

Investigating arsenic thyroid disrupting properties in humans utilising the benchmark dose approach

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INTRODUCTION

Arsenic (As) is a ubiquitous element the potent endocrine disruptive properties of which have been suggested as occurring at environmentally relevant exposure levels. The aim of the study was to evaluate the connection between the exposure to As and thyroid-stimulating hormone (TSH), free serum thyroxine (FT4) and free serum triiodothyronine (FT3).

METHODOLOGY

The data were collected from 435 blood samples drawn from participants (218 men and 217 women) as part of the DecodExpo project. Blood samples were compiled and As levels were determined using ICP mass spectrometry and hormone levels measured in serum. The role of As in the development of thyroid hormone disturbances was elucidated using a novel approach, i.e. calculating the benchmark dose (BMD). EFSA guidance has previously proposed that the BMD approach is applicable to human data. The data was processed using PROAST 70.1 (PROAST web) software. The calculations were based on the Benchmark methodology, using BMR 10 % (extra risk 0.1).

RESULTS

The following benchmark confidence interval was obtained for FT4: 1.74 –22.4 µg/L for men and 1.82 – 11.8 µg/L for women – and the dose dependence for the observed effect was determined. The confidence interval for FT3 in women was 7.56 –14 µg/L, while the interval obtained for men was extremely wide. The obtained intervals were also wide for TSH, which suggests a high degree of uncertainty.

DISCUSSION

The observed lower confidence limits of BMD for the effects on FT4 in both sexes are lower than the medium levels of As determined in the study (13.602 µg/L), which suggests an extra risk of thyroid hormone disturbances due to As exposure. These data confirm the As thyroid-disrupting properties and implicate the danger of environmentally relevant doses. Additionally, the study reveals the possibility of calculating the benchmark confidence interval for human data, which indicates the prospects of using this particular method of data processing to examine the risk of developing various endocrine disorders. However, further studies are required in order to confirm or rule out use of this methodology under such a specific situation.