# Clinical laboratory manifestations of perinatal exposure to background levels of dioxins in Dutch children

**Gavin W. ten Tusscher[1], Hendrik J. Pluim[2], Kees Olie[3], Janna G. Koppe[4]**

[1] Department of Paediatrics, Emma Children's Hospital/ Academic Medical Centre, University of Amsterdam, The Netherlands
[2] Department of Internal Medicine, University of Nijmegen, The Netherlands
[3] Department of Environmental and Toxicological Chemistry, University of Amsterdam, The Netherlands
[4] Professor of Neonatology em., University of Amsterdam, The Netherlands

**Correspondence address:** G.W. ten Tusscher, Reaal 13, 1628 RA Hoorn, The Netherlands
Tel/Fax: NL +(0)229 27 86 27 Email: g.w.ten.tusscher@wxs.nl

**Introduction:**
During 1990 and 1991 data were collected in 35 mother-baby pairs with the intent of studying the effects of exposure to dioxins transplacentally and by breastfeeding. A correlation with thyroid hormone metabolism and with abnormalities in liver function and number of bloodplatelets were found and were subsequently published (1,2).
Presently, a follow-up study is being conducted, of the same group of children, now aged 8-9 years. In the light of current findings, we again looked at the 1990-1991 data with the aim of identifying indicators of persistant effects resulting from perinatal exposure. We hereby present some previously unpublished blood, serum and urine findings, all of which may prove to be significant in the (near) future.

**Materials and Methods:**
35 Mother-infant couples participated in the study, which was performed in Hospital De Heel, in the city of Zaandam, ten kilometres north of Amsterdam.
Maternal blood, obtained by vena puncture, and cord blood were sampled immediately after birth.
At one and eleven weeks of age blood sampless were obtained from the infant by vena puncture shortly after a feeding.
At one week, eleven weeks and 26 weeks urine samples were collected from the infant.
The haematological profile determined included leukocytes (WBC), bloodplatelets and a WBC differential.
At one and eleven weeks after birth, retinol binding protein (RBP), urea and creatinine were measured in the infants' serum.
In the urine of the babies, calcium and creatinine excretion was measured in samples obtained at one week, eleven weeks and 26 weeks after birth.
The outcomes of these laboratory tests were compared with the dioxin concentrations in the breastmilk fat of the mothers and with the individual cumulative dioxin intakes of the children calculated as follows: breastmilk dioxin concentration x amount of breastmilk consumed.

**Results:**

*Haematology*

The previously published significantly reduced number of polynuclear neutrophils found in the infants at one week of age, and the reduced number of bloodplatelets at eleven weeks of age, were found to be relative to the cumulative amount of dioxins consumed after birth, via breastfeeding (2).

The children exhibited a non-significant trend (with P = 0.077) towards a lower monocyte count (1.46 mean ± 0.28 SEM 10 9/L (n = 12) versus 0.83 mean ± 0.18 SEM 10 9/L (n = 6)) at one week of age in the lower versus the higher exposure groups.

The serum urea was borderline significantly reduced in the higher exposure group, at one week of age (3.94 ± 0.32 (n = 18) mmol/L versus 3.15 ± 0.24 mmol/L (n = 16)), relative to the cumulative dioxin intake, with P = 0.056. The serum urea was significantly lower in the higher exposure group at eleven weeks of age, again relative to the cumulative dioxin intake (3.18 ± 0.24 mmol/L (n=17) versus 2.44 ± 0.16 mmol/L (n=15), P = 0.016).

Retinol binding protein (RBP) was decreased, although not significantly, at one week of age relative to increasing dioxin concentration in breastmilk (29.4 ± 1.6 mg/L (n = 13) versus 25.0 ± 1.9 mg/L ( n = 11) P = 0.095). However at eleven weeks, the RBP was significantly lower in relation to the dioxins consumed via breastmilk (36.0 ± 2.9 (n = 13) mg/L versus 27.3 ± 2.7 mg/L (n = 10) P = 0.042).

*Urine*

At one week of age a non-significant trend towards higher calcium excretion in the higher exposure group was evident. The calcium/creatinine ratio amongst the lower exposure children (n = 17) exhibited a mean of 1.448 mmol/µmol with SEM 0.421 while the ratio amongst the higher exposure children (n = 13) exhibited a mean of 3.036 mmol/µmol with SEM 0.792 (P = 0.093).

At eleven weeks of age the trend remained evident with the lower exposure group (n = 15) revealing a mean ratio of 1.508 SEM 0.225 versus a mean ratio of 2.175 SEM 0.333 amongst the higher exposure infants (n = 17) (P= 0.109).

This non-significant trend was still evident at 26 weeks of age, with the lower exposure (n = 14) mean being 0.939 SEM 0.115 versus the higher exposure (n = 15) mean of 1.471 SEM 0.244 (P= 0.062).

**Discussion:**

The findings of a lower retinol binding protein concentration in the higher exposed group is in accordance with animal studies and might be related to a lower vitamin A level (3).

The trend towards increased urinary excretion of calcium is interesting. It could be hypothesised that this is a result of lower vitamin D levels, in turn a result of enhanced hepatic metabolism. A

similar effect is seen in patients on phenobarbital medication. It is recommendable to repeat these (non-invasive) laboratory urinary measurements in larger groups of children, using the measured dioxin exposures as independent factor. In this manner it might be possible to determine whether the trends seen in our study group are indeed effects of perinatal dioxin exposure. Should this be so, then the failure to achieve statistical significance would probably lie in the limited size of our group.

**References:**

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