

Antioxidant profiles of vertically farmed leafy herbs

A. Clark¹, A. Prashar², N. Boonham², G. Robinson^{1,3}, F. Colwell^{2,3} and T.R. Hill¹

¹Human Nutrition and Exercise Research Centre, Population Health Sciences Institute, Faculty of Medical Sciences, Newcastle University, UK,

²School of Natural and Environmental Sciences, Newcastle University, UK and

³Infarm Ltd, Elm Farm Industrial Estate, Bedford, UK

Leafy herbs grown in traditional soil base systems serve as a potential source of secondary metabolites with antioxidant activity⁽¹⁾. However, published data on the antioxidant profiles of herbs grown under hydroponic vertical farming systems is extremely limited. The aim of this study was to determine the profiles of antioxidant-relevant metabolites in vertically farmed herbs.

Samples of Italian Basil, Flat Coriander, Flat Parsley, Dill, and Green Mint (n = 10 per crop) were grown in a vertical farming unit, under white light (day night cycle of 18/6 hours). Irrigation was conducted every two hours (during day period) using the Ebb and Flow technique. Plant growing cycle was between 3 weeks plus nursery time; upon harvesting, herbs were freeze-dried overnight. Total Phenolic content (TPC), total carotenoids and chlorophyll, and ascorbic acid/vitamin C were determined in crops using spectrophotometric methods. A Welch ANOVA with Games-Howell post hoc test was used to verify inter-crop effects if data were normally distributed, otherwise a Kruskal-Wallis test with post-hoc Dunn test was used if data were not normal (RStudio Version 2022.07.2 + 576). In all cases, significance was achieved when $p < 0.05$.

Phenolic compounds in Italian Basil ($40.04 \pm 6.08\text{mg/g DW}$) showed greater content of these compounds in comparison to Flat Parsley ($8.49 \pm 1.35\text{mg/g DW}$), Flat Coriander ($7.55 \pm 0.58\text{mg/g DW}$), and Dill ($7.13 \pm 1.63\text{mg/g DW}$) ($p < 0.01$). Dill demonstrated higher content of total carotenoids ($1.16 \pm 0.13\text{mg/g DW}$) in comparison to other crops ($p < 0.01$). Flat Parsley ($0.60 \pm 0.08\text{mg/g DW}$) showed higher levels in comparison to Green Mint ($0.43 \pm 0.11\text{mg/g DW}$), Italian Basil ($0.40 \pm 0.06\text{mg/g DW}$), and Flat Coriander ($0.20 \pm 0.17\text{mg/g DW}$) ($p < 0.05$). Regarding total ascorbic acid, Green Mint ($4.19 \pm 1.18\text{mg/g DW}$), Flat Parsley ($4.17 \pm 0.86\text{mg/g DW}$) and Flat Coriander ($3.58 \pm 0.62\text{mg/g DW}$) showed the highest content; Italian Basil ($2.84 \pm 0.40\text{mg/g DW}$) demonstrated reduced concentrations in comparison to Flat Parsley ($p < 0.05$). Dill ($1.89 \pm 0.05\text{mg/g DW}$) showed the lowest values of ascorbic acid in comparison to the other species ($p < 0.01$).

Nutrition databases indicate that soil-based herbs may generally have higher total phenolic content and reduced ascorbic acid in comparison to vertically grown herbs^(2,3). The study has provided baseline values of secondary metabolites in vertically farmed leafy herbs and has indicated that these crops can vary in serving as sources of antioxidant compounds.

Acknowledgments

We gratefully acknowledge Innovate UK for funding this research.

References

1. Henning SM, Zhang Y, Seeram NP *et al.* (2011) *Int J Food Sci Nutr* **62**, 219–225.
2. Neveu V, Perez-Jimenez J, Vos F *et al.* (2010) *Phenol-Explorer: an online comprehensive database on polyphenol contents in foods*. [Available at: <http://phenol-explorer.eu>].
3. US Department of Agriculture (2022) *FoodData Central Data* [Available at: <https://fdc.nal.usda.gov/download-datasets.html>].