Study associates organic food intake in childhood with better cognitive development

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A study analyzing the association between a wide variety of prenatal and childhood exposures and neuropsychological development in school-age children has found that organic food intake is associated with better

scores on tests of fluid intelligence (ability to solve novel reasoning problems) and working memory (ability of the brain to retain new information while it is needed in the short term). The study, published in *Environmental Pollution*, was conceived and designed by researchers at the Barcelona Institute for Global Health (ISGlobal)—a center supported by the "la Caixa" Foundation—and the Pere Virgili Health Research Institute (IISPV-CERCA).

The explanation for this association may be that "healthy diets, including organic diets, are richer than fast food diets in nutrients necessary for the brain, such as fatty acids, vitamins and antioxidants, which together may enhance cognitive function in childhood," commented lead author Jordi Júlvez, a researcher at IISPV-CERCA who works closely with ISGlobal.

The study also found that fast food intake, house crowding and environmental tobacco smoke during childhood were associated with lower fluid intelligence scores. In addition, exposure to fine particulate matter (PM2.5) indoors was associated with lower working memory scores.

The study, titled "Early life multiple exposures and child cognitive function: A multi-centric birth cohort study in six European countries," used data on 1,298 children aged 6-11 years from six European country-specific birth cohorts (United Kingdom, France, Spain, Greece, Lithuania and Norway). The researchers looked at 87 environmental factors the children were exposed to in utero (air pollution, traffic, noise, various chemicals and lifestyle factors) and another 122 factors they were exposed to during childhood.

A Pioneering Study

The aim of the study was to analyze the influence of these exposures on the development and maturation of the human brain, since during

childhood the brain is not yet fully developed for efficient defense against environmental chemicals and is particularly sensitive to toxicity, even at low levels that do not necessarily pose a risk to a healthy mature brain.

The originality of the study lies in its use of an exposome approach, i.e. the fact that it takes into account the totality of exposures rather than focusing on a single one. This approach aims to achieve a better understanding of the complexity of multiple environmental exposures and their simultaneous effect on children's neurodevelopment.

Another strength of the study, which analyzes cohorts from six European countries, is its diversity, although this factor also poses the additional challenge of cultural differences, which can influence exposure levels and cognitive outcomes.

Notable Associations

The study found that the main determinants of fluid intelligence and working memory in children are organic diet, fast food diet, crowdedness of the family home, indoor air pollution and tobacco smoke. To date, there has been little research on the relationship between type of diet and cognitive function, but fast food intake has been associated with lower academic development success and some studies have also reported positive associations between organic diets and executive function scores. "In our study," explained Júlvez, "we found better scores in fluid intelligence and working memory with higher organic food intake and lower fast food intake."

In contrast, exposure to tobacco smoke and indoor PM2.5 during childhood may negatively affect cognitive function by enhancing pro-inflammatory reactions in the brain. Still, according to Júlvez, it is worth bearing in mind that "the number of people living together in a home is

often an indicator of the family's economic status, and that contexts of poverty favor less healthy lifestyles, which in turn may affect children's cognitive test scores."

Some Surprising Findings

The study also found some unexpected associations, which could be explained by confounding and reverse causality. For example, a positive association was found between childhood exposure to perfluorooctane sulfonic acid (PFOS) and cognitive function, even though PFOS is considered an endocrine disruptor that may alter thyroid function and negatively influence cognitive development.

The study forms part of the large European project Human Early-Life Exposome (HELIX), as does another recent paper that used the same exposome and the same participants but looked at symptoms of attention deficit hyperactivity disorder (ADHD) and childhood behavioral problems. "We observed that several prenatal environmental pollutants (indoor air pollution and tobacco smoke) and lifestyle habits during childhood (diet, sleep and family social capital) were associated with behavioral problems in children," explained Martine Vrijheid, last author of the study and head of ISGlobal's Childhood and Environment program.

"One of the strengths of this study on cognition and the earlier study on behavioral problems is that we systematically analyzed a much wider range of exposure biomarkers in blood and urine to determine the internal levels in the model and that we analyzed both prenatal and childhood exposure variables," concluded Vrijheid.

Tests used to quantify cognitive function:

1. Raven's Coloured Progressive Matrices (fluid intelligence)

2. Attention Network Test (attention)
3. N-Back (working memory)

Cohorts used in the study:

1. Born in Bradford (BiB), United Kingdom
2. Étude des déterminants pré- et postnatals du développement et de la santé de l'enfant (EDEN), France
3. Infancia y Medio Ambiente (INMA), Spain
4. Kaunus Cohort (KANC), Lithuania
5. Norwegian Mother, Father and Child Cohort Study (MoBa), Norway
6. Mother-Child Cohort in Crete (Rhea), Greece

More information: Jeroen de Bont et al, Urban environment and obesity and weight-related behaviours in primary school children, *Environment International* (2021). DOI: 10.1016/j.envint.2021.106700

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