

## Iron, zinc and copper concentration in maternal and umbilical cord blood during delivery

Kocylowski R, Grzesiak M, Gaj Z, Oszukowski P, Baralkiewicz D, Suliburska J  
Polish Mother's Memorial Hospital Research Institute, Łódź, Poland

### Objective

Mineral status in women is altered during pregnancy with changes in the physiology and the requirements of the growing fetus. Concentration of trace minerals in newborn is strongly associated with maternal status. The aim of our study was to evaluate iron, zinc and copper concentration in umbilical cord blood serum and maternal serum before and after birth.

### Methods

The study was carried out in 64 pregnant women, aged 28. 1 ± 5. 4 years. The mean gestational age was 39. 2±1. 3 week. The study included 35 (55%) male and 29 (45%) female newborns. Blood samples from women were taken before (in 1st stage of delivery) and right after childbirth (in 4th stage of delivery). Blood samples from the umbilical cord artery and vein of neonates were obtained separately right after delivery (in 3rd stage of delivery). The levels of iron, zinc and copper level in serum were determined by flame atomic absorption spectrometry (with a Zeiss AAS-3 spectrometer with deuterium background correction). The accuracy of the method was verified using certified reference material (HUM ASY CONTROL 2, Randox) and was 95%, 99%, 94%, 99% and 101% for iron, zinc and copper, respectively. The study protocol was approved by the Bioethics Commission at Poznan University of Medical Sciences (approval no. 1800/04 and 30/15). Informed consent was obtained from each participant.

### Results

Maternal serum Fe concentration (µg/ml) was found significantly lower after birth (1. 08±0. 46 vs 0. 82±0. 35 mean±SD and 1. 04\* vs 0. 74 median before and after birth, respectively, \*p < .05). Maternal serum Zn concentration (µg/ml) was found significantly lower after birth (0. 63±0. 17 vs 0. 46±0. 16 mean±SD and 0. 64\* vs 0. 46 median before and after birth, respectively, \*p < .05). Maternal serum Cu concentration did not differ after birth (1. 91±0. 40 vs 1. 90±0. 35 mean±SD and 1. 91 vs 1. 87 median before and after birth, respectively). Umbilical cord serum Fe concentration (µg/ml) was higher than maternal after delivery and higher in vein vs artery (1. 96±0. 43 vs 1. 63±0. 30 mean±SD and 2. 03\*, \*\* vs 1. 61\*, \*\* median in vein and artery after birth, respectively, \*significant differences vs maternal after birth, p < .05; \*\*significant differences vs artery cord blood (p < .05). Umbilical cord serum Zn concentration (µg/ml) was higher than maternal after delivery and did not differ in vein vs artery (0. 65±0. 16 vs 0. 65±0. 15 mean±SD and 0. 63\* vs 0. 64\* median in vein and artery after birth, respectively, \*significant differences vs maternal after birth, p < .05). Umbilical cord serum Cu concentration (µg/ml) was much lower than maternal after delivery and did not differ in vein vs artery (0. 36±0. 09 vs 0. 36±0. 10 mean±SD and 0. 36\* vs 0. 36\* median in vein and artery after birth, respectively, \*significant differences vs maternal after birth, p < .05). Iron and zinc concentration in umbilical cord blood serum was significantly higher and copper significantly lower than in maternal serum after childbirth. Moreover iron and zinc concentration in maternal serum after delivery was markedly lower in compared to their serum level before childbirth. Iron level positively correlated with zinc and negatively with copper concentration in umbilical cord serum.

### Conclusion

Umbilical cord serum contains higher concentration of iron and zinc and lower concentration of copper than maternal serum after birth. Obtained results suggest that childbirth changes iron and zinc status in women.

**Table 1** Concentration of minerals in maternal serum before and after birth and in umbilical cord blood

| Parameter (µg/ml) | Maternal serum |             | Umbilical cord serum |           |
|-------------------|----------------|-------------|----------------------|-----------|
|                   | Before birth   | After birth | Vein                 | Artery    |
| Fe                |                |             |                      |           |
| mean±SD           | 1.08±0.46      | 0.82±0.35   | 1.96±0.43            | 1.63±0.30 |
| median            | 1.04*          | 0.74        | 2.03*,**             | 1.61*,**  |
| Zn                |                |             |                      |           |
| mean±SD           | 0.63±0.17      | 0.46±0.16   | 0.65±0.16            | 0.65±0.15 |
| median            | 0.64*          | 0.46        | 0.63*                | 0.64*     |
| Cu                |                |             |                      |           |
| mean±SD           | 1.91±0.40      | 1.90±0.35   | 0.36±0.09            | 0.36±0.10 |
| median            | 1.91           | 1.87        | 0.36*                | 0.36*     |

\*significant differences vs after birth (p < .05)

\*\*significant differences vs artery cord blood (p < .05)

SD-standard deviation

**Table 2.** Significant correlation between minerals in umbilical cord serum

| FeV         | ZnV        | CuV         |
|-------------|------------|-------------|
| ZnA R= 0.37 | ZnA R=0.45 | CuA R=0.41  |
| CuV R=-0.34 | FeA R=0.63 | FeV R=-0.34 |
| CuA R=-0.49 |            |             |

\*Spearman correlation (R), p< .05; A-artery, V-vein