Serum Marker of Glyphosate Exposure Associated with Changes in Oral and Gut Microbiome Composition

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Background: Glyphosate, the main chemical in popular weed killers, is found in common foods such as breakfast cereals, bread-products, eggs, and snack foods. Glyphosate blocks a necessary amino acid pathway in plants and bacteria, providing biological rationale that it can disrupt the balance of bacteria in human microbiomes. Microbiome imbalance is linked to multiple cancers, diabetes, and cardiovascular disease. There have been no human studies examining the association between glyphosate exposure from food and human microbiomes. Methods: I used de-identified serum, saliva, and stool samples from 96 racially diverse adults participating in a biospecimen repository. A competitive ELISA was used to quantify serum glyphosate levels, a marker of dietary exposure. Oral and gut microbiome compositions were analyzed using 16S rRNA sequencing. The association between the glyphosate levels and the microbiome compositions were assessed using PERMANOVA, MANOVA, and univariate regression models. Results: Glyphosate was detected in all serum samples, implying that dietary glyphosate exposure is prevalent throughout the US population. Higher serum glyphosate levels significantly correlated with abundance changes in multiple oral and gut bacteria. Conclusions: This study was the first to determine levels of glyphosate in human blood and the first to analyze the association between glyphosate and the composition of oral and gut bacteria in humans. Glyphosate levels were associated with significant oral and gut microbiome changes in humans. These changes have known negative health effects and are linked to increased risk of chronic diseases. Exposure to glyphosate on food may negatively affect human health.

Awards Won:

Fourth Award of $500