



Cardoon Leaves as a Nutrient Food Source: Promoting Sustainability and Circular Economy

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Introduction

Valorisation of agro-industrial by-products

- Agro-industrial by-products are rich in bioactive compounds and nutrients.
- Valorisation promotes sustainability and a circular economy.
- *Cynara cardunculus* L. (cardoon) flowers are used in cheesemaking, but leaves are often discarded.
- Leaves could be consumed directly or used in food packaging.



Aim

- Evaluate the nutritional composition of cardoon leaves.
- Explore their potential as a food ingredient and for sustainable use.



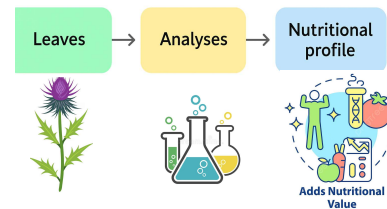
Material & Methods

Sample identification

- *Cynara cardunculus* L. (cardoon) fresh leaves

Analyses

- Moisture (gravimetric method)
- Ash (incineration at 525 °C)
- Total protein (Kjeldahl method)
- Total dietary fiber (enzymatic-gravimetric method)
- Total fat (acid hydrolysis with extraction)
- Total sugars (Munson and Walker method)
- Fatty acids (gas chromatography)



Results

Nutritional Profile of fresh cultivated cardoon leaves



Figure 1 – Nutritional Profile of fresh cultivated cardoon leaves

Table 1 – Moisture content and energy of fresh cultivated cardoon leaves

Fresh cardoon leaves	
Moisture (g/100g)	81.3 ± 0.3
Energy (KJ/100 g)	211 ± 9
Energy (Kcal/100 g)	51 ± 2

Fatty Acid Profile of fresh cultivated cardoon leaves

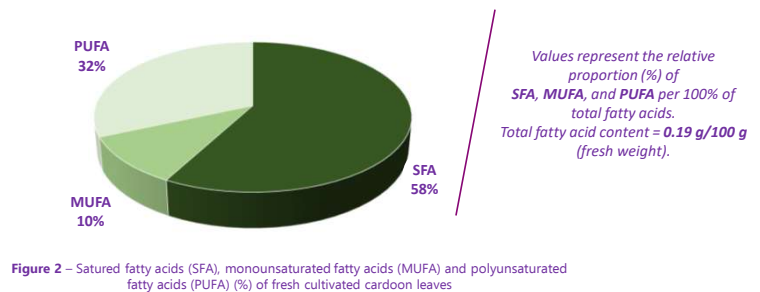


Figure 2 – Saturated fatty acids (SFA), monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) (%) of fresh cultivated cardoon leaves

Table 2 – Fatty Acid profile of fresh cultivated cardoon leaves

Type of fatty acid	Total Concentration (g/100g)	Individual Fatty Acid	Concentration (g/100g)
SFA (Saturated)	0.11 ± 0.01	C16:0	0.01 ± 0.00
		C22:0	0.03 ± 0.00
		C24:0	0.07 ± 0.00
MUFA (Monounsaturated)	0.02 ± 0.00	C18:1c	0.02 ± 0.00
PUFA (Polyunsaturated)	0.06 ± 0.01	C18:2c (n6)	0.04 ± 0.00
		C18:3c (n3)	0.01 ± 0.00

Discussion

- **Nutritional potential:** Cardoon leaves demonstrated a balanced composition, combining high fiber (7.9 g/100 g) and adequate protein (4.2 g/100 g) contents with low fat (0.2 g/100 g) and sugar (0.9 g/100 g).
- **Healthy lipid profile:** The predominance of saturated fatty acids (SFA > PUFA) suggests potential health benefits.
- **Sustainability link:** Since cardoon leaves are often discarded during processing, their valorisation contributes to **waste reduction** and aligns with **circular bioeconomy goals**.

Conclusion

- Cardoon leaves are a **nutrient-rich by-product** with **high fiber** and **protein** content.
- Their **low fat and sugar levels** reinforce their potential as a **healthy plant ingredient**.
- Valorizing this agro-industrial residue supports **sustainable food systems** and **resource efficiency**.
- Future work should explore **bioactive compounds** and **technological applications in functional foods and active packaging**.

From waste to resource: Cardoon leaves reveal high nutritional and functional potential.

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