A procedure that allows phenotyping on paper-absorbed blood and serum (where the samples reach the laboratory by mail) could be particularly useful in this context; the use of isoelectric focusing followed by silver staining makes a certain diagnosis possible in virtually all cases. Costs are very low if ultrathin gels are utilized, as described, which makes it possible to use greatly reduced quantities of material.

References

Serum Copper Concentration Significantly Less in Abnormal Pregnancies
Paul K. Buamah, Margaret Russell, A. Milford-Ward, Peter Taylor, and Derek F. Roberts

We estimated copper concentration in maternal serum during 244 normal and 15 abnormal pregnancies. Values were lower in the abnormal pregnancies than in the normal ones, and did not vary with gestational age between 15 to 18 weeks in normal pregnancies.

Additional Keyphrases: anencephaly · spontaneous abortion · trace elements · fetal status

During normal pregnancy the copper concentration in maternal serum may almost double because of increased synthesis of ceruloplasmin (1); the copper content of the maternal liver is also increased. The exact mechanism of these increases in pregnancy is unclear, but hormones produced by the placenta may be responsible (2). Reportedly (3–5), premature infants receiving copper-deficient milk diets develop neutropenia, anemia, and scurvy bone changes, and growth is impaired in these infants, along with profoundly low serum copper and ceruloplasmin.

To examine the possibility that copper deficiency in pregnancy may be related to the development of fetal malformations, we measured serum copper in pregnant women who were being screened for fetal anomalies.

Patients and Method
We examined 259 pregnant women (244 normal pregnancies and 15 abnormal), looking for any association between serum copper and fetal malformation or demise. Serum was sampled from pregnant women referred for measurement of serum alpha-fetoprotein in the geographical areas served by our institutions (1–2). The samples taken at known gestational ages during the second trimester of pregnancy were stored in plain plastic tubes at −30°C until analyzed. Postmortem examinations were carried out on abnormal fetuses to determine the exact fetal malformation.

Maternal serum was diluted fivefold with propanol/copper-free water (10/1 by vol) and its copper content determined by flame atomic absorption (6), in a Pye Unicam SP191 spectrophotometer. Samples were measured in duplicate and the mean value was taken.

Results
As compared with the concentration of copper in maternal serum from 244 normal pregnancies, that in seven of the nine anencephalic pregnancies fell below the mean at the corresponding gestational age (Figure 1), five of them beyond twice the standard deviation. The overall mean maternal serum copper concentrations in anencephalic pregnancies was lower (mean 25.5 μmol/L, 2 SD 7.7 μmol/L) than in normal pregnancies (32.5 μmol/L, 2 SD 5.5 μmol/L). The t-test analysis for the difference between the two groups gave p < .001, which is highly significant.

Similarly, by comparison with 179 normal pregnancies, the serum copper concentrations in four of the six which resulted in spontaneous abortion are more than 2 SD below the mean (Figure 2), and the overall mean serum copper concentration at 15–18 weeks of gestation was lower (25.2 μmol/L, 2 SD 5.4 μmol/L). The t-test analysis of the difference between the two groups gave p < .005, which is significant. In the normal pregnancies, in the 15 to 18 weeks gestation period, maternal serum copper concentration did not vary with gestational age (Figure 1).

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Discussion

Our data show a highly significant decrease in maternal serum copper concentration in the pregnancies with anencephaly or subsequent spontaneous abortions. This suggests that a relative copper deficiency may be associated with the pathogenesis of fetal demise and of neural tube defects. Whether it is a contribution or a consequence remains to be determined.

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References


