

Xie, Z., Sutaria, S. R., Chen, J. Y., Gao, H., Conklin, D. J., Keith, R. J., Srivastava, S., Lorkiewicz, P., & Bhatnagar, A. (2024). Evaluation of urinary limonene metabolites as biomarkers of exposure to greenness. *Environmental Research*, 245, 117991. <https://doi.org/10.1016/j.envres.2023.117991>

## **Definitions**

- **Greenness Exposure:** Being around areas with a lot of plants and trees.
- **Biogenic Volatile Organic Compounds (BVOCs):** Natural chemicals released by plants.
- **Limonene:** A common BVOC found in many plants.
- **LC-MS (Liquid Chromatography-Mass Spectrometry):** A technique used to identify chemicals in samples.
- **Biomarkers:** Indicators in the body that show exposure to certain substances.

## **Key Findings**

- Urinary limonene metabolites can be used as biomarkers to measure exposure to green environments.
- Eighteen different metabolites were found in urine after limonene inhalation.
- The levels of certain metabolites increased after exposure to a forested area.

## **Introduction**

This study explores how being around green spaces can improve health. Researchers investigated if chemicals from plants, like limonene, that show up in urine can be used to measure how much time people spend in green areas.

## **Main Content**

### **Background**

Current methods to measure exposure to green environments include using satellite images, calculating the percentage of green space in an area, assessing proximity to green spaces, and collecting self-reported data. However, these methods are not always precise. There is a need for more accurate and quantitative ways to assess how much time individuals spend in green environments and how this exposure affects their health.

### **Objectives**

The main goal was to see if urinary limonene metabolites could serve as reliable biomarkers of exposure to green environments.

### **Methods**

- **Participants:** Eight healthy volunteers were recruited and asked to inhale limonene or spend time in a forest.
- **Urine Collection:** Urine samples were collected before and after exposure.
- **Analysis:** Samples were analyzed using LC-MS to detect and measure metabolites.

## **Results**

- **Limonene Metabolites:** Researchers found 18 different metabolites in the urine after limonene inhalation.
- **Forest Exposure:** Levels of these metabolites increased after participants spent time in the forest, indicating recent exposure to greenness.

## **Conclusion**

Urinary limonene metabolites, especially uroterpenol glucuronide and dihydroperillic acid glucuronide, can be used to measure individual exposure to green spaces. This method is promising for understanding how greenness impacts health and can complement existing measurement techniques. Future research should focus on refining these biomarkers and exploring their potential uses further.

Word Count: 341

This summary was generated July 2024 by ChatGPT4.o and has not been reviewed for accuracy. This summary should not be relied on to guide health-related behavior and should not be reported in news media as established information. Please refer to the original journal publication listed in the hyperlink on the first page to validate representations made here. This summary will be updated once an expert review is complete.