerned with the biochemistry of semen^(2,3). The physiologic role of these elements in relation to male infertility is still not fully understood⁽⁴⁾. Cadmium (Cd) is highly toxic metal for humans, it is pervasive in the human environment and accumulate in the human body over a lifetime.

The biological half-life of Cd in the human body is estimated to be about 10-20 years⁽⁵⁾.

The concentration of Cd in serum is regarded as the best biological indicator of recent exposure to Cd. The majority of information concerning the adverse effects of Cd on male reproductive capacity is related to experimental animal studies while data in human subjects are inconclusive⁽⁶⁾. Lead (Pb) is inevitably present in the human environment and is known to be toxic agents which accumulate in the human body over a lifetime⁽⁷⁾. Recent studies showed that long-term moderate exposure to Pb can considerably reduce

semen quality in men⁽⁸⁾. Although experimental data indicated the presence of both Pb and Cd in the seminal fluid and spermatozoa of infertile subjects, no information was presented regarding possible occupational exposure to Pb or Cd in the population studied⁽⁹⁾.

Zinc (Zn) in human semen seems to play an important role in the physiology of spermatozoa it is perhaps the most critical trace mineral for male sexual function. It is involved in virtually every aspect of male reproduction including the hormone metabolism, sperm formation and sperm motility⁽¹⁰⁾. However, there has been some controversial debate about the manner in which (Zn) may influence the structure, motility and survival of spermatozoa⁽¹¹⁾. Several studies showed the multiple functions of zinc in semen. Human spermatozoa are endowed with zinc-rich prostatic fluid during the sequence of ejaculation⁽¹²⁾ which implies that zinc may affect. Spermatozoa during the immediate post-ejaculatory periods⁽¹³⁾. The present study is aimed to measure the elemental levels (Pb, Cd and Zn) of human seminal plasma and serum in infertile subjects and the correlation of such elements with parameters of semen quality in the same subjects.

Methods

The study was carried out in 70 adult male aged 30-47

years during their attendance at the infertility clinic in Al-Elwiya maternity teaching hospital and private Laboratories for a period of six months (Oct.2000 – March2001).

Data on age, medical and sexual history of the subjects were collected with the assistance of a physician. Before sample collection, the subject had to abstain from any form of sexual activity for at least 3 days. Semen samples were collected by masturbation, and the entire ejaculate was passed into sterile graduated centrifuged container for their volume measurement.

The seminal plasma was separated from the spermatozoa by centrifugation at 3000 r.p.m for 10 min at room temperature (22-25 C°).

An aliquot of the seminal plasma was carefully decanted into a metal free plastic khan tubes (washed thoroughly with 1% nitric acid and rinsed properly with de-ionized water), and stored at -20C° until required for analysis.

According to the number of sperm (world health organization guidelines) ⁽¹⁴⁾, the samples were classified into 3 groups:

n > 40 x 10 ⁶ sperm/ml	Normozoospermic	Group (1)
n < 40 x 10 ⁶ sperm/ml	Oligozoospermic	Group (2)
n = 0	Azoospermic	Group (3)

The ejaculate and venous blood were sampled between 8 a.m. and 12 a.m. for each subject.

The seminal plasma elements (Cd, Pd and Zn) measurements were performed by a method which includes deproteinization of seminal plasma with nitric acid, followed by Jenway 6100 spectrophotometer (model 6100 serial no 3000, frequency 50/60 HZ, U.K. England) according to the methods described by Shibata for zinc analysis ⁽¹⁵⁾.

The seminal plasma Cd and Pb measurements were performed by electrothermal atomic absorption spectrometry described by Jurasovic and Telisman ⁽⁸⁾.

All measurement of serum and seminal plasma were performed in duplicate, and median values were used for the calculations. Statistical analysis was performed by using t-test with (p < 0.05) level of significant.

Results

Table- 1 shows the elemental content of the three groups of infertile men, and because the levels of serum and seminal plasma elements showed a skewed distribution within the groups, all data are presented as median and range.

Except for zinc, cadmium and lead occur in much lower Concentrations in seminal plasma than in serum. In general, the elemental content of seminal plasma is considerably lower than reported values for human

semen. This is due in part to the fact that sperm are very rich in proteins and enzymes, and therefore require an abundance of essential elemental nutrients for normal physiologic activity.

The concentrations of lead in serum or seminal plasma did not appear to have any correlation with the sperm parameters studied. Statistical evaluation of lead concentration in serum and seminal plasma among the three groups reflected no statistically significant variation (p < 0.05) in relation to infertility classification.

Cadimium concentrations in seminal plasma for the three groups did not show significant differences (p > 0.05). A significant correlation was observed between serum Cd and seminal plasma Cd in oligozoospermic men but not in normospermic and azoospermic.

The concentration of zinc in seminal plasma was about 25 times higher than in serum. Zinc concentration in both serum and seminal plasma was lower in oligospermic and azoospermic than in normospermic. Zinc and lead concentrations in seminal plasma correlated weakly with the fertility status.

Our results show a considerable scatter of individual seminal plasma trace element levels for the same level of serum trace elements .No significant differences occurred in the levels of trace elements in normozoospermic, oligospermic and azoospermic in both serum and seminal plasma. Seminal plasma, like human serum, appears not to be a good indicator of elemental status due to homeostatic regulatory mechanisms. No correlation was found between serum trace elements and seminal plasma trace elements in the three groups of infertile men.

Discussion:

The seminal plasma has the important function as a vehicle for the transportation of the spermatozoa through the epididymis, the vas deference, and urethra and into the vagina ^(16, 17).One factor influencing function of the seminal plasma on the sperm metabolism is the trace elements content ⁽¹⁸⁾.

Zinc is perhaps the most critical trace element for male sexual function ⁽¹⁹⁾. It is involved in virtually every aspect of male reproduction ⁽²⁰⁾. Most reports contradict each other in relating human sperm count to seminal zinc content; some of them (including our study) have found no significant correlation between zinc concentrations in serum and seminal plasma and sperm density or motility ⁽²¹⁾.

The lack of correlation between zinc concentrations in serum, seminal plasma and fertility classification found

in our study suggests that biochemical complexity of seminal plasma attempts to perform such simple correlations between seminal plasma serum and andrological parameters are likely to produce inconsistent results⁽¹⁹⁾. Although experimental data for animals have indicated that both lead and cadmium can reduce male reproduction capacity very few data are available regarding the possible reproductive effects of Pb and /or Cd in men⁽²²⁾. Relatively few studies have shown that Cd has a primary effect on the testicular vasculature and possibly exerts a secondary action by modifying the effects of endogenous testosterone, which may be attributed to the occupation and inactivation of protein – SH groups and its interference with the necessary enzyme system involved in testosterone synthesis⁽²³⁾.

A recent study has shown that exposure to Pb can slightly increase testosterone in serum and significantly decrease sperm count, progressive motility of sperms,

and parameters of prostate function, and can slightly increase abnormal sperm morphology, Whereas Cd only decreased sperm motility and increased abnormal sperm morphology⁽²⁴⁾. The present study have shown a relatively poorer correlations of serum-Pb and serum – Cd with seminal plasma of Pb and Cd in the three groups of men.

The three elements (Zn, Cd and Pb) reflected no statistically significant differences among the three groups.

Further research is required to gain a clearer understanding of data on the correlations of trace elements in serum and seminal plasma with parameters of semen quality in the same subjects, as well as the influence of age, smoking habits which are associated with reduced semen quality⁽²⁵⁾ and alcohol consumption which was beyond the scope of the present investigations.

(Table 1)

Median and Range Values of Cadmium (Cd), Lead (Pb), and Zinc (Zn) in the Serum and Seminal Plasma of the Infertile Men with Normospermic, Oligospermic and Azoospermic

<i>Azoospermic n=23</i>	<i>Oligospermic n=25</i>	<i>Normospermic n=22</i>	<i>Elements</i>
<i>0.97 (0.4 - 2.7)</i>	<i>0.81 (0.2 - 2.1)</i>	<i>0.61 (0.17 - 1.67)</i>	<i>Seminal Plasma</i>
<i>1.92 (1.2 - 2.4)</i>	<i>1.51 (1.1 - 1.98)</i>	<i>1.31 (0.98 - 2.1)</i>	<i>Serum</i>
<i>14.8 (6.1 - 18.2)</i>	<i>14.1 (4.9 - 17.4)</i>	<i>12.4 (4.3 - 16.7)</i>	<i>Seminal Plasma</i>
<i>88.6 (80 - 251)</i>	<i>87.1 (74 - 209.1)</i>	<i>82.6 (61 - 194.2)</i>	<i>Serum</i>
<i>166 (140 - 275)</i>	<i>171 (151 - 288)</i>	<i>198 (185 - 302)</i>	<i>Seminal Plasma</i>
<i>5.8 (0.81 - 14.2)</i>	<i>6.2 (0.9 - 15.7)</i>	<i>7.4 (1.1 - 16.7)</i>	<i>Serum</i>
			<i>Zn mg/L</i>

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