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Unlocking the Nutritional Potential of Broccoli Stalks powders obtained via lyophilisation and hot air dehydration

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Aim: The food industry is increasingly embracing sustainable practices and circular economy principles to reduce environmental impact and improve resource efficiency. One promising approach involves the valorisation of vegetable by-products, traditionally considered waste, into value-added ingredients. Broccoli stalks, often discarded during processing, represent an underutilised by-product with valuable nutritional potential. This study aimed to evaluate the nutritional composition of broccoli stalk powders obtained through two drying techniques: lyophilisation and conventional hot air dehydration.

Method: Fresh broccoli stalks were washed, diced, and subjected to either lyophilisation or conventional hot air dehydration (at 85ºc for 90 minutes), followed by milling into fine powders (<500 µm). Nutritional analyses of broccoli stalk powders, including moisture, total fat, total protein, total carbohydrates, total dietary fibre and ash content, were performed using AOAC procedures.

Results: Both drying techniques produced powders with high total dietary fibre content (>40 g/100 g), indicating their potential as fibre-rich functional ingredients. Specifically, the lyophilised broccoli stalk powder contained 52.47 g/100g of total carbohydrates, 21.50 g/100g of total proteins, 20.45 g/100g of ash, 4.89 g/100g of moisture and 0.70 g/100g of total fats. In comparison, the hot air dehydrated broccoli stalk powder presented slightly higher levels of total carbohydrates (54.90 g/100g) and moisture (5.85 g/100g) and lower content in total proteins (19.45 g/100g), ash (19.45 g/100g) and total fats (0.35 g/100g).

Conclusion: Broccoli stalks may be effectively converted into nutrient-dense powders using lyophilisation and conventional hot air dehydration. The similar nutritional profile reveals that the drying technique is not a limiting step from a nutrition perspective. The resulting ingredients not only contain valuable macronutrients but also contribute to waste reduction and resource circularity in food production. Their incorporation into functional food formulations supports sustainable innovation and aligns with the broader goals of reducing food loss and promoting a more circular food system.