Analysis of the Association between Exposure to Perchlorate, Thiocyanate, and Nitrate and Thyroid Hormone Levels in Pregnant Women

WANG Chenchen [1*],ZHOU Jing[2]

1 Xinjiang Uygur Autonomous Region Center for Disease Control and Prevention, Urumqi, China

2 School of Public Health, Xinjiang Medical University, Urumqi, China

*E-mail address: 357935099@qq.com (C. Wang)

1.Institute of Health Hazard Factors Monitoring and Control, Xinjiang Uygur Autonomous Region Center for Disease Control and Prevention, Urumqi, Xinjiang 830002, China;**Abstract:**

[Background] Perchlorate, thiocyanate and nitrate are widely found in food, water and the natural environment. The three salt ions act as endocrine disruptors, inhibiting the body's ability to take up iodine and causing abnormal levels of thyroid hormones, which are essential for fetal development.

[Objective] A study of the correlation between exposure to the water-soluble inorganic salt ions perchlorate, thiocyanate, and nitrate and thyroid hormone levels in pregnant women.

[Methods] Healthy women before the 28th week of pregnancy who had been in labor and delivery at local medical institutions for a long time were invited to participate in this study in Midong District and Bole City, Urumqi City, from March to August 2023. Whole blood and urine samples of pregnant women who signed informed consent were collected, and the 5 items of thyroid function, urinary creatinine level, and urinary levels of perchlorate, thiocyanate, and nitrate were tested for each study participant. Association between perchlorate, thiocyanate, and nitrate levels in pregnant women's urine and pregnant women's thyroid hormone levels analyzed by generalized linear modeling and weighted quantile and regression.

[Results] In this study, 157 pregnant women were included in Midong District, Urumqi City, and 145 pregnant women were included in Bole City. There was no difference in perchlorate, thiocyanate and nitrate levels in the urine of pregnant women in the two areas. In single ion exposure, the perchlorate content in urine of pregnant women as a whole showed a positive correlation trend with the FT3 and FT4 levels, and the nitrate content in urine showed a positive correlation trend with the FT4 level; the perchlorate content in urine of pregnant women in Bole City showed a negative correlation trend with the TSH level. In the combined exposure of perchlorate, thiocyanate and nitrate, the overall pregnant women's urine content of the three ions

in the combined exposure showed a negative correlation trend with the FT3 level, of which perchlorate had the highest weight (0.497); the same negative correlation trend with the FT4 level but thiocyanate had the highest weight (0.442); the Bole pregnant women's urine content of the three ions in the combined exposure showed a negative correlation trend with the FT3 level, of which perchlorate had the highest weight (0.943), and also negatively correlated with TSH level but thiocyanate had the highest weight (0.495). There was no correlation between single ion exposure and combined exposure and maternal thyroid hormone levels in the urine of pregnant women in Midong District.

[Conclusion] Single exposure to perchlorate and combined exposure to perchlorate, thiocyanate, and nitrate are both risk factors for abnormal thyroid hormone levels in pregnant women. Relevant departments should continuously increase their attention to the issue of exposure to water-soluble inorganic salt ions, strengthen monitoring and prevention efforts, and ensure the health of pregnant women and their offspring.

Keywords: perchlorate; thiocyanate ; nitrate; combined exposure; thyroid hormones; pregnancy