Functional mango peel powders: what is the impact of different drying methods on their phytochemical composition and antioxidant activity?

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In 2018, mangoes were among the six most-produced fruits worldwide(1). Annually, 15–25 million tons of mango byproducts are generated(2). According to the previous studies, one of the best strategies to valorise mango peels in the food industry is to convert them into powders(2). Hence, this study aims to evaluate the impact of different drying methods on mango peels' nutritional composition, bioactive compounds, and antioxidant activity.

Firstly, mango peels were washed with peracetic acid (PAA) (mango peels to disinfectant solution ratio: 1:1 (kg:L); PAA concentration: 27 mg/mL; disinfection time: 19 min) **(fresh sample (FS))**(1). Then, they were submitted to three different processes: freeze-drying **(freeze-dried samples (FD))**; hot-air drying at 65 ºC for 48 h, with constant air circulation **(hot-air dried samples (HAD))**; and freezing at -20 ºC for 30 days and then hot-air drying at 65 ºC for 48 h, with constant air circulation **(Frozen and hot-air dried samples (FZ+HAD)).** The dry matter, soluble and insoluble fiber, protein, fat, and ash of these four samples were determined according to AOAC methods. Carotenoids were extracted with hexane: acetone (50%:50%; v:v). Moreover, free and bound phenolic compounds were obtained by performing a methanolic extraction and an alkaline and acid hydrolysis, respectively. The main mango peels' carotenoids and phenolic compounds were identified using HPLC analysis. Finally, total free and bound phenolic compounds were quantified through Folin-Ciocalteu method, and their antioxidant activity was evaluated through DPPH and ABTS assays.

Overall, the different drying methods did not impact mango peels' soluble and insoluble fiber, protein, fat, and ash content. Considering the four analysed samples, these parameters ranged between 19.47±0.48 - 20.73±0.44, 19.60±0.62 – 21.04±1.89, 4.93±0.13 – 6.02±0.44, 1.56±0.01 – 1.92±0.03, and 2.05±0.19 – 2.89±0.11, respectively. All of them were expressed in g/100DW. However, drying markedly impacted mango peels' phenolic compounds, carotenoids, and antioxidant activity. All drying methods caused a statistically significant decrease in total free phenolic compounds (FS: 12.76±0.80 mg of gallic acid equivalents (GAEs) / gDW; FD: 10.04±0.17 mg of GAEs/ gDW; HAD: 7.69±0.12 mg of GAEs/ gDW; FZ+HAD: 6.63±0.05 mg of GAEs/ gDW). The main free phenolic compounds identified in all samples were mangiferin (FS: 873.61±71.43; FD: 863.71±6.15; HAD: 647.61±1.86 FZ+HAD: 447.88 ± 5.37), gallic acid (FS: 590±30.93; FD: 650.48±11.85; HAD: 850.29±10.99 FZ+HAD: 523.60 ±10.83), quercetin-3-O-galactoside (FS: 467.20±34.15; FD: 464.31±1.97; HAD: 391.07±4.29 FZ+HAD: 502.41±22.73) and penta-O-galloyl-β-D-glucose (FS: 397.60±22.56; FD: 384.30±5.63; HAD: 362.88±5.03 FZ+HAD: 167.94 ±3.36). Compared with other dried peels, FZ+HAD samples showed a significantly lower amount of these compounds (excluding quercetin-3-O-galactoside). Gallic acid (basic hydrolyse: FS: 476.99±52.51; FD: 42.65±0.94; HAD: 152.66±15.35 FZ+HAD: 207.74±4.23; acid hydrolyse: FS: 83.00±12.98; FD: 12.27±0.16; HAD: 23.25±0.02 FZ+HAD: 28.26±0.76) and 4–hydroxybenzoic acid (basic hydrolyse: FS: 59.26±5.00; FD: 16.69.65±0.69; HAD: 50.39±4.17 FZ+HAD: 46.15±6.23; acid hydrolyse: FS: 23.13±0.75; FD: 2.58±0.14; HAD: 6.12±0.25 FZ+HAD: 5.63±0.50) were the main phenolic compounds obtained in both basic and acid hydrolysis. All phenolic compound amounts were expressed in μg/gDW. Regarding carotenoids, drying also had a negative impact. FS samples contained violaxanthin (2.94±0.05 μg/gDW), lutein (4.83±0.52 μg/gDW), and β-carotene (104.46 ±0.25 μg/gDW), while in dried samples, only lutein (lower than quantification limit) and β-carotene (FD: 36.19 ± 0.53 μg/gDW HAD: 36.06 ± 2.45 μg/gDW; FZ+Oven: 40.65 ± 3.66 μg/gDW) were detected. All drying methods impaired the antioxidant activity of free and bound phenolic compounds. As expected, freeze drying enabled a better preservation of free phenolic compounds' antioxidant activity. No statistically significant differences were found between the antioxidant activity of free phenolic compounds from HAD and FZ+HAD samples. Concerning bound phenolic compounds' antioxidant activity, overall, no significant differences were detected between dried samples. This study showed that mango peel powders had a high amount of fiber, phenolic compounds, and carotenoids, suggesting that they have a high potential to be used as functional ingredients. However, drying processes, namely hot air drying, should be optimized to enable better preservation of mango peels' bioactive compounds and antioxidant activity.

Acknowledgments: This work was supported by the National Funds from FCT - Fundação para a Ciência e Tecnologia through project UIDB/50016/2020 and by FCT individual PhD grant (SFRH/BD/145301/2019).

References:

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