

Introduction to Food Analysis

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Key concepts, objectives, and common techniques used to evaluate the composition, quality, safety, and nutritional value of foods.

1. What Is Food Analysis?

- **Definition** – Scientific examination of food items to determine their chemical, physical, microbiological, and sensory properties.
 - **Purpose** – Ensure safety, verify label claims, support product development, monitor quality, and comply with regulations.
 - **Scope** – Raw materials, processed foods, beverages, supplements, and packaging interactions.
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2. Major Objectives

Objective	Why It Matters	Typical Parameters Measured
Safety	Protect public health	Pathogens, toxins, pesticides, heavy metals, allergens
Quality	Maintain brand reputation	Moisture, fat, protein, ash, color, texture
Nutritional labeling	Meet regulatory labeling requirements	Macro? and micronutrients, vitamins, minerals, fiber
Authenticity & Adulteration detection	Prevent fraud	Species identification, geographic origin, adulterant markers
Shelf?life & stability	Optimize storage & distribution	Oxidation products, microbial growth, moisture migration

3. Core Analytical Areas

3.1. Proximate Composition

- **Moisture** – Oven drying, Karl Fischer titration.
- **Ash (minerals)** – Combustion in a muffle furnace.

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- **Protein** – Kjeldahl, Dumas, or Bradford assay.
- **Fat** – Soxhlet extraction, acid hydrolysis, or gas chromatography (GC).
- **Carbohydrates** – Calculated by difference or measured by HPLC (sugars, starch).

3.2. Micronutrient Analysis

- **Vitamins** – HPLC with UV/Vis or fluorescence detection; LC-MS/MS for trace vitamins.
- **Minerals & Trace Elements** – Atomic absorption spectroscopy (AAS), inductively coupled plasma-optical emission spectrometry (ICP-OES), or ICP-mass spectrometry (ICP-MS).

3.3. Food Additives & Contaminants

- **Preservatives, sweeteners, colorants** – HPLC, capillary electrophoresis.
- **Pesticides & Herbicides** – QuEChERS extraction + GC-MS or LC-MS/MS.
- **Mycotoxins** – LC-MS/MS, ELISA kits.
- **Heavy Metals** – ICP-MS, AAS.

3.4. Microbiological Analysis

Test	Target	Common Methods
Total Plate Count	Overall bacterial load	Plate count on agar
Coliforms / E. coli	Indicator organisms	Petrifilm, Most Probable Number (MPN)
Salmonella, Listeria, Campylobacter	Pathogens	ISO/BS EN 6579, selective enrichment + PCR
Yeasts & Molds	Spoilage	Plate count on selective media
Spoilage enzymes (e.g., lipase)	Quality deterioration	Spectrophotometric assays

3.5. Physical & Sensory Evaluation

- **Texture** – Texture profile analysis (TPA), penetrometry.
- **Color** – Colorimeter, spectrophotometer (CIE Lab*).
- **Viscosity** – Rheometer, viscometer.
- **Sensory panels** – Descriptive analysis, hedonic testing, trained vs. consumer panels.