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POLYPHENOLS: Origin, properties and applications in health and food

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INTRODUCTION

Chronic diseases like diabetes, cancer, and cardiovascular diseases account for **70%** of deaths, according to the WHO [1]

Diet has been shown to play a key role in preventing chronic diseases, with polyphenols - **bioactive compounds present in plant-based foods** - providing significant health benefits [2]

OBJECTIVES

- To identify the main **sources** of polyphenols
- To analyze their **mechanisms of action** on human health
- To evaluate existing **extraction techniques**
- To examine EU food fortification **regulations**
- To explore the application in **fortified foods**

METHODOLOGY

Scopus and *Google Scholar*

Key words: *Polyphenol and food*
Polyphenol and chemistry
Polyphenol and health
Polyphenol and stability ...

Total of **60** studies

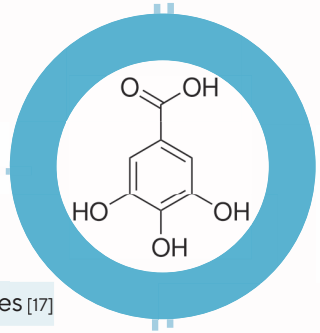
RESULTS

1. Concept

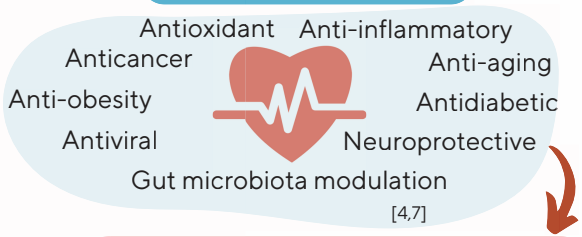
- Origin: Defense of  against biotic and abiotic stress factors [3]
- Chemical structure: Aromatic rings with hydroxyl groups [4]
- Classification: [2]

Phenolic acids	Stilbenes	Lignans	Flavonoids	Tannins
 				

- Agro-industrial by-products: [5,6]
  Fruit peels, wine residues and coffee grounds



2. Mechanisms of action



[4,7]

Low bioavailability

1. Environmental factors [4,8]
2. Internal factors
3. Interaction with other compounds
4. Host related factors
5. Food processing factors

Advances [9,10,11]
- Nanotechnology
- Non-thermal processing techniques
- Combination of processing methods
- Selection of food matrices

3. Extraction techniques

Cleaning
Drying
Size reduction

[12,13,14]

Conventional techniques:
- Percolation
- Decoction
- Maceration
- Soxhlet

→ Long extraction time, High energy cost, Solvent waste, Heat generation

Advanced techniques:
- Ultrasound-assisted extraction
- Supercritical fluid extraction
- Membrane technologies
- ...

→ More sustainable, 32-36% higher efficiency, 15 times lower energy consumption, Higher quality extracts

Final extract

4. Regulatory framework

- Strict EU regulations limit polyphenol use in functional foods [15]
- Only  have a health claim approved by EFSA [16]

5. Fortified foods

Improvements in nutritional and antioxidant properties [17]

- Challenges: stability, flavour, texture and colour
- Recent **advances**: microencapsulation [18]

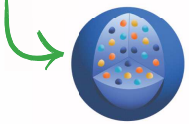


Figure 1. *Pretreatments and extraction techniques for obtaining polyphenol extracts.* Adapted from [14]

CONCLUSIONS

Benefits
- Promote public health and sustainability through agro-industrial by-products

Challenges
- Regulatory barriers limit their use in fortified functional foods
- Need to establish a recommended daily intake (RDI) that ensures safety for human health

Future research
- Improve polyphenol bioavailability
- Optimize fortification in food products
- Explore new industrial applications

REFERENCES