

# Phytochemical and physicochemical properties of dried orange peel as affected by processing conditions



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PORTO

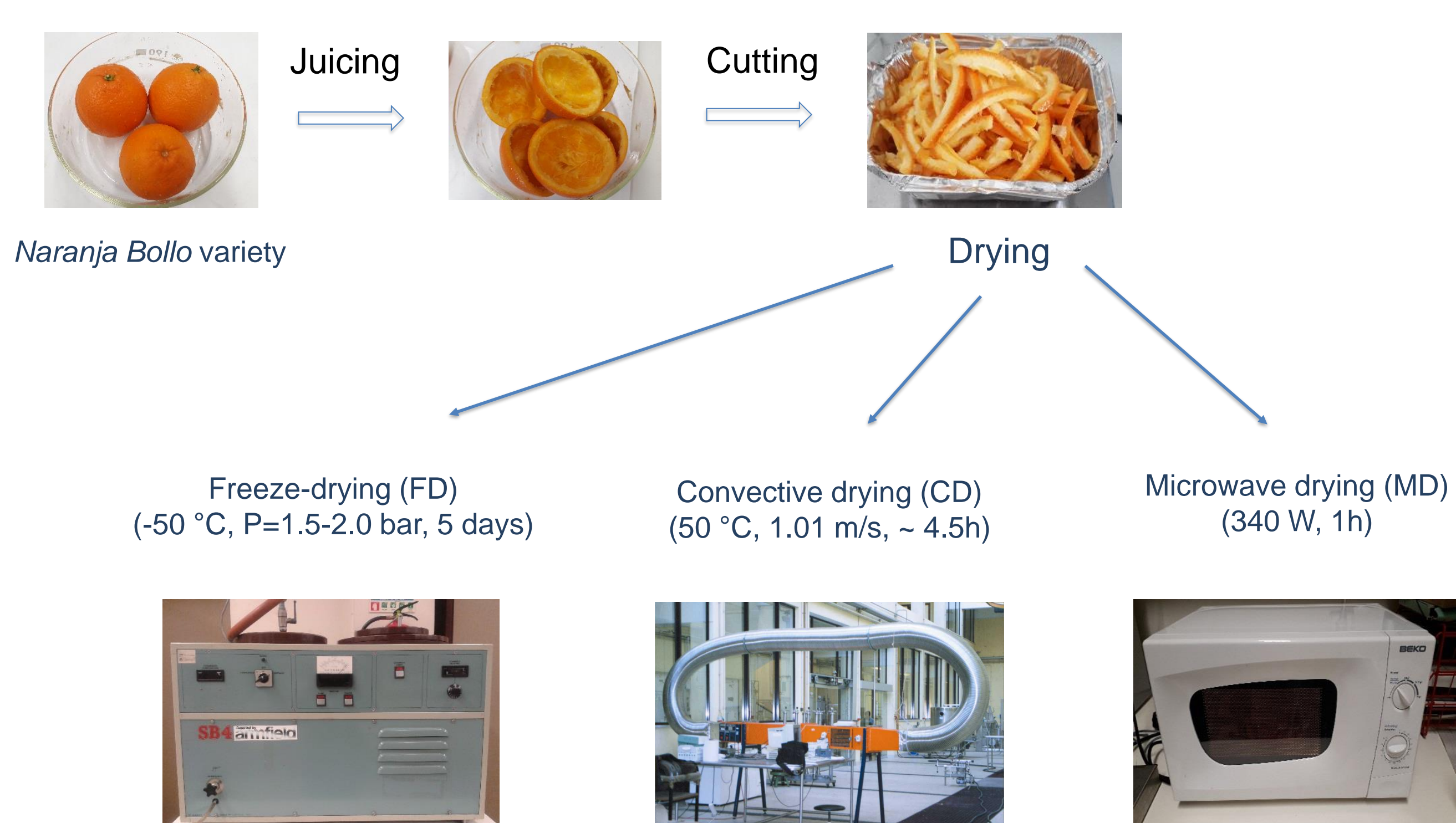
## Introduction

- Orange peel is a valuable natural source of fiber and phytochemicals (Obafaye and Omoba, 2018).
- Orange by-products (peel, seeds, rag and pulp) represent 50-60% of the whole fruit, being discarded after juicing (Zaker et al., 2017).
- Orange peel powder has been incorporated with other flours in baked products such as cakes, breads and biscuits (Kiran, Bala and Kumar, 2013), improving their dietary fibre and bioactive compounds content.

## Objectives

- The main objective of this study was to evaluate the phytochemical and physicochemical properties of orange peel as affected by three drying methods: convective drying, microwave drying and freeze-drying.
- Water activity, water content, total phenolic compounds, total antioxidant activity and colour characteristics ( $L^*$ ,  $a^*$ ,  $b^*$  coordinates and browning index) were assessed.

## Methodology



### Quality Analysis

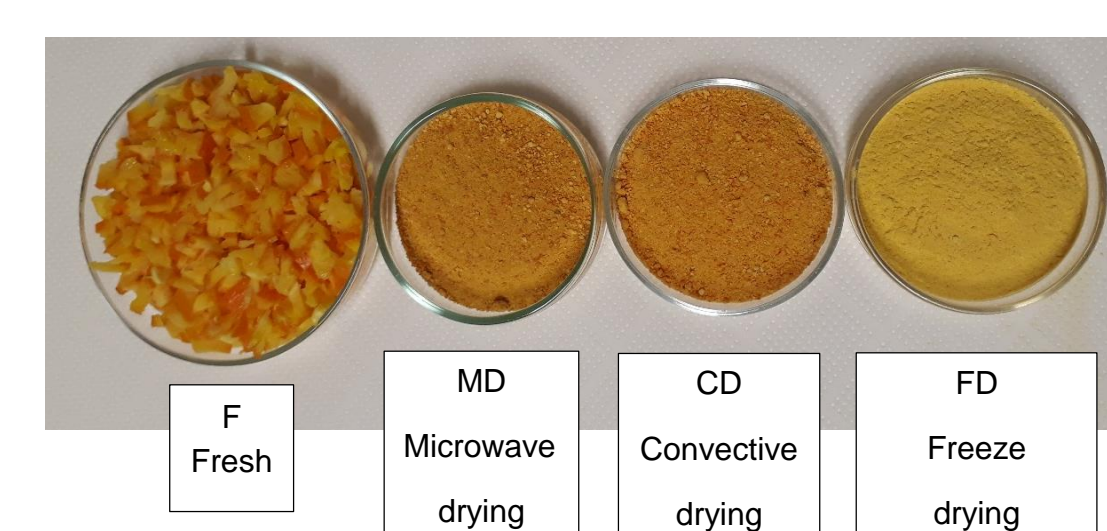


- ✓ Total phenolic compounds (TPC) by Folin-Ciocalteu method
- ✓ Total antioxidant activity (TAA) by ABTS radical method
- ✓ Water activity (aw)
- ✓ Water content
- ✓ Colour –  $L^*$   $a^*$   $b^*$  coordinates and browning index (BI)
  - $L^*$  for lightness (from black 0 to white 100)
  - $a^*$  from green (-) to red (+)
  - $b^*$  from blue (-) to yellow (+)

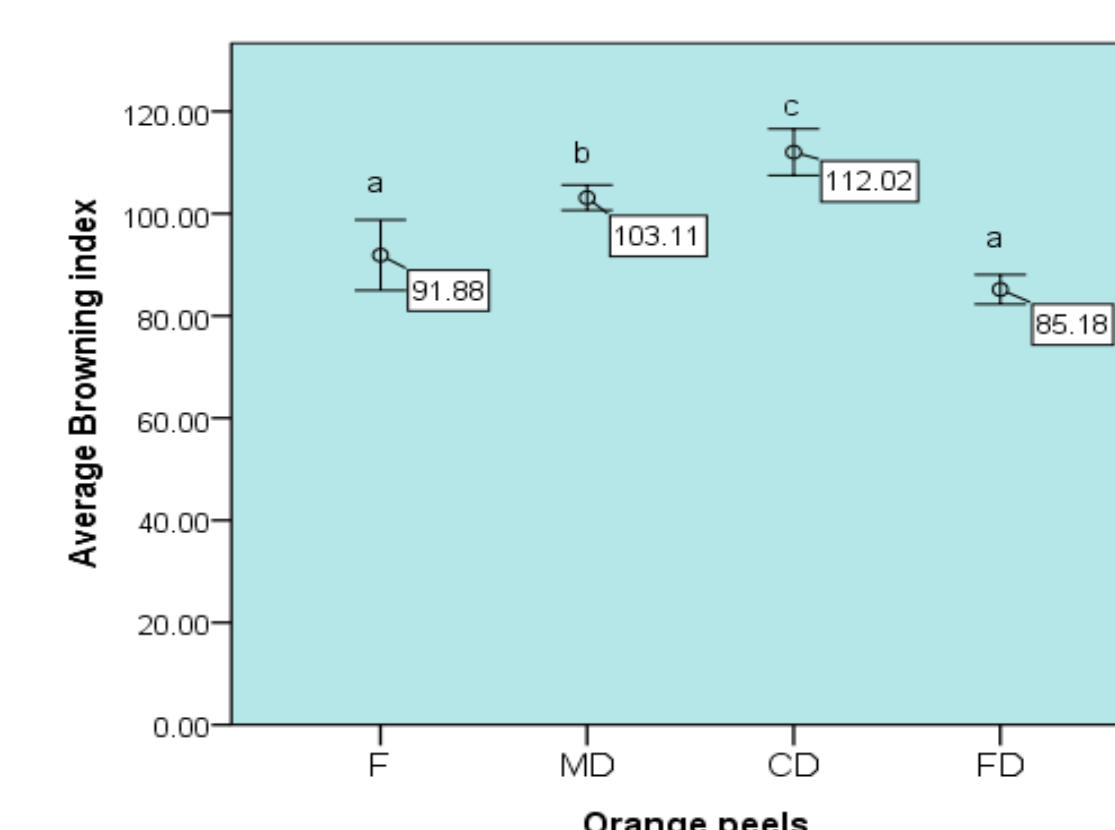


## Results & Discussion

### Colour



- $L^*$  and  $b^*$  values of the FD orange flour increased when compared to the fresh orange peel, and  $a^*$  value decreased. This indicates that FD samples are more bright and yellow and less red than fresh samples.

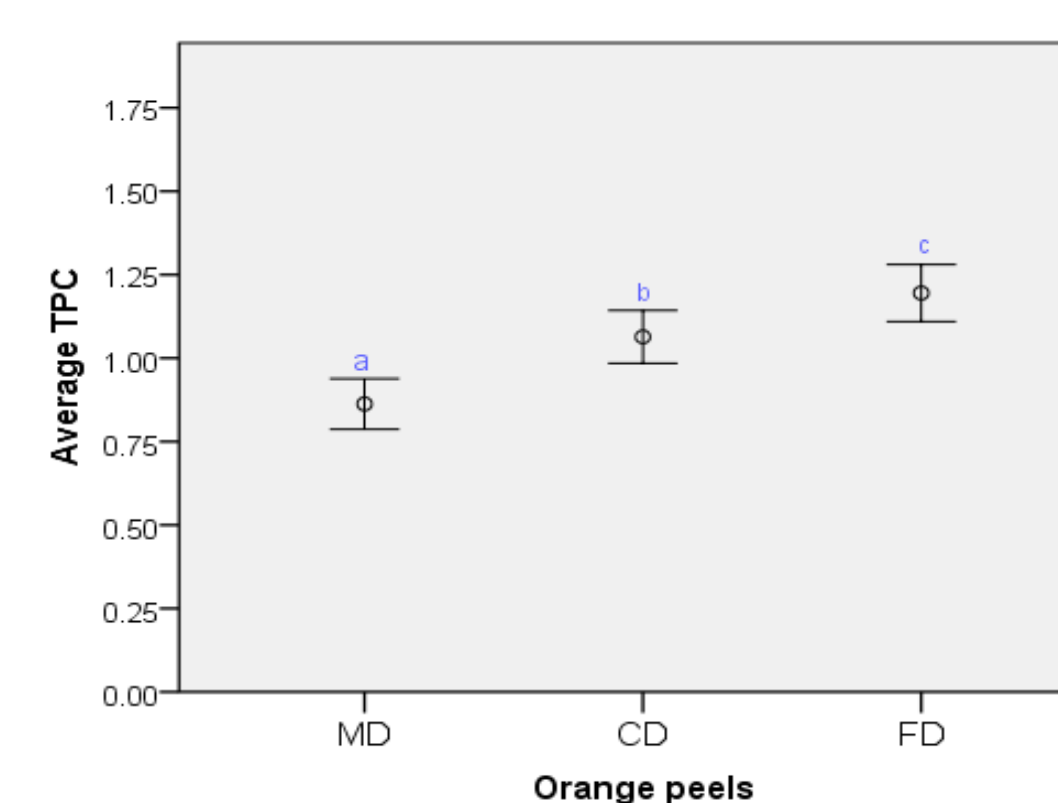


Values with different letters differ significantly (p<0.05).

- FD samples got lower browning index when compared to MD and CD methods and were equivalent to fresh peel samples.

### Total Phenolic Compounds (TPC)

normalized in relation to fresh samples

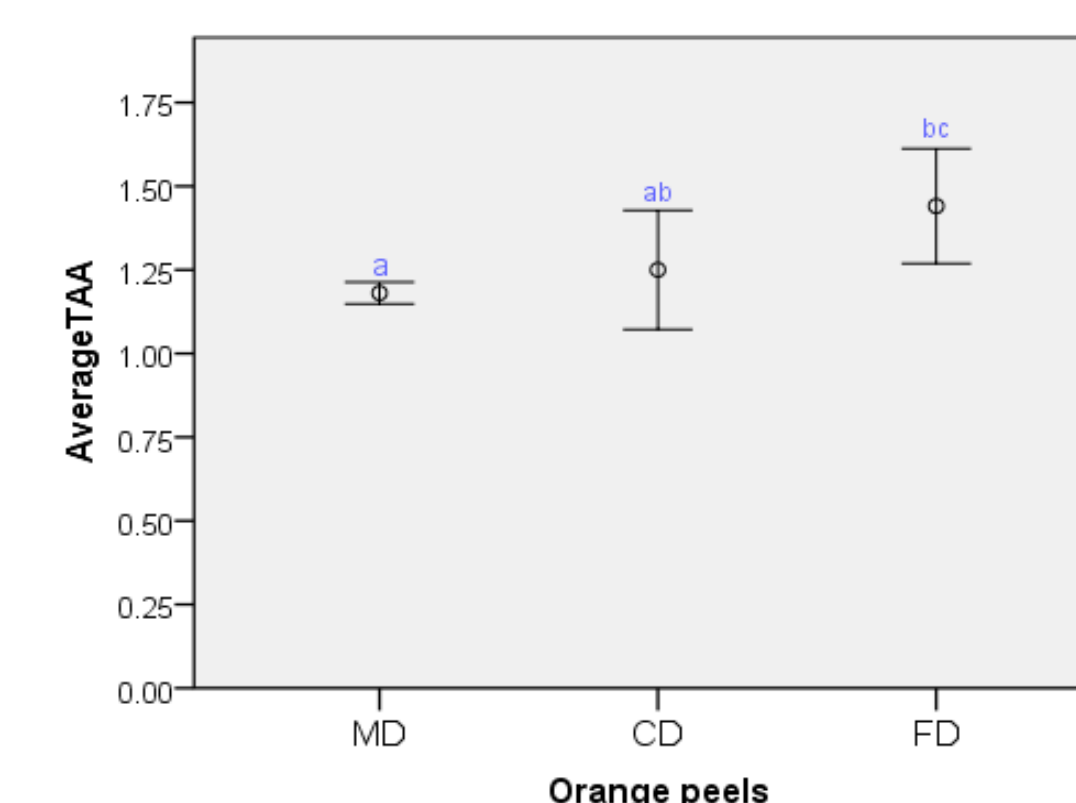


Values with different letters differ significantly (p<0.05).

- Total phenolic compounds, when compared to fresh peel, had an average decrease of 13.7% after microwave drying and increased by 6.4% and 19.5% after convective and freeze-drying processes, respectively.

### Total Antioxidant Activity (TAA)

normalized in relation to fresh samples



Values with different letters differ significantly (p<0.05).

- Total antioxidant activities of dried orange peel improved on average 18.1%, 25.0% and 44.1%, after microwave, convective and freeze drying processes, respectively.

- Water activity of the dried orange peel was below 0.45 for the three different drying methods, showing a good acceptance level for safe storage of samples.
- CD and FD processes increased the phytochemical properties such as TPC and TAA values of the dried orange peels, with the FD method having a higher effect.

### References

- Kiran, L., Bala, K. and Kumar, A. (2013) 'Development and Quality evaluation of Fortified Biscuits', *The Allahabad Farmer*, LXIX, pp. 1–9.
- Obafaye, R. O. and Omoba, O. S. (2018) 'Orange peel flour: A potential source of antioxidant and dietary fiber in pearl-millet biscuit', *Journal of Food Biochemistry*, (January), pp. 1–8. doi: 10.1111/jfbc.12523.
- Zaker, M. A. et al. (2017) 'Utilization of orange (Citrus sinensis) peel powder as a source of dietary fibre and its effect on the cake quality attributes', *International Journal of Agricultural Sciences*, 13(1), pp. 56–61. doi: 10.15740/HAS/IJAS/13.1/56-61.

## Conclusions

- Freeze-drying process enhanced the total phenolic compounds, total antioxidant activity, and colour properties, when compared to those observed in microwave and convective dried orange peel.
- Furthermore, the dried orange peel flour may be an excellent value added ingredient, with potential to be implemented in the food pastry and bakery industry, by incorporation in cakes, biscuits or bread recipes.

### Acknowledgements

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