

MODULE 2



Boosting Innovation for Food SMEs

Adding value to plant-based at the farm and processor level



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Learning Summary



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01

Purpose and Objectives

Purpose

This module explores how modern technologies and traditional methods enhance plant-based foods.

SMEs will understand the main drivers and opportunities associated to technology and how they can contribute to produce better and safer plant-based foods.



Objectives

By the end of the module, learners will be able to:

- How plant-based products can provide essential flavours, taste, nutrients and bioactive compounds that can contribute to the health benefits of plant-based foods; technologies enhance their nutritional quality, bioavailability, and functionality.
- Discover how specific food technology works and can help to preserve and transform plant-based products.
- Explore real-life uses for these technologies, already used in making drinks, snacks, and meat alternatives.
- Learn about use of technologies.
- Meet the nutritional needs of different life stages as plant base consumer.



02

Technologies and novel strategies to produce safe, sustainable and healthy plant-based

Learning Journey Overview

Explore the multifaceted role of plant-based foods in nutrition, food technology, and public health through innovative processing methods and sustainable practices.

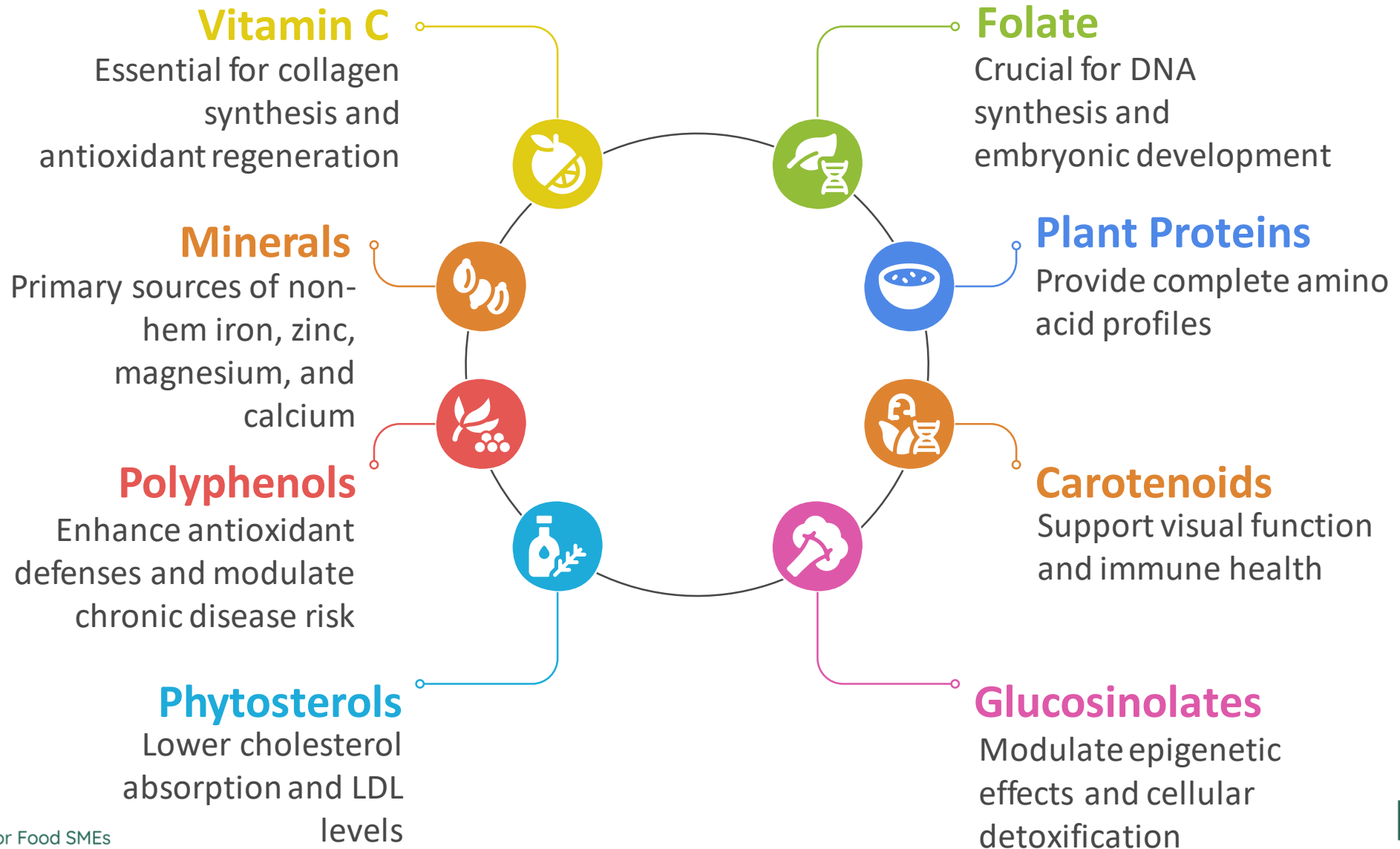


Plant-Based Food Sources: Nutrition and Health Potential

The growing popularity of plant-based diets reflects significant changes in how people think about health, environmental responsibility, and animal welfare. Plant-derived foods provide an extensive array of micronutrients essential for cellular function, enzymatic activity, and physiological homeostasis.



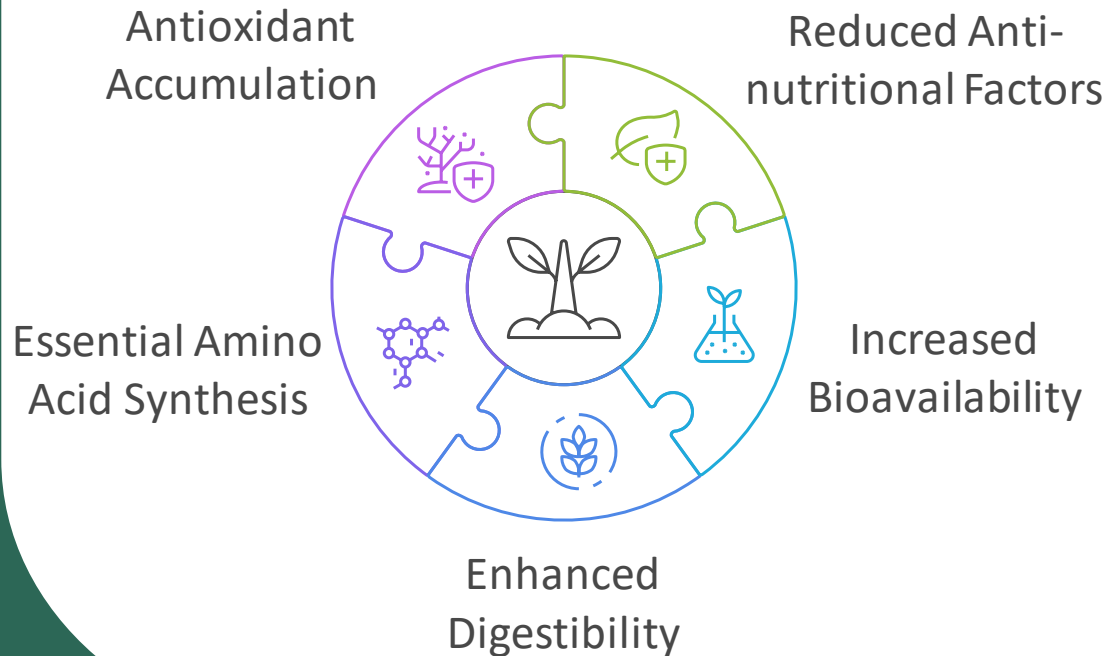
Key Nutritional Components



Traditional Enhancement: Sprouting and Fermentation

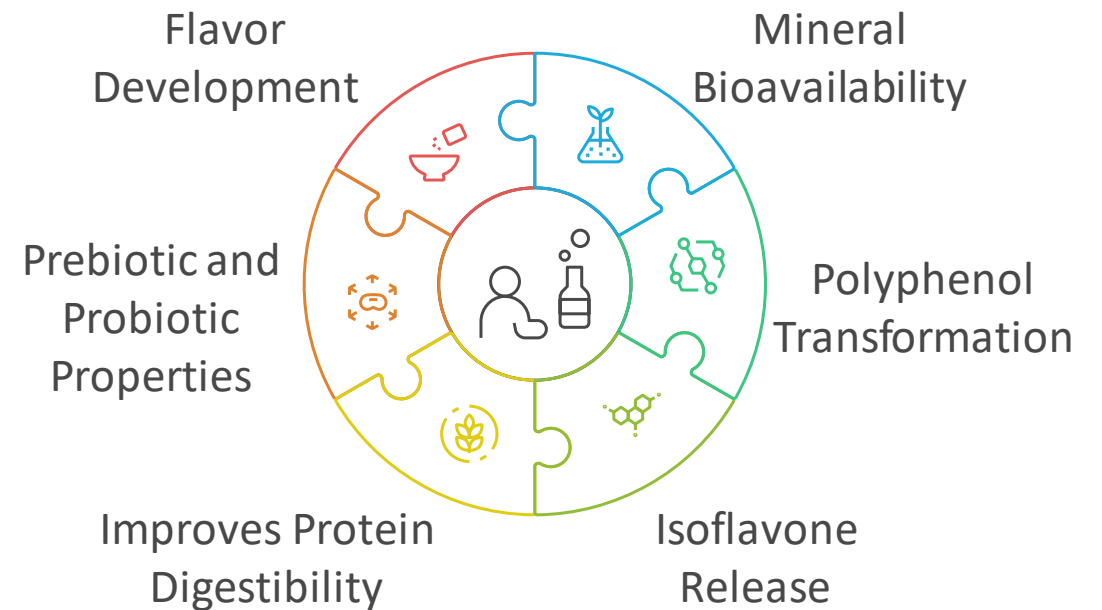
Sprouting

A traditional, low-cost technique that activates endogenous enzymes and initiates biochemical transformations to enhance nutritional quality.



Fermentation

Microorganisms metabolize plant substrates, producing bioactive compounds including vitamins, bioactive peptides, and short-chain fatty acids.



Advanced Processing Technologies

These technologies offer powerful tools to create shelf-stable, nutrient-dense, and highly palatable foods that align with performance, recovery, and wellness goals while supporting sustainable food processing.

Inactivates microorganisms while preserving nutrients. Maintains nutritional integrity and enhances shelf-life.

High
Hydrostatic
Pressure

Shapes plant-based ingredients into meat analogues and snacks. Reduces anti-nutritional factors and improves mineral bioavailability.

Extrusion

Enhances stability and delivery of sensitive compounds. Protects bioactive ingredients and improves bioavailability.

Nanoencapsulation

Sustainable
Food
Processing



Challenges in the Plant-Based Sector

Formulation Concerns

Many commercially available products are highly processed with elevated levels of salt, saturated fats, refined oils, or added sugars—undermining perceived healthfulness and creating gaps between consumer expectations and actual nutritional profiles.

Allergenicity Issues

Key ingredients like soy, wheat (gluten), nuts, and legumes are common allergens, presenting barriers for sensitive populations and complicating universal formulation. Cross-contamination and inadequate labeling increase risks.

Sensory Disconnect

Texture, taste, and appearance may not meet consumer expectations, particularly among those accustomed to animal-derived foods, reducing repeat purchases and overall trust.



Challenges in the Plant-Based Sector

Processing Impact

High-temperature treatments can degrade thermolabile nutrients including vitamins, polyphenols, omega-3 fatty acids, and bioactive peptides. Protein quality and amino acid bioavailability may be negatively affected without careful control.

Consumer Skepticism

Growing resistance toward "ultra-processed" foods with long, unfamiliar ingredient lists. Use of GMOs, synthetic additives, or novel proteins can trigger public resistance without transparency and education.

Regulatory Inconsistencies

Different jurisdictions vary in definitions, approvals, and labeling of plant-based products. Challenges in product standardization, labeling clarity, and cross-border marketing limit communication of nutritional and environmental advantages.





**LEARN ABOUT THE
POWER OF PLANTS
BY WATCHING THIS
VIDEO**





03

Non-thermal technologies
-high hydrostatic pressure
(HHP)- for safe,
sustainable and healthy
plant-based products

Learning Journey Overview

High Hydrostatic Pressure (HHP) is a revolutionary non-thermal technology that applies uniform isostatic pressure to inactivate microorganisms and enzymes while maintaining nutritional and sensory quality. This module explores HHP's principles, equipment, applications, and role in creating clean-label, sustainable plant-based foods.



What is High Hydrostatic Pressure?

Uniform Treatment

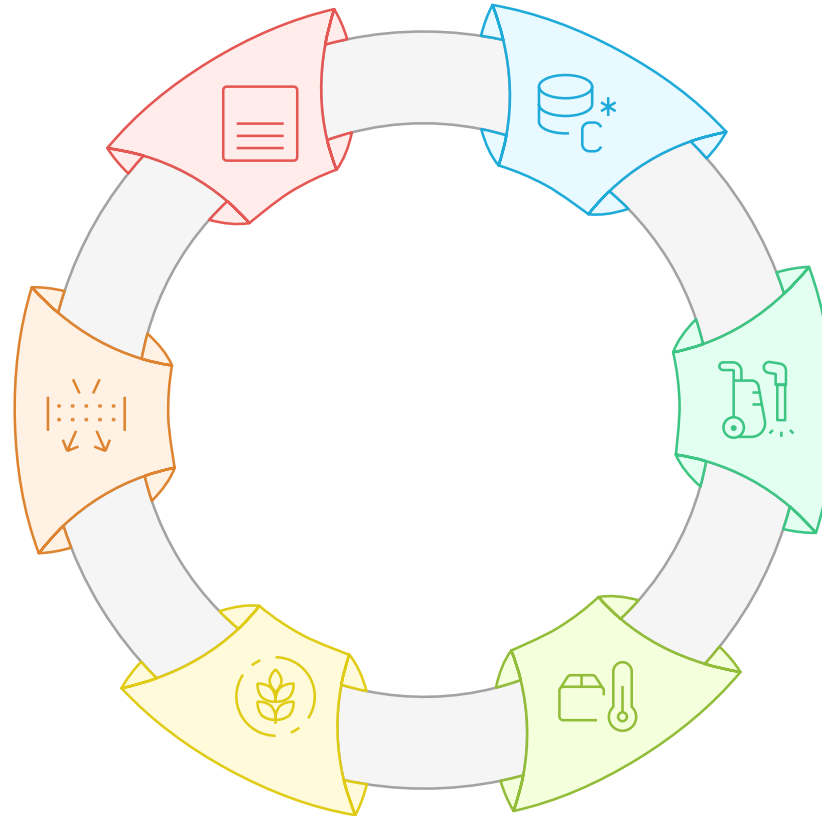
Ensures consistent results throughout the food

Isostatic Pressure Transmission

Distributes pressure evenly in all directions

Fresh-Like Qualities

Maintains the natural taste and texture



Non-Thermal Preservation

Preserves food without heat

High Pressure Application

Uses pressures between 100-600 MPa

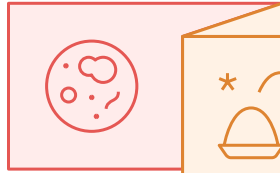
Ambient/Chilled Temperatures

Operates at room or cool temperatures

How HHP Preserves Food Safety

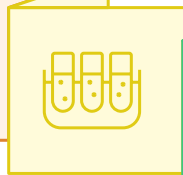
Cellular Disruption

High pressure disrupts microbial cell membranes



Enzyme Inactivation

Enzymes are inactivated, preventing browning



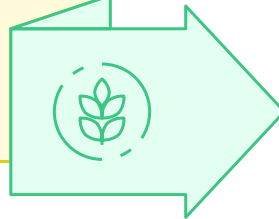
Protein Unfolding

Intracellular proteins unfold, inactivating bacteria

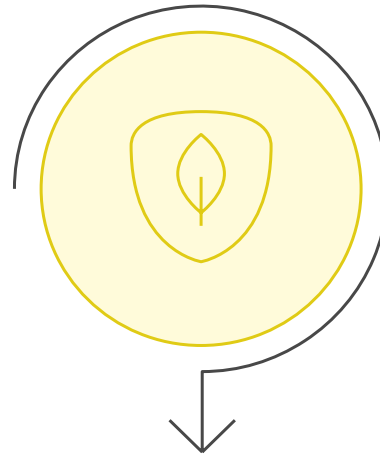


Nutrient Preservation

Nutrients remain intact at fresh food levels

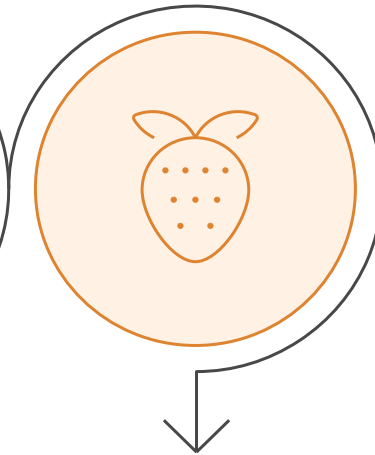


Key Benefits of HHP Technology



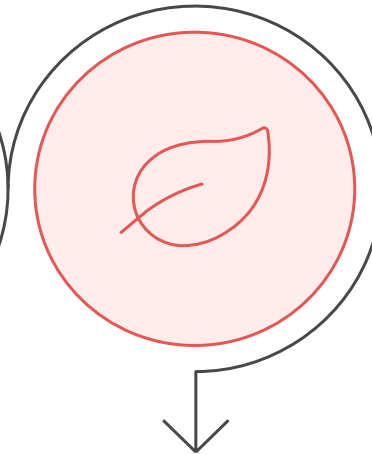
Nutrient Retention

Preserves heat-sensitive vitamins & antioxidants. Thermal methods destroy these compounds.



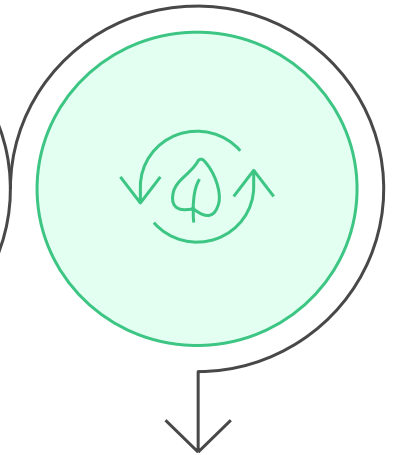
Sensory Quality

Maintains natural colors, aromas, And textures. Avoids maillard browning and pigment breakdown.



Clean Label

Eliminates need for chemical preservatives. Meets consumer demand for natural, minimally processed foods.



Environmental Sustainability

Reduces food waste through extended shelf life. Consumes less energy than thermal processing.

Applications in Plant-Based Products



Liquid Products

Cold-pressed juices and smoothies
Plant-based milks (almond, oat, soy)
Functional beverages
Plant-based broths

Solid & Semi-Solid Products



Fruit and vegetable purees
Plant-based spreads and dips
Ready-to-eat legume dishes
Meat analogues



Optimization Parameters

Pressure level

100-600 MPa
depending on
product matrix and
microbial targets

Holding Time

3-6 minutes typical
for most applications,
adjusted for safety
levels



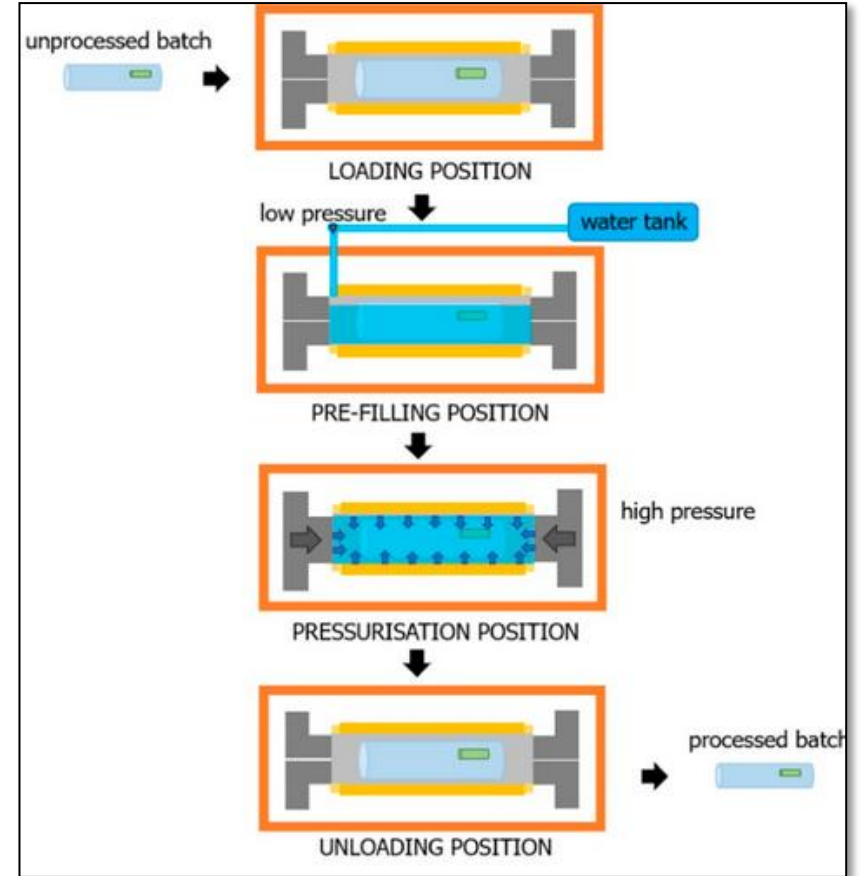
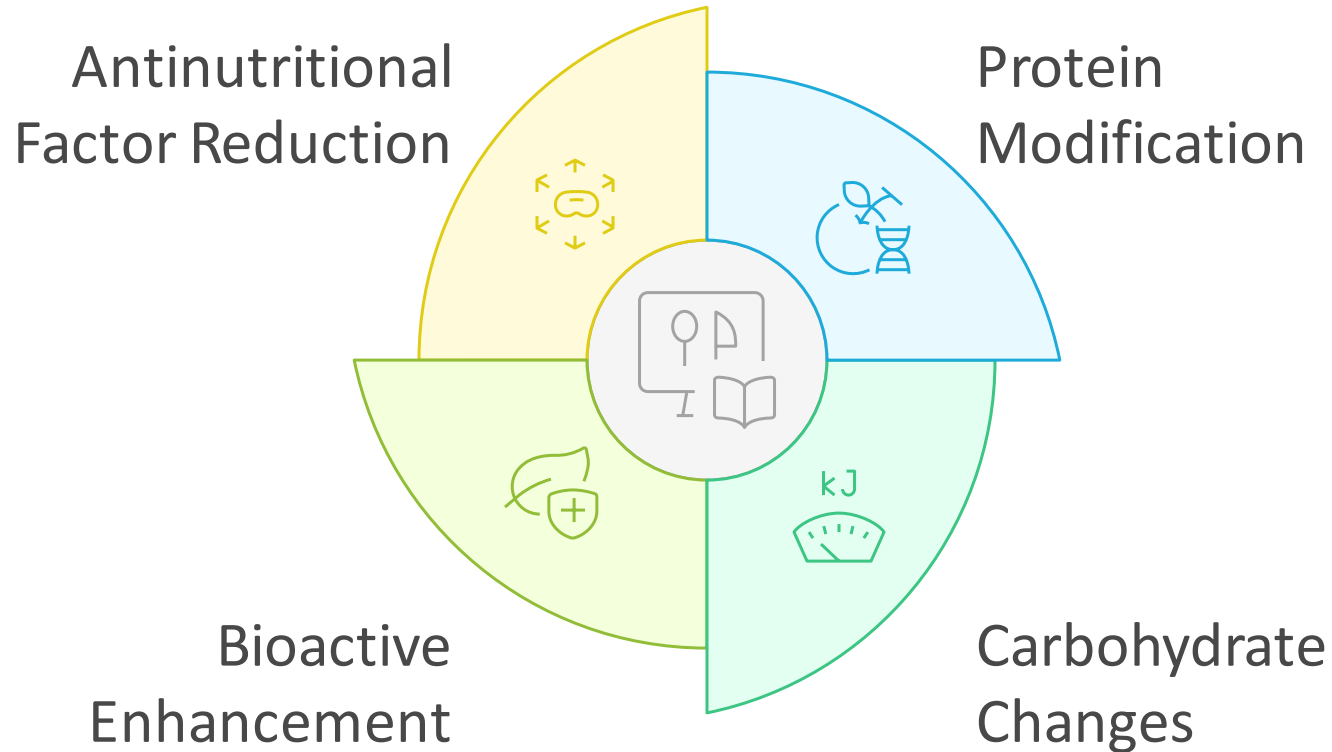
Packaging Selection

Flexible materials that
withstand compression
and provide barrier
protection

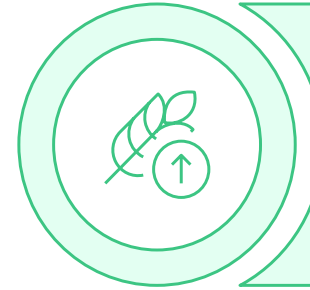
Temperature Control

Room temperature or
chilled to minimize
adiabatic heating

Effects on Nutritional Composition



The Future of Plant-Based Food Processing



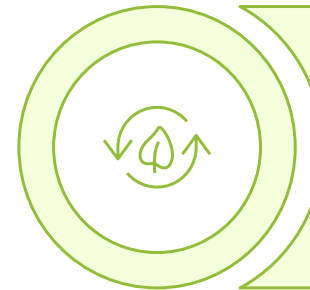
Market Growth

Rising demand for plant-based foods drives market growth.



Innovation Potential

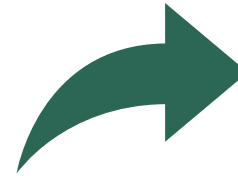
Enables novel plant-based food product development.



Sustainability Impact

Reduces waste, energy, and supports clean-label trends.

**WHAT IS HIGH
PRESSURE PROCESSING?
WATCH THIS VIDEO TO
LEARN ABOUT IT.**





04

**Controlled
sprouting: bridging
ancestral process
with modern
innovation**

Learning Journey Overview

Sprouting represents one of humanity's oldest food preparation methods, now reimagined through modern science and technology. This ancient practice enhances nutritional quality, digestibility, and culinary versatility of seeds and legumes through controlled germination.



Importance of Sprouting

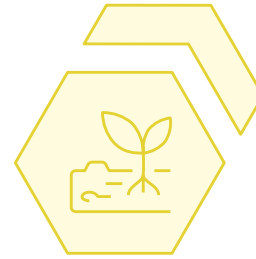
Health Benefits

Improved digestion, nutrient absorption, and disease prevention



Biological Process

Environmental and physiological stages of sprouting



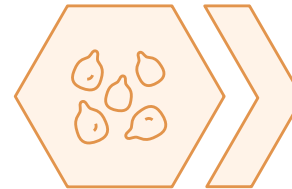
Food Innovation

Sprouting's role in functional foods and plant-based development



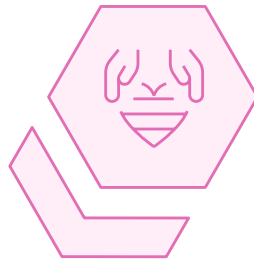
Enzymatic Changes

Biochemical transformations affecting nutrient composition



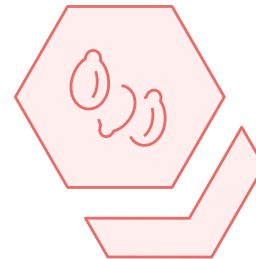
Cultural Relevance

Historical and cultural importance in food preparation



Common Seeds

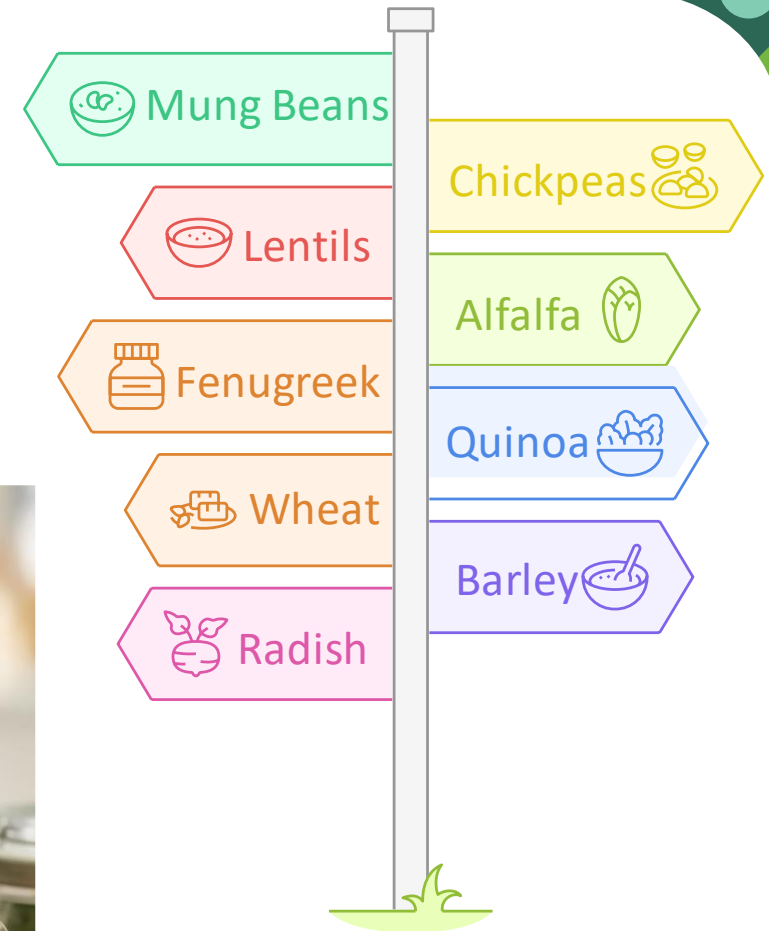
Seeds and legumes used for sprouting and their significance



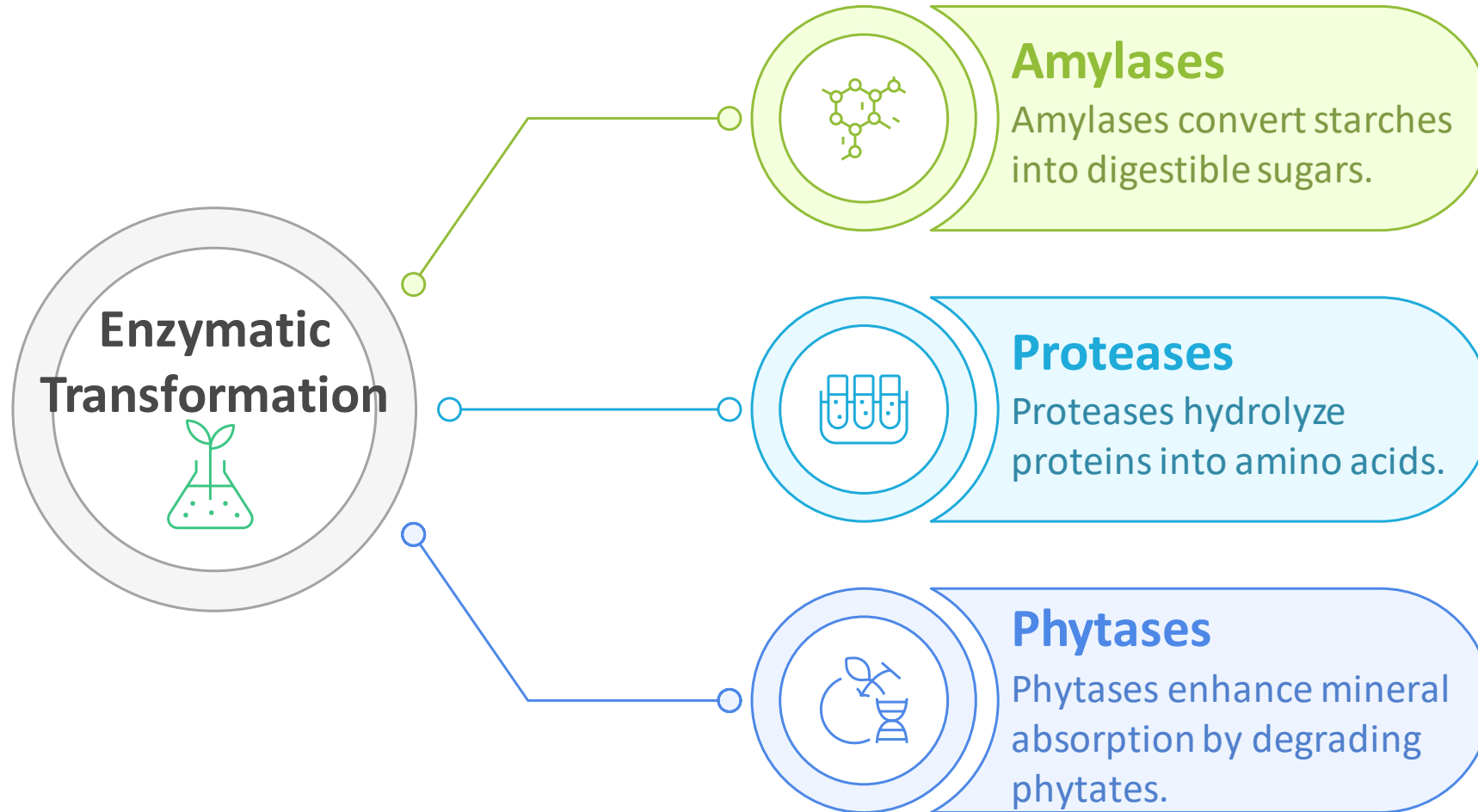
The Science of Sprouting

Germination is the biological process where seeds, grains, or legumes develop into young plants under controlled conditions of moisture, temperature, and oxygen.

This represents the first stage of plant growth, involving complex physiological changes including water absorption, enzymatic activation, and cellular division.



Enzymatic Transformation During Germination



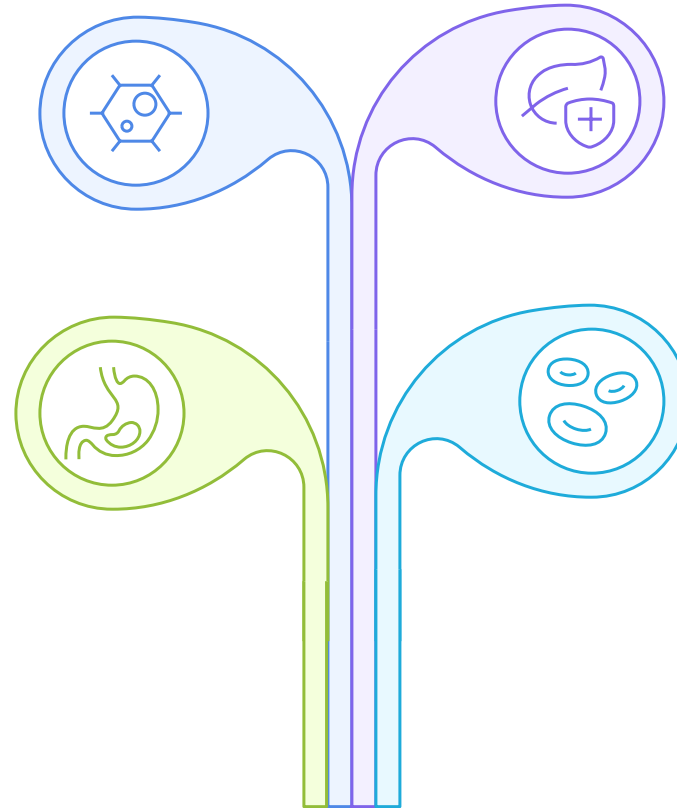
Health Benefits of Sprouted Foods

Antioxidant Activity

Reduces oxidative stress and inflammation with phenolic compounds.

Digestive Health

Increases nutrient absorption and reduces digestive discomfort.



Immune Support

Supports health with enhanced vitamins, minerals, and peptides.

Blood Glucose Regulation

Modifies glycemic response by breaking down starch.



Macronutrient Enhancement Through Sprouting

Protein quality



Proteases hydrolyze storage proteins into peptides and free amino acids

Carbohydrate modification



Enzymatic activity reduces starch content and increases simple sugars

Lipid quality



Proportion of unsaturated fatty acids improves



Micronutrient and Phytochemical Improvements



10x

Vitamin C Increase

Mung bean sprouts show up to tenfold increase compared to dry seeds

3x

B-Vitamin Boost

Riboflavin, niacin, folate, and thiamine levels rise significantly

60%

Phytic Acid Reduction

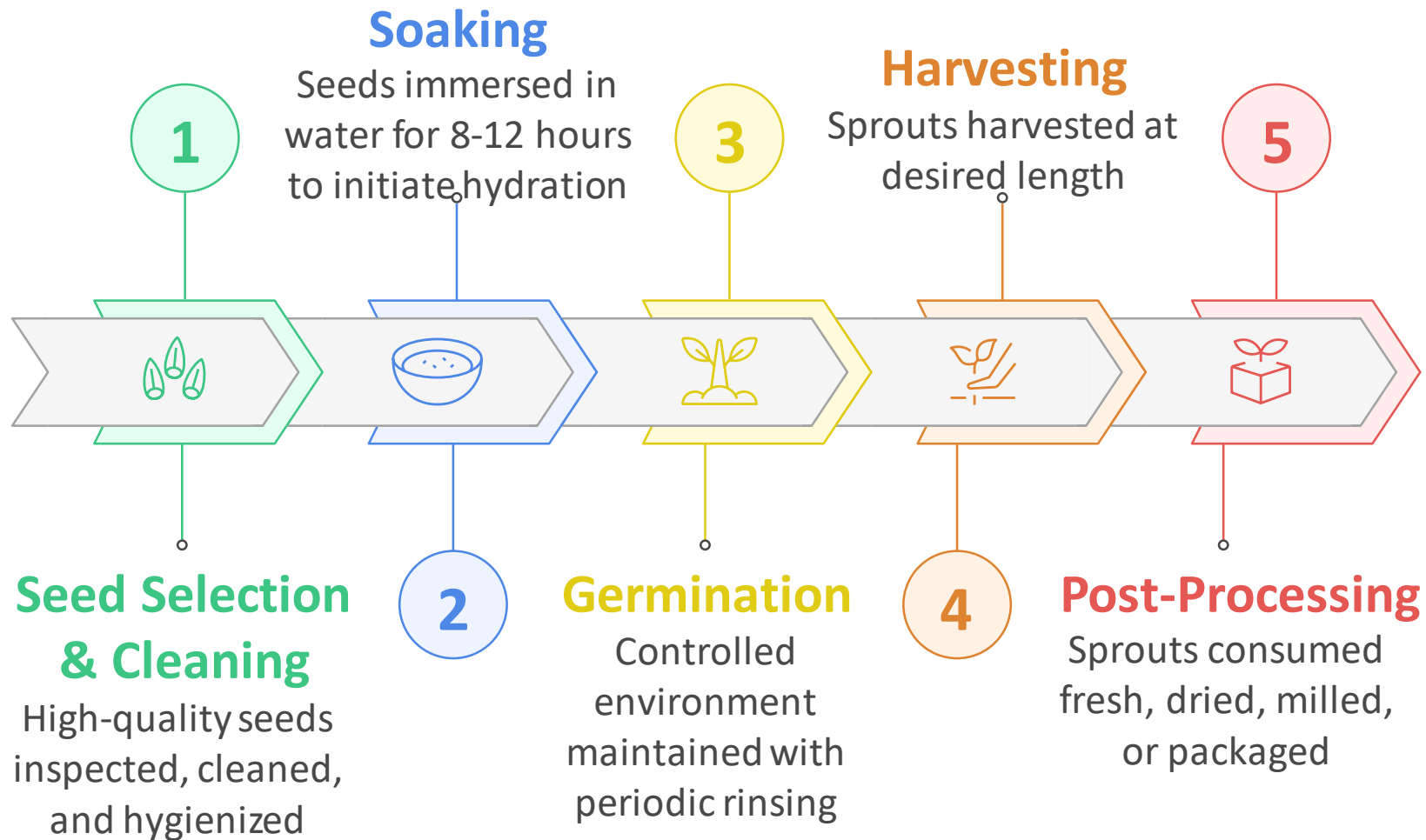
Decreased antinutrients enhance mineral bioavailability

2x

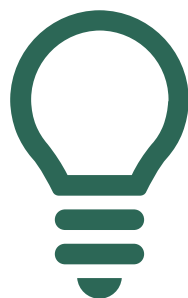
Antioxidant Activity

Phenolic compounds and flavonoids double during germination

Industrial Sprouting Process



Watch this video
produced by ITACyL and
University of Valladolid
to learn about the
sprouting process.





NUTRITION FACTS

Serving Size: 2 Slices (50g) / Servings per container: approx. 10

Amount Per Serving		Calories from Fat 27
Calories 160		
Total Fat 3g (4% DV*)	Saturated Fat 0.5g (3% DV)	Trans Fat 0g
Cholesterol 0mg (0% DV)	Sodium 180mg (8% DV)	
Total Carbohydrate 28g (10% DV*)		
Dietary Fiber 5g (18% DV)		
Sugars 2g		
Protein 6g		

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Ingredients: Whole grain wheat flour, water, salt, wheat starch, sugar, yeast, whole grains, honey, potassium chloride, wheat natural and artificial colors and flavors, preservatives, corn protein, folic acid, calcium, and



05

Labelling of plant-based products: regulatory aspects & market perspectives

Learning Journey Overview

This module provides comprehensive information on current practices and regulations for labelling plant-based food products in the European Union. Topics include required labelling rules, voluntary claims on packaging, consumer understanding, and emerging regulatory trends.



Nutritional Labelling and Consumer Perception



Plant-based beverages in Spain typically have lower protein and calcium than cow's milk (except soy), with higher carbohydrate content when sugars are added.

Claims like "no added sugars" don't always indicate higher quality—accurate labelling and consumer education are essential.



Research shows terms like "plant-based," "vegan," or "vegetarian" have minor effects on preference.

Anticipated taste and ethical values are stronger purchase predictors.

Defining Plant-Based: The Challenge of Terminology



Vegan

Excludes all animal-derived ingredients, including dairy, eggs, honey, and additives.

Vegetarian

Excludes meat and fish but may include dairy and eggs.

Plant-Based

Ambiguous, may include dairy, eggs, or occasional meat.

Critical Issue

No official, legally binding definitions exist for these terms at the EU level, creating confusion for consumers, researchers, and producers.

Three Pillars of EU Food Labelling Regulation



Regulation (EU) No 1169/2011

Essential labelling rules ensuring consumers have reliable, understandable information

- Mandatory information requirements
- Legibility standards
- Allergen protection

Regulation (EU) No 1308/2013

Product naming protections for agricultural markets

- Reserves terms like "milk," "cheese," "yogurt"
- Defines protected designations
- Establishes quality schemes

Regulation (EC) No 1924/2006

Framework for nutrition and health claims

- Scientifically justified claims only
- Pre-approved by EFSA
- Prevents misleading information

How to Read and Apply Food Labelling Rules



Product Name

Ensure the name accurately describes the product without implying it's dairy or meat.



Ingredients

Check the ingredients list for allergens and order from most to least.



Nutritional Value

Compare nutritional values per 100g or 100mL for easy comparison.



Shelf Life

Verify the "best before" or "use by" date and storage instructions.



Producer Details

Ensure company name and EU address are transparent.



Claims

Verify health and nutrition claims follow EU-authorized standards.

WATCH THIS VIDEO & LEARN ABOUT FOOD LABELS





06

Nutrition: clinical training on gaps and opportunities in plant-based diets – Best practices for diagnosis

Learning Journey Overview

Equip clinical staff to identify nutritional deficiencies and assess dietary patterns in patients following plant-based diets, considering the impact of processing methods like HHP, sprouting, and fermentation on nutrient bioavailability. Develop evidence-based skills to recommend balanced, tailored plant-based nutrition strategies for diverse patient needs and clinical conditions.



Plant-Based in Clinical Scenarios

Vegetarian and Vegan Diets

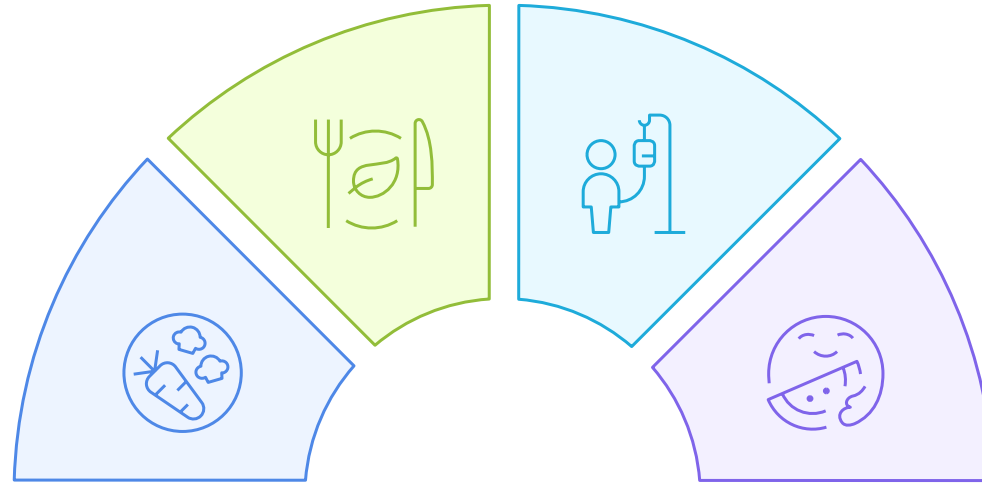
Form the foundation. Proper planning with fortified foods and supplements ensures adequate B12, calcium, vitamin D, and omega-3

Disease-Related Malnutrition

Complete oral supplements and protein modules provide essential nutrients for cancer, COPD, heart failure, and frailty patients

Omnivorous Diets

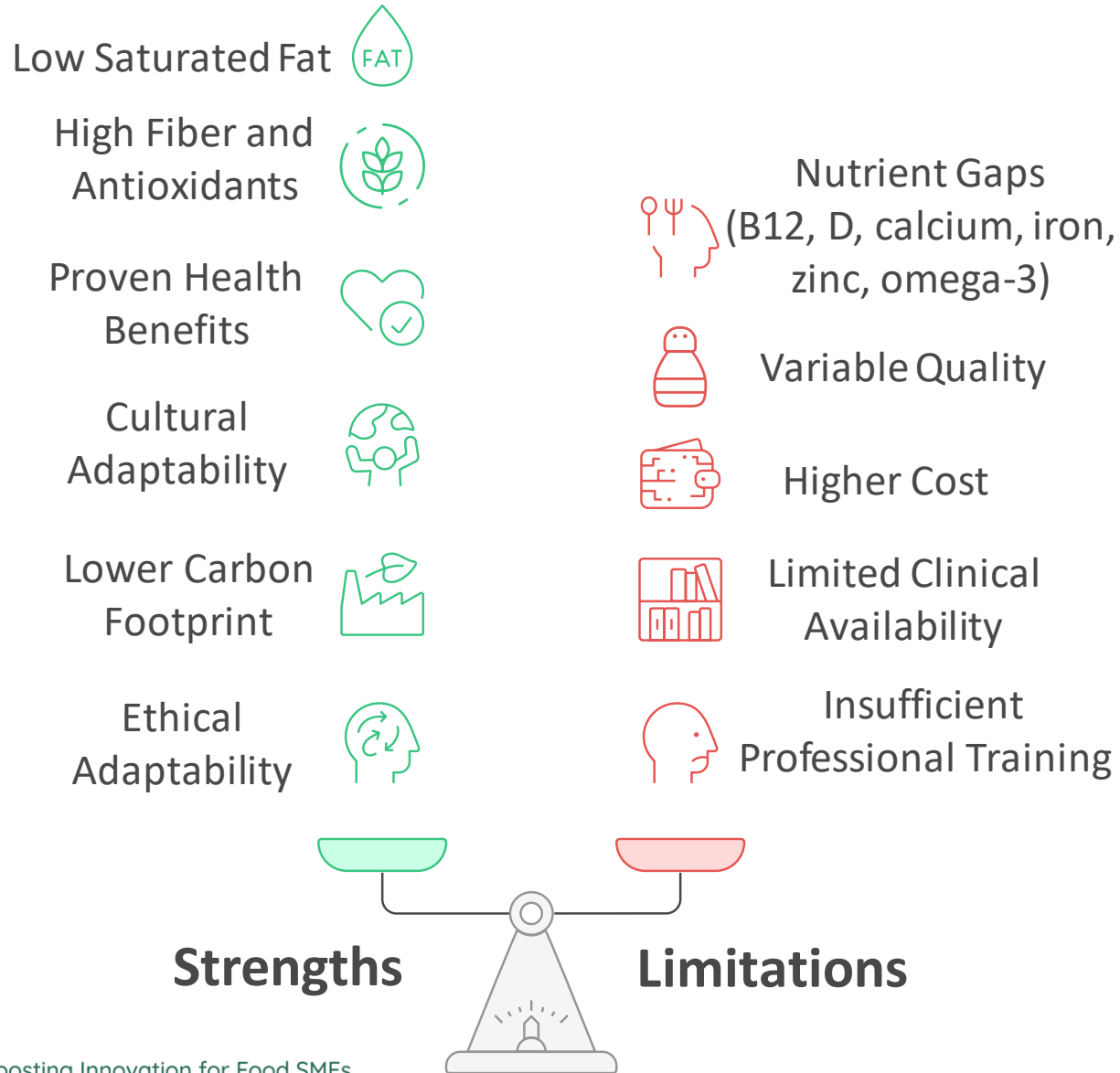
Plant-based products improve nutritional quality by increasing fiber, antioxidants, and unsaturated fats while reducing saturated fat and cholesterol



Obesity and Metabolic Syndrome

High fiber and low glycemic index regulate glucose. Phytochemicals reduce inflammation and cardiovascular risk

Balancing the Plate



Medical Nutritional Therapy

Plant-based products formulated as Foods for Special Medical Purposes (FSMP) are indicated in disease-related malnutrition, cachexia, and chronic conditions.



Complete Plant-Based Formulas

Blends of proteins, carbohydrates, fats, fiber, vitamins, and minerals for DRM and oncology patients.



Plant-Based Protein Modules

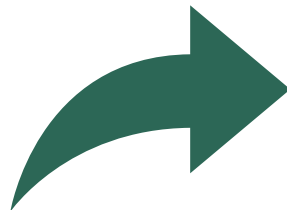
Pea, rice, or soy protein powder enrich soups, purees, and smoothies. Provide essential amino acids.



Specific Supplements

Omega-3 from microalgae (DHA and EPA) for cardiovascular prevention and triglyceride control.

WATCH
&
LEARN





07

Learning Summary

Summary

The evolution of plant-based food systems aims to integrate the nutritional richness of pulses and seeds with cutting-edge technologies to address **public health** and **sustainability challenges**.

This progress is built on the synergy between traditional methods, such as **sprouting** and **fermentation**, and modern technologies like **High Hydrostatic Pressure (HHP)**. These innovations allow for the optimization of nutrient bioavailability while eliminating anti-nutritional factors.

The ultimate goal is to develop “**clean label**” products that respect cultural identity and guarantee high nutrient bioavailability, balancing food security with minimal processing. These advances enable the **design of personalised diets** for managing metabolic conditions and malnutrition.

Thank you for completing Module 2 – Adding value to plant-based at the farm and processor level



Boosting Innovation for Food SMEs

Supporting Europe's food sector in
adopting plant-based innovation and
sustainability.

follow our journey



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