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## Long-term stress and diet among Finnish pre-schoolers

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### Abstract

**Introduction:** Studying the link between children's stress and diet is crucial, as early childhood is an important period for the development of eating habits as well as other health behaviours. Among adults, studies have shown that elevated cortisol levels (indicator of long-term stress) might be associated with overweight and a preference for energy-dense foods. However, the association between hair cortisol concentration (HCC) and diet among pre-school-aged children is poorly understood. The aim of this study was to investigate whether HCC, a measure of long-term stress, is associated with diet among 3–6-year-old Finnish children.

**Materials and methods:** The current cross-sectional study is a part of the DAGIS study conducted in 66 Finnish pre-schools in 2015–2016. Of the 864 participating pre-schoolers, 578 (67%) provided the information needed to examine the association between HCC and diet. HCC was measured from 4-cm hair samples using a chemiluminescence immunoassay, and the HCCs were categorized into fifths. The parents of the participating children filled in a food frequency questionnaire (FFQ) assessing the child's food consumption outside preschool hours. The FFQ items ( $n = 47$ ) were used as inputs in principal component analysis to derive dietary patterns. The associations between HCC and food group consumption frequencies as well as dietary pattern scores for 'sweets-and-treats', 'health-conscious' and 'vegetables-and-processed meats' patterns were examined with multilevel linear mixed models and adjusted for age, gender and parental education.

**Results:** The median HCC was 11.7 pg/mg (min 0.24, max 879.6). Compared to the children who had the lowest HCCs, the children with the highest HCCs consumed vegetables as well as fruits and berries less frequently ( $\beta = -1.62$ , 95% CI -3.14, -0.09;  $\beta = -1.49$ , 95% CI -2.95, -0.04) and scored lower on the 'health-conscious' dietary pattern ( $\beta = -0.31$ , 95% CI -0.51, -0.11). After adjustments, the associations between HCC and fruit and berry and sugary beverage consumption as well as 'health-conscious' pattern were significant ( $\beta = -1.62$ , 95% CI -3.09, -0.16;  $\beta = 1.30$ , 95% CI 0.06, 2.54;  $\beta = -0.33$ , 95% CI -0.53, -0.14).

**Discussion:** This study supports the link between long-term stress and lower-quality diet, as it showed that elevated HCCs and less healthful diets were connected already in the early childhood. However, because of the cross-sectional design of the study, we are not able to conclude whether stress affects diet or vice versa. Nevertheless, these results give reason to further investigate the relationship between stress and children's eating habits as well as health in general.

### Conflict of Interest

There is no conflict of interest.