

A place-based biomarker approach to understanding dietary inequalities in food-insecure communities in the UK

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Introduction

Health inequalities related to poor diet are more prevalent in disadvantaged communities¹. Traditional dietary assessment tools (FFQ, 24h recall) are limited by recall bias. Biomarkers provide objective and quantifiable measures of nutrient intake. This study applied a place-based approach to explore dietary patterns across four disadvantaged UK communities, using biomarkers in urine and hair to provide objective indicators of nutritional intake.

Methods

- **Design:** Cross-sectional study; **Sample collection:** Single-spot urine & hair
- **Participants:** Adults across four sites located within high IMD (Indices of Multiple Deprivation) areas: BHFP in Brighton & Hove (n=25), FGCT in Plymouth (n=38), WCDA in Reading (n=53), and Tower Hamlets (n=11).

Results

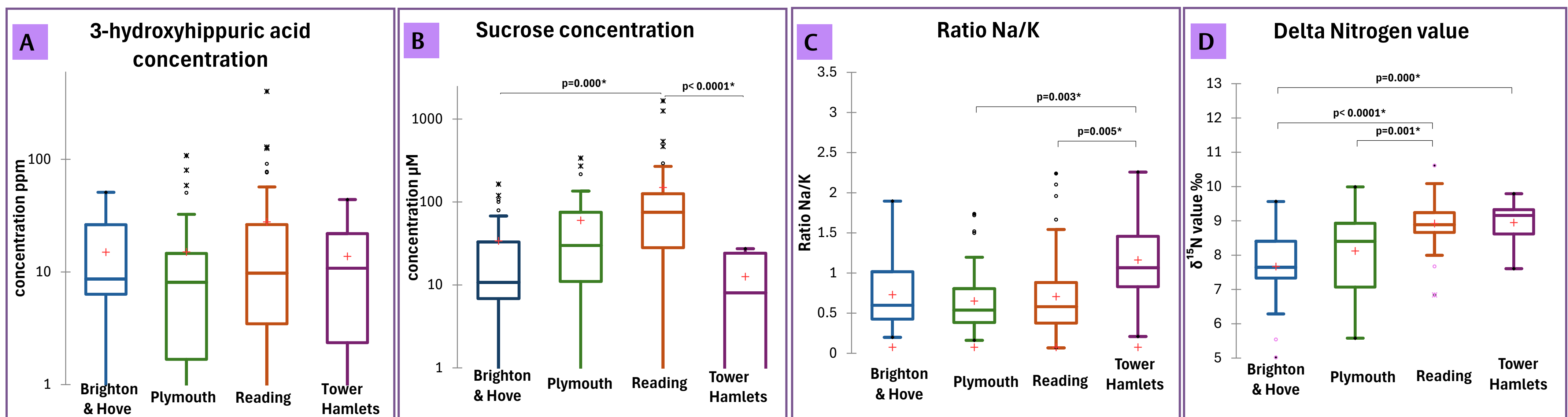


Fig. 1: The average concentration of different biomarkers in urine and hair at four sites. Letters A, B, C, and D refer to 3-hydroxyhippuric acid concentration, sucrose concentration, the ratio of sodium to potassium, and delta nitrogen values, respectively. * represents significant differences with $p=0.05$ from a Kruskal-Wallis test with a Bonferroni correction for multiple comparisons. The line is the median, boxes are the interquartile range, and whiskers are 1.5 times the interquartile range.

Results from urinary 3-hydroxyhippuric acid concentration (Fig. 1A) show no significant differences among the four cohorts, suggesting similar intake of fruit, vegetables, & tea. Urinary sucrose concentration (Fig. 1B) was significantly higher in Reading (median: 75.23 μM ; IQR: 28.0–125.7) than in the other locations, indicating greater exposure to sugar-rich foods & beverages. The Tower Hamlets cohorts (Fig. 1C) had a higher sodium-to-potassium ratio (median: 1.06; IQR: 0.82–1.46) than participants from the other locations, consistent with diets containing more salted foods. The stable isotope ratio of nitrogen ($\delta^{15}\text{N}$), a marker of protein source in hair, was significantly higher in the Tower Hamlets cohorts (median: 9.16‰; IQR: 8.82–9.33) than participants from other locations (Fig. 1D), suggesting a greater consumption of animal-derived protein.

Conclusion

Biomarkers provided objective insights into dietary intake, revealing nutritional patterns that may not be detectable through traditional recall based self-assessment approaches. Clear site-specific differences reflected the influence of cultural practices and local food environments on dietary intake. Although the cross-sectional design, small sample sizes, and single-spot urine & hair samples limit assessment of long-term intake, the findings still offer a useful foundation for designing targeted and equitable interventions in disadvantaged communities.

References

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