

## **Trace Elements in the Blood Serum and Follicular Fluid of Patients undergoing In Vitro Fertilization**

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**Introduction:** Dietary supplementation with minerals has been assumed to be not only harmless but beneficial to women trying to achieve a pregnancy. Numerous studies suggest that variations of trace element concentration can affect fertility and pregnancy. However, little is known about the trace element status of these subjects and whether supplementation was actually needed. The aim of this study was to investigate trace element levels in the serum and follicular fluid (FF) of patients undergoing IVF. Patients with a known and an unknown cause of infertility were compared; we also attempted to determine whether dietary modification or environmental factors may affect trace element status and pregnancy outcome.

**Materials and methods:** Patients less than 35 years of age were recruited. They underwent a standard protocol for ovarian stimulation with follicle stimulating hormone. Serum and FF samples were obtained from women with tubal (N=59) and unexplained infertility (n=45) on the day of egg collection. These were centrifuged, transferred to “metal free” polypropylene tubes and stored at  $-70^{\circ}\text{C}$ . The analysis of iron, copper, zinc, selenium, cadmium and lead in serum and FF samples was undertaken using inductively coupled plasma mass spectrometry (ICP-MS).

**Results:** Trace element concentrations in FF were found to be lower than those in serum. This was true for all measured elements. Serum and FF measurement of iron ( $p<0,01$ ), copper and selenium ( $p<0,001$ ) were correlated significantly. In serum, levels of both iron and zinc decreased significantly with increasing age ( $p<0,05$ ). Copper levels increased as body mass index (BMI) increased ( $p<0,001$ ) in serum an

FF ( $p < 0.05$ ). There was no significant difference between the levels in women with tubal and unexplained infertility. When IVF outcome was compared, women who became pregnant ( $n=35$ ) had significantly higher ( $p < 0.05$ ) serum levels of zinc; those who did not become pregnant ( $n=69$ ) had higher serum levels of cadmium ( $p < 0.05$ ). Selenium concentration was higher ( $p < 0.05$ ) in the serum of women who delivered a baby ( $n=17$ ). In FF concentrations of all these elements, except cadmium, was higher in women who had a miscarriage ( $n=8$ ), although not significantly. Cadmium concentration was higher ( $p < 0.05$ ) in women who did not take folic acid. There were no significant differences found between FF concentrations of trace elements and the number of oocytes retrieved or fertilization rate. No correlation between trace element levels and alcohol consumption. Lead levels were higher in the serum of passive smokers than in non-smokers ( $p < 0.05$ ).

**Conclusion:** The mechanism by which these elements cross the follicle basement membrane is not known, but it may depend on an active transport system. Because there were significant differences in trace element concentrations in serum, but not for follicular fluid, it is possible that they may produce their effect by changing endometrial environmental rather than oocyte quality. It is of interest that apart from zinc, all of the measured elements were found in higher concentrations in women who did not become pregnant. Selenium levels were higher in women with successful pregnancies. In view of these findings it is very doubtful that mineral supplementation will benefit women trying to achieve pregnancy.