////Title: The Benefits of an Organic Diet on Oxidative Stress and Inflammation in Children

////Stand-first:

Lifestyle factors and behavioural changes, such as diet modifications, are gaining interest as methods to modify or even prevent the global progression of chronic diseases, such as heart conditions and type 2 diabetes. Dr Konstantinos Makris (con-stan-teen-os Mah-kris), at the Cyprus International Institute for Environmental and Public Health within the Cyprus University of Technology, and his colleagues conducted a clinical trial to investigate the benefits of eating an organic diet in school children, with findings making an important contribution to this emergent field.

////Body text:

Previous clinical studies in adults have indicated a link between organophosphate (awr-*guh*-noh-**fos**-feyt) pesticides, and oxidative stress and inflammation. In addition, studies in animal models have demonstrated an association of some pesticides, specifically pyrethroid (pahy-**ree**-throid) and neonicotinoids (neo-nic-o-ti-noid), with oxidative stress and inflammation. Researchers have now proposed an association (*uh*-soh-see-**ey**-sh*uh*n) between these processes with fat development and weight gain.

Although a number of clinical trials and studies have investigated the impact of an organic diet into oxidative stress and inflammation, conclusions remain limited as the research has typically lacked scientific rigour. These earlier studies had issues with duration, or the use of specific food items instead of a whole diet.

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To address the limitations of previous studies, Dr Konstantinos Makris at the Cyprus International Institute for Environmental and Public Health within the Cyprus University of Technology conducted a large-scale clinical trial with colleagues in which a total of 149 primary school children were recruited. Given that some previous studies have used durations of organic diet considered too short to result in tangible benefits, Dr Makris and colleagues extended the duration of exposure to the organic and conventional diets in their study to 40 days each.

Over the entire 80 days of the study, the children, who were split into two groups, consumed the organic diet and their usual conventional diet over two separate periods. Children in group one consumed an organic diet for 40 days and then their usual diet for a further 40 days, while children in group two undertook these diet manipulations in the reverse order.

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Urine samples were collected at a number of points throughout the study to determine levels of pesticide metabolites namely 3-PBA, which is a metabolite of pyrethroid pesticides and 6-CN, which is a metabolite of neonicotinoid pesticides, using mass spectroscopy. Levels of biomarkers denoting oxidative stress and inflammation, specifically 8-iso-pgf2a, MDA and 8-OHdG were determined by immunoassays.

In brief, the team found that levels of pesticide metabolites were more frequently below the limit of detection using the chosen detection method during the organic diet than during the conventional diet. Only 23% of samples of 6-CN were detected during the organic diet compared to 33% during

the conventional diet. Likewise, for 3-PBA, only 68% of samples were detectable during the organic diet while 85% of conventional diet samples contained detectable levels of metabolite.

More detailed analysis showed that participants had significantly lower levels of 3-PBA and significantly less likelihood of samples containing detectable levels of 6-CN during the organic diet compared to their conventional diet.

The trends observed in pesticide metabolite detection were comparable to those seen in other studies with organophosphates. The low numbers of samples containing detectable levels of 6-CN were expected and likely the result of a recent EU directive ban on few neonicotinoid pesticides.

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For markers of oxidative stress and inflammation, Dr Makris and colleagues found that during the organic diet, the level of 8-OHdG was immediately and sustainably lower than during the conventional diet. For the other two oxidative stress and inflammation biomarkers in this study, both 8-iso-PGF2a and MDA showed an initial increase which was followed by a gradual reduction during the organic diet.

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Statistical analyses looking at the relationship between the presence of pesticide metabolites and levels of oxidative stress and inflammatory biomarkers showed a relationship between 3-PBA and both 8-iso-PGf2a and 8-OHdG, but no association with 3-PBA and MDA.

Unsurprisingly, given the few samples where 6-CN was detectable, there was no association identified between this group of pesticide metabolites and any of the oxidative stress and inflammation biomarkers.

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While not the main focus of this study, the researchers also found that the organic diet was negatively correlated with corrected body mass index (BMI) scores, that is, overall BMI was lower during the organic diet than the conventional diet.

This finding tentatively supports some previous work in adults indicating a putative negative link between the consumption of an organic diet and the likelihood of being overweight or obese. As such, eating an organic diet may increase the likelihood of having a normal BMI. However, it is important to note that adults who consume an organic diet generally have healthier lifestyles, and the researchers cannot, as of yet, conclude that eating an organic diet is causally linked to the lower weight of these individuals.

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While Dr Makris and colleagues took considerable care to minimise methodological limitations in this study, they note that while compliance with the set diet was reported to be 90%, this may not be entirely accurate. They also note that there was an imbalance of the composition of the two dietary phases, with the consumption of fruit and vegetables during the conventional diet phase being substantially lower than that during the organic phase.

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Further work is required to identify any causative link between pesticide exposure and the resulting levels of oxidative stress and inflammation, and BMI. Nonetheless, the methodological approach taken by Dr Makris and colleagues allows them to conclude that, critically, eating an organic diet results in lower levels of the pesticides tested, and over time, in lower levels of oxidative stress and inflammation biomarkers.

Meet the Researcher

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Key Collaborators

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