

Iodine Status, Fluoride Exposure, and Thyroid Function in Pregnant Women in the United States

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Objectives: Iodine (I) is an essential nutrient for fetal neurodevelopment through its role in thyroid function. Like I, fluoride (F) is a halogen and urinary F concentration (UFC) has been linked to increased thyroid stimulating hormone (TSH) in non-pregnant adults with I deficiency. We hypothesize that F and I may interact in their role on thyroid function among pregnant women.

Methods: Pregnant women ($n = 966$) provided urine between 12- and 20-weeks gestation. UIC was measured by the modified Sandell-Kolthoff reaction and UFC by a F-sensitive electrode. Enzyme-linked immunosorbent assay (ELISA) was used to measure plasma TSH. Associations between 1) UIC and TSH, 2) UFC and TSH, and 3) I status, UFC, and TSH were estimated using generalized linear models with gamma distribution and log link. Potential interactions between I status and UFC in association with TSH was also investigated.

Results: The cohort UIC (median: 154.2 $\mu\text{g/L}$, IQR: 92.9,271.7) indicated a population with marginally adequate I status by WHO criteria. Nearly half ($n = 464$, 48%) were I insufficient ($\text{UIC} \leq 150 \mu\text{g/L}$). Median UFC (0.832 mg/L , IQR: 0.495, 1.29) was above the benchmark used to determine risk for child cognition (0.2 mg/L) (Grandjean et al., Risk Anal 2021; doi: 10.1111/risa.13767). Higher UIC was associated with increased TSH ($\beta = 0.0003$, $\text{SE} = 0.0001$, $p = 0.01$). UFC was not related to TSH ($p = 0.13$); however, a significant interaction between UIC and UFC was observed ($p = 0.01$). When analyzing only I insufficient participants, UFC and TSH were inversely associated ($\beta = 0.1488$, $p = 0.0004$). No association between UFC and TSH was observed for I adequate participants ($p = 0.63$).

Conclusions: Changes in TSH in relation to UIC and UFC were counter to our hypothesis as the relationship between UFC and TSH was inverse and only in I insufficient participants. Future research should explore if TSH is the best indicator of thyroid function in pregnancy and the mechanisms underlying the effects of pre- and postnatal F exposure on child cognition.

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