

Unlocking Nutritional Value: The Role of Fruit and Vegetable By-Products in Sustainable Food Systems

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Introduction

Sustainable waste management has become a key priority in the agri-food industry, driven by growing environmental and economic concerns. Fruit and vegetable waste contributes to approximately **42% of total food loss, including peels, seeds, stems, stalks, and other processing by-products** (Ganesh, K.S. *et al.*, 2022). These residues are frequently discarded despite being **rich in dietary fibre, plant proteins, and bioactive compounds** (Nirmal N.P. *et al.*, 2023), making them valuable for the development of health-oriented functional ingredients. **Converting such by-products into nutrient-dense powders presents a promising strategy for reducing waste while enhancing the nutritional quality and sustainability of food products.**

Objectives

Evaluate the **nutritional composition** of three plant-based industrial by-product powders: **apple pomace, pear pomace, and broccoli stalk.**

Methods



Results

Table 1. Nutritional composition of the 3 plant-based industrial powders.

NUTRIENTS	APPLE POMACE (100 G)	PEAR POMACE (100 G)	BROCCOLI STALK (100 G)
TOTAL FAT	1.1 G	0.7 G	0.2 G
TOTAL SUGARS	48.8 G	27.7 G	16.6 G
FIBRE	32.3 G	49.5 G	36.4 G
PROTEIN	2.9 G	3.2 G	17.5 G
MOISTURE	8.6 G	7.5 G	11.3 G
MINERALS	1.4 G	1.9 G	3.3 G



All three powders demonstrated **low fat content and high levels of fibre**;



A **high protein content** was also observed in **broccoli stalk powder**.

SDGs framing



Conclusions

All three plant-based industrial by-product powders exhibited favourable nutritional profiles, characterised by **low fat and high dietary fibre content, reinforcing their potential as value-added ingredients in food applications.**

Broccoli stalk powder was identified as a **promising source of protein and fibre**, while **pear pomace powder** exhibited the **highest fibre content**, suggesting its suitability for fibre-enriched formulations.

Apple pomace powder was found to contain a **balanced composition, with interesting levels of total sugars and fibre**. This suggests potential applications in natural sweetening and textural enhancement.

Collectively, findings support the valorisation of fruit and vegetable processing by-products in the development of sustainable, nutritionally enhanced food systems aligned with circular economy principles.

References

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