Citrate, zinc, magnesium and calcium levels of seminal plasma in the normospermic, Oligospermie and azospermic patients

Erol KOÇ¹, Atilla GÖR¹, Orhan DEĞER², Abdullah SİVRİKAYA¹, Güner K. ÖZGÜR¹

Depts. of Urology and Biochemistry, Medical School of Karadeniz Technique University, TRABZON, TURKEY

Citrate, zinc, magnesium and calcium levels of seminal plasma were measured in the fertile (normospermic) and infertile (oligo and azospermic) patients, to show the biochemical changes of the semen. 20 normospermic, 25 Oligospermie and 20 azospermic patients who were kept under control in the Urology Department, were evaluated. In the normospermic fertile group, the mean semen concentrations were as follows: citrate 5.79 ± 1.01 g/L, zinc 19.28 ± 2.43 mg/dl, magnesium 11.90 ± 2.43 mg/dl and calcium 27.20 ± 3.26 mg/dl. These values were significantly higher than that of the infertile oligo and azospermic group. The values of Oligospermie group were also significantly higher than that of the azospermic group. The measurement of citrate, zinc, magnesium and calcium levels which secreted in the high proportion by the prostate, should be considered in the detection of infertility. [Turk J Med Res 11(6): 282-285]

Key Words: Seminal fluid, Citrate, Zinc, Magnesium, Calcium

The genital accessory glands have major roles in the male fertility. It is known that not only high levels of acid phosphatase, citric acid, zinc (ZN), magnesium (Mg) and calcium (Ca) exist in the prostate secretion, but the seminal vesicle secretion has a high fructose level as well(1).

Citrate is the major anion of the prostate secretion (75 mmol/L in semen, and 0.12 mmol/l in serum)(2). This anion directs the osmotic balance of the prostate. It is used as an indicator in testing the function of the prostate(3). Mowson and Fischer have proved that zinc (Zn) concentration is high in the human semen and originated from prostate. In human beings prostate is assumed as a tissue that has the highest Zn content(4).

Although, other glands in the male genital system have nearly the same magnesium concentration, the human prostate gland and seminal vesicle have high Mg content. ATP must form complex with Mg in order to maintain the required energy for the fertilization(5).

Calcium is very important for the cell function. It exists in a high concentration in some body fluids. In the seminal plasma the calcium concentration is 3-4 'old high with respect to blood serum level. The calcium in semen is originated from semen(6). As a result of the pathologies in the accessory sex gland chemical changes take place and may effect the fertility as increasing or decreasing the secretion(1).

MATERIALS AND METHODS

In this study, 20 normospermic, 25 infertile oligospermic and 20 azospermic patients were sampled. The semen samples were collected into a sterile petri disk by masturbation at the end of sexual diet which continued for 5 days. The specimen was used for semen culture, spermiogram. The rest of the semen was centrifugated at 3000 rpm for 10 minutes. In order to obtain the seminal plasma and kept at -20 °C in glass tubes, until assayed. The citrate level at semen was detected by the enzymatic UV method(7) and the results were calculated as g/L. The Zn and Mg levels were detected by using Atomic Absorbtion Spectrophotometer in terms of mg/dl (8,9). Colorimetric method was used for the measurement of Ca level in mg/dl.

In Table 1 detailed information is given about the properties of study population.

RESULTS

The seminal plasma citrate levels were shown in Table 2.
CITRATE ZINC, MAGNESIUM AND CALCIUM LEVELS OF SEMINAL PLASMA IN THE NORMOSPERMIC, OLIGOSPERMIC AND AZOSPERMIC PATIENTS

Table 1. The properties of the study population

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of case</th>
<th>Age ±SD</th>
<th>Duration of marriage ±SD</th>
<th>Number of children</th>
<th>Number of sperm ±SD</th>
<th>Volume of semen ±SD</th>
<th>Semen pH ±SD</th>
<th>Number of leucocyte ±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normospermic</td>
<td>20</td>
<td>30.0±6.44</td>
<td>9.0±5.93</td>
<td>2.4±1.35</td>
<td>68.8±5.49</td>
<td>3.22±0.33</td>
<td>7.44±0.19</td>
<td>4.0±0.81</td>
</tr>
<tr>
<td>Oligospermic</td>
<td>25</td>
<td>29.0±3.70</td>
<td>5.4±3.17</td>
<td>0</td>
<td>23.2±7.44</td>
<td>3.51±0.44</td>
<td>7.44±0.15</td>
<td>4.5±1.00</td>
</tr>
<tr>
<td>Azospermic</td>
<td>20</td>
<td>31.3±4.57</td>
<td>7.0±3.97</td>
<td>0</td>
<td>2.92±0.57</td>
<td>7.67±0.18</td>
<td>4.1±1.13</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. The average semen citrate levels of normospermic, Oligospermic and azospermic patients (g/L)

<table>
<thead>
<tr>
<th>Group</th>
<th>X ±SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normospermic</td>
<td>5.79</td>
<td>3.78 - 7.64</td>
</tr>
<tr>
<td>Oligospermic</td>
<td>3.90</td>
<td>2.07 - 5.76</td>
</tr>
<tr>
<td>Azospermic</td>
<td>1.65</td>
<td>1.10 - 2.15</td>
</tr>
</tbody>
</table>

Table 3. The average semen Zn levels of normospermic, oligospermic and azospermic groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>X ±SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normospermic</td>
<td>19.28</td>
<td>14.1-25.9</td>
</tr>
<tr>
<td>Oligospermic</td>
<td>10.30</td>
<td>6.8-15.3</td>
</tr>
<tr>
<td>Azospermic</td>
<td>5.70</td>
<td>3.5-8.2</td>
</tr>
</tbody>
</table>

In the normospermic group; the semen citrate levels were significantly higher than that of the oligospermic and azospermic groups (p<0.01). The average semen citrate level in the infertile oligospermic group was significantly higher with respect to the azospermic group (p<0.01).

The seminal plasma Zn levels were as in Table 3. A statistically significant higher seminal plasma Zn levels were observed in normospermic group according to the other groups (p<0.01). However the oligospermic group had higher Zn level according to the azospermic group (p<0.01).

The Mg level in the seminal plasma of the normospermic, oligospermic and azospermic group were indicated in Table 4.

Significantly highest Mg level was observed in the normospermic group (p<0.01) and followed by the oligospermic group (p<0.01) among the study group.

Table 5 indicated the average seminal plasma Ca level within our study group.

The average semen calcium level was found to be significantly high within the normospermic population (p<0.01). The patients in the oligospermic group had significantly high Ca levels than azospermic group (p<0.01).

DISCUSSION

The complete analysis of the ejaculate is consisted of spermioagram and biochemical analysis. Mann indicated that both the number of the sperm and physical - biochemical properties of the seminal liquid is important for the fertilization(10). Normal ejaculate is a heterogenous compound secreted from male genital system. For a sucessful fertilization the compound should be in normal ratios having proper physical and biochemical properties. By analysing the seminal plasma, activities of the accessory glands and the properties of the secretions could be validated.

In this study we tried to investigate the relationship with the citrate, zinc, magnesium and calcium levels and infertility.

The fertil normospermic seminal plasma citrate, zinc, Mg and Ca levels were compared with the previous studies in literature (Table 6).

In the malignant diseases of prostate, semen citrate level decreases(18). Therefore the reduced citrate level indicates the dysfunction of the prostate(19).

It was proved that in the prostatitie the seminal plasma citrate level decrease therefore this anion can be used as a biochemical marker for the prostate function(20). Paz et al reported that the change in the citrate level among the azospermic patients and fertil normospermic group was insignificant. But in our study this alteration was found to be statistically significants 3). Azospermic patients had low cation concentration in semen so, it may also effect the citrate concentration in our study. Since this anion has a high affinity to the cations such as Ca, Mg, Zn. These metals form complexes with the anion. So the reduction in the level of these cations will cause the elevation of the citrate level(21).

The semen zinc levels of the infertile oligospermic and azospermic patients were found to be suitable with the results indicated in the literature. Mbizuo et al, reported that the zinc level in oligospermic patients was 5.06 ± 0.9 mg/dl, and in azospermic patients was 3.2 ± 0.6 mg/dl(22). Stankovich et al found the Zn level in infertil patients as 11.2 ± 0.06 mg/dl(23). Wood and his group showed that Zn level was 13.7±7.2 mg/dl in oligospermic patients and its level was lower than that of the azospermic patients(24). Although Skandhan et al had reported that the Zn level in the
Table 4. The average semen Mg levels (mg/dl)

<table>
<thead>
<tr>
<th>Group</th>
<th>X</th>
<th>±SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normospermic</td>
<td>11.90</td>
<td>2.43</td>
<td>8.1 - 16.9</td>
</tr>
<tr>
<td>Oligospermic</td>
<td>6.58</td>
<td>2.04</td>
<td>3.8 - 10.8</td>
</tr>
<tr>
<td>Azospermic</td>
<td>3.35</td>
<td>0.63</td>
<td>2.5 - 4.3</td>
</tr>
</tbody>
</table>

Table 5. The average semen Ca levels (mg/dl)

<table>
<thead>
<tr>
<th>Group</th>
<th>X</th>
<th>±SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normospermic</td>
<td>27.20</td>
<td>3.26</td>
<td>22 - 32</td>
</tr>
<tr>
<td>Oligospermic</td>
<td>22.25</td>
<td>2.73</td>
<td>18.5 - 28.5</td>
</tr>
<tr>
<td>Azospermic</td>
<td>17.25</td>
<td>3.85</td>
<td>11 - 23</td>
</tr>
</tbody>
</table>

Table 6. The comparison of semen citrate, Zn, Mg and Ca levels of fertil group (normospermic group) with the values in the literature.

<table>
<thead>
<tr>
<th>References</th>
<th>Citrate</th>
<th>Zn</th>
<th>Mg</th>
<th>Ca</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffey et al. (11)</td>
<td>0.96 - 14.3</td>
<td>5 - 23</td>
<td>11</td>
<td>28</td>
</tr>
<tr>
<td>Kavanagh et al. (12)</td>
<td>6.45 ±1.50</td>
<td>15.7±5.2</td>
<td>10.7±2.9</td>
<td>29.6±8</td>
</tr>
<tr>
<td>Paz et al (13)</td>
<td>5.28±0.21</td>
<td>12.4±5.4</td>
<td>7.9±3.3</td>
<td>24.5±7.9</td>
</tr>
<tr>
<td>Uneyama et al (14)</td>
<td>-</td>
<td>-</td>
<td>11.4±4.3</td>
<td>32±12</td>
</tr>
<tr>
<td>Grizard et al. (15)</td>
<td>5.95±0.54</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bondani et al.</td>
<td>13.1 ±7.8</td>
<td>14.1±7.2</td>
<td>10.4±4.9</td>
<td>22.8±10</td>
</tr>
<tr>
<td>Santorino et al. (17)</td>
<td>5.79±1.01</td>
<td>19.28±3.03</td>
<td>11.9±2.43</td>
<td>27.7±3.26</td>
</tr>
</tbody>
</table>

The changes can be managed by using the exogenous compounds in semen may affect the capacity of the fertilization of male germ cells(29). Therefore the mentioned divalent cations can regulate the fertilization. For this purpose, the therapies with Zn, Mg, Ca tried and good results weie obtained from the Zn therapy(29-31).

We concluded that sitrate-zinc or sitrate-magnesium levels are good paramètres in predicting the function of prostate.

**Normospermik, oligospermik ve azospermik şahıslarda seminal plazma sitrat, çinko, magnezyum ve kalsiyum düzeyleri**

Fertile (normospermic) ve infertile şahıslarda (oligospermic ve azospermic) semen biokimyasındaki değişimlerini göstermek amacıyla seminal plazmada sitrat, çinko, magnezyum ve kalsiyum düzeyleri ölçülmüştür. Çalışmaya KTÜ. Tip Fakültesi Üroloji Polikliniğine başvuran 20 normospermic fertile grupta ortalaması seminal sitrat konsantrasyonu 5.79±H.01 g/L, çinko 19.28±3.03 mg/dl, magnezyum 11.9±2.43 mg/dl ve kalsiyum 27.7±3.26 mg/dl olarak testil edilmiştir. Bu değerler infertile oligospermic ve azospermic grubu göre anımlı derecede yüksektir. Oligospermic grupta değerlerde azospermic gruba göre anımlı derecede yüksek bulunmuştur. Infertilitenin değerlendirilmesinde prostat tarafından yüksek oranda salgılanan sitrat çinko magnezyum ve kalsiyum düzeylerinin tayini de göz önünde tutulmalıdır.

REFERENCES


