



Module 2.1

Food quality: attributes and indices

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Outline

This chapter is dealing with the main concepts on food quality and the attributes that contribute to define it.

- Quality of food: general definition
- Quality properties
- Factors that affect quality in foods
- Food quality standards

Learning Outcomes

The objectives of this course are to:

- introduce learner to the principles of Food Quality
- give the knowledge basis to optimize processing to improve quality of processed foods

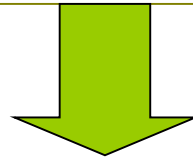
LEARNING OUTCOMES

Upon successful completion of this module, the learner will be able to:

- understand the principles of Food Quality
- apply the acquired knowledge to optimize raw materials and processing parameters to improve quality of foods

Food quality

Food quality can be defined as the combination of attributes or characteristics of a product that have significance in determining the degree of acceptability of that product to the consumer.



Which are the quality attributes to be considered?

How we can evaluate the quality attributes?



Food quality

Main importance for:

- conformance to specification (production)
- fitness for use (consumption)
- customer satisfaction
- exceeding consumer expectations



Food quality

Each food is characterised by a different combination of quality attributes, whose importance may vary depending on the product

Each food product is, moreover, characterised by quality attributes more important than others

Examples

- **milk:** *nutritional, health (vitamines, proteins)* **vs.** **wine:** *sensory (flavour, aroma)*
- **pasteurized milk** (safety, nutritional, sensory, technological functionality) **vs.** **sterilised milk** (safety, nutritional- lower than pasteurised- stability/shelf-life, convenience)

Food quality: evaluation

Two main methods categories:

1. Subjective:

The quality evaluation is based on opinion of the investigators. It includes sense organs (as physiological reaction, result of past training, experience of the individual influence of personal preference and power of perception. It is also referred as subjective or sensory methods (e.g. flavor, color, touch, odour and taste).

2. Objective:

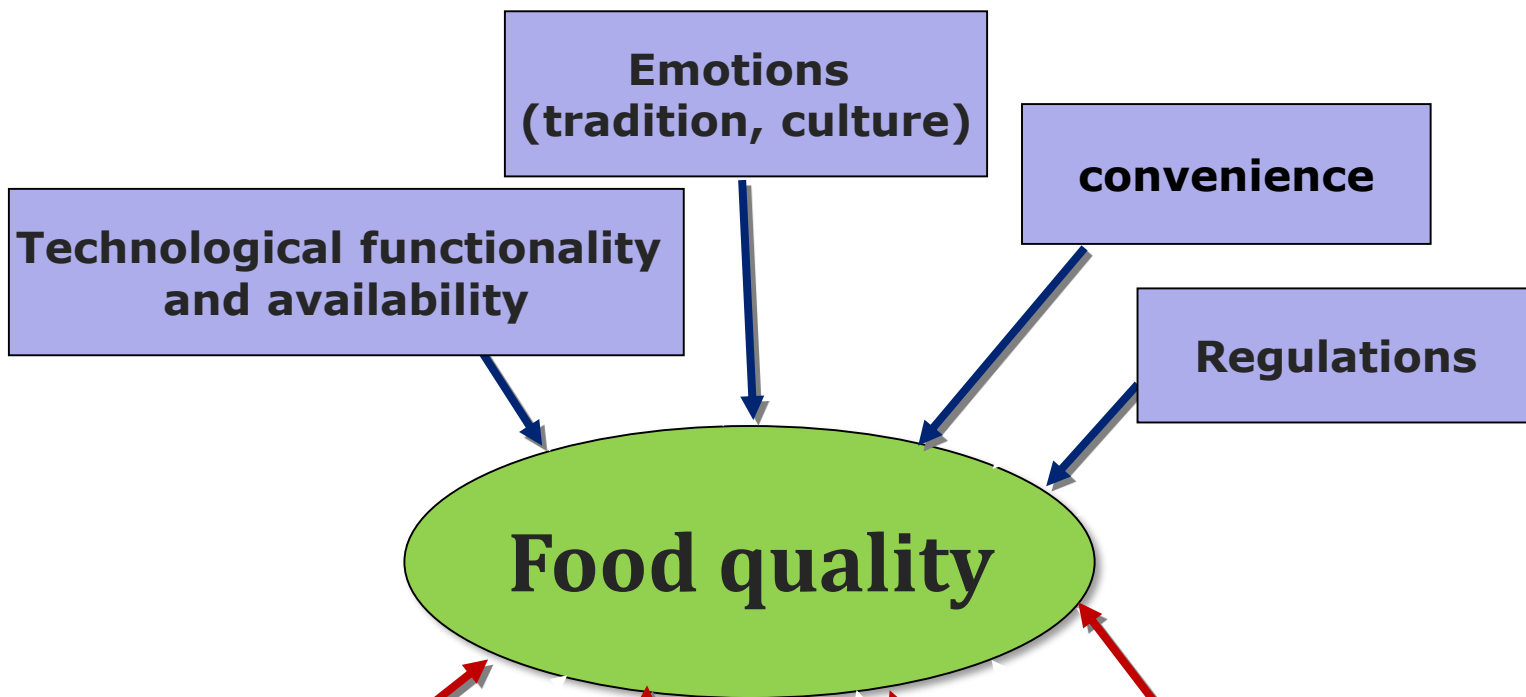
Objective methods of quality based on observations from which the human perception is excluded. They are based on scientific tests.

Main quality attributes

- Nutritional value
- Safety
- Sensory properties
- Health and wellbeing
- Technological functionality (*for the use*)
- Stability over storage time
- *Convenience (upon usage/consumption)*
- Emotional (*history, culture, anthropological*)
- Ethical
- Environmental impact and sustainability

Main quality attributes

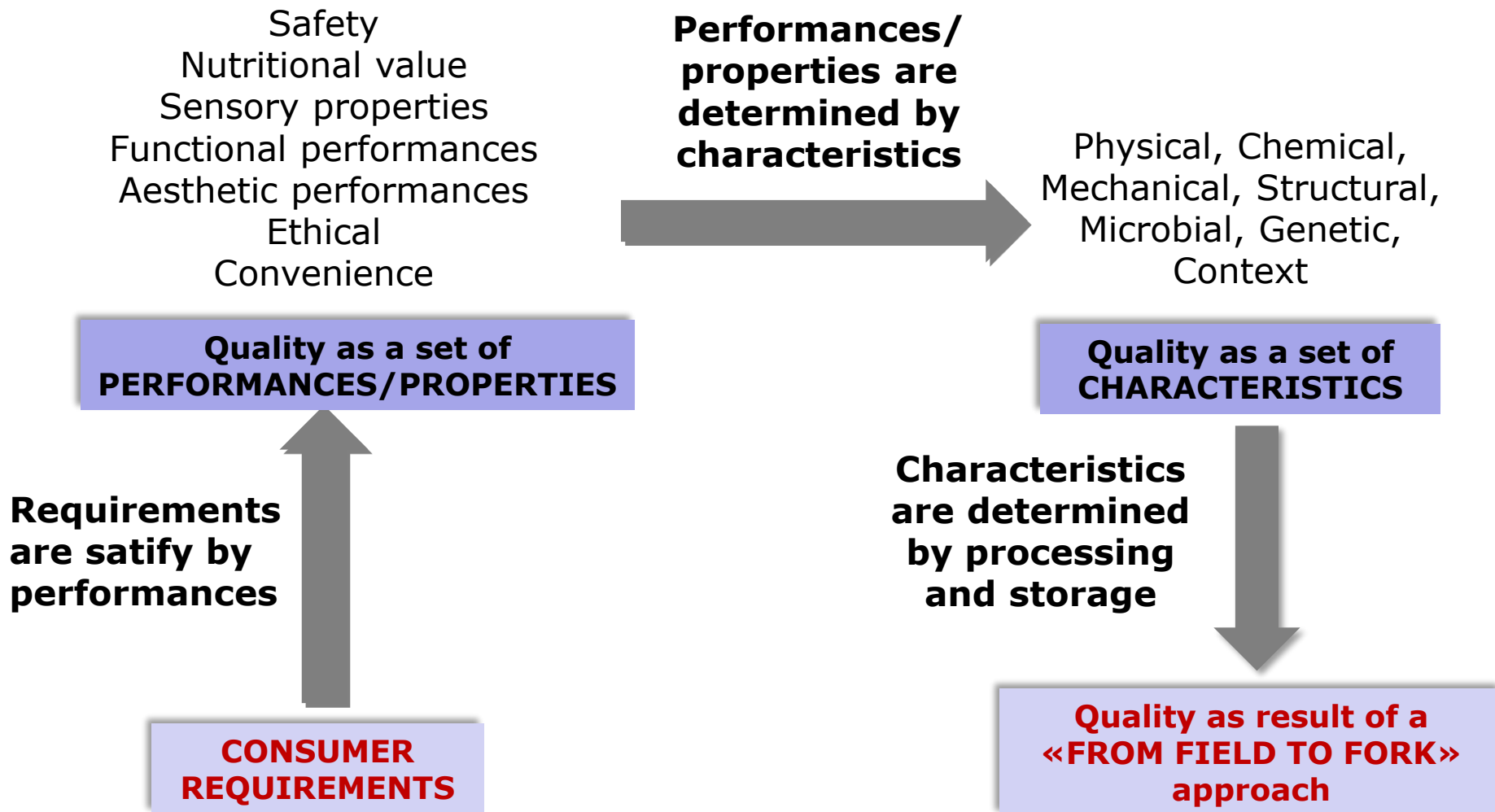
Extrinsic factors



Intrinsic factors

Main quality attributes

Modified from van Boekel, 2008



Quality of processed foods

Factors that affect food quality:

- Composition, physical and structural properties
- Processing
- Storage and packaging conditions (time, temperature, Relative Humidity)

Quality of processed foods

Where quality attributes could be lost/reduced

- Selection, production, picking up, storage raw materials ingredients
- Formulation
- Processing and manufacturing technologies
- Packaging
- Storage conditions, transport, distribution and (esercizi di vendita)
- Domestic management and use (storage, transport, preparation)

Safety

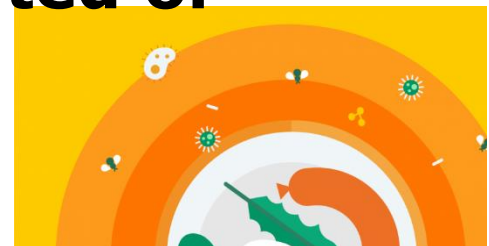
Quality attribute (intrinsic) associated to the acceptable risk of :

- ⇒ food poisonings and infections
- ⇒ carcinogenesis, mutagenicity
- ⇒ parasitic traumatic injuries
- ⇒ toxic substances and dangerous components

due to:

- Biological organisms
- Chemical agents
- Physical agents

This is related to no spoiled foods, in good preservation, no altered, adulterated or soiled.



Nutritional value

Propriety associated to the presence and content of:

- micro- e macro-nutrients, e.g.
 - proteins
 - lipids
 - carbohydrates (sugars, starch)
 - vitamines, salts,
- Energetic value



Healty properties

Proprieties related to the ability of a food or a food component to positively contribute to healthy status of consumers, e.g.

- Absence of anti-nutritional components
- Absence of components that may cause allergies and intollerances
- Presence and availability of components (bioactives) able to exert positive effects on human (quantità e disponibilità)



Healthy properties (cont.)

Definition of «bioactive»

Small components of food that influence positively physiological or cellular activities in the animals or humans that consume them.

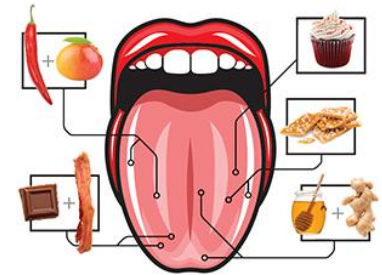
These include: phytochemicals, phenolic compounds, carotenoids, essential oils, antioxidants, or flavors.



Sensory properties

They depend on the stimuli that a food induces during eating on our senses:

- Eyesight: visual aspect (shape, colour, etc..)
- Smell and taste: flavour and aroma
- Tact: texture, hardness
- Hearing: sound produced during consumption (e.g. crunchyness)



These properties affect significantly the attractiveness, palatability and acceptability of a product by the consumer.

It is a property evaluated by individuals in a subjective way and affected by many environmental factors (social, cultural, etc.)

Convenience

Related to the easiness to be used or consumed

It may include aspects related to:

- **stability over storage and transportation** (*shelf stable, packaging*)
- **easiness to prepare** (*e.g. ready-to cook food, microwavable products*)
- **easiness to consume** (*ready-to-eat, snack*)
- **waste management** (*ready-to-cook*)



Emotional

They are referred to the role that a food has in a population/group of consumers also referred to a geographical region/area due to hystory, culture, diet habits and anthropology

These property give an added value to typical and traditional products

They depend on:

- the geographical framework (region, nation)
- hystory of the product

Ethical requirements

Referred to religious, political, ideological issues.

Ethical requirements include, among others:

- ⇒ organic agriculture and farming products
- ⇒ environment protection/sustainability
- ⇒ the defence of biodiversity against mass production
- ⇒ “Kosher” o “Halal” products
- ⇒ Vegetarian, vegan products
- ⇒ “GMO-free”
- ⇒ “Social Accountability”
- ⇒ “Fairtrade”

and related certification requirements.

Technological properties

Related to the performances of raw materials and ingredients to be processed

Each product/ingredient has specific technological properties to comply when used for processing.

These include:

- Availability and price
- Intrinsic quality properties (meeting the specifications of the final product for which they are used)
- Suitability to be processed, e.g.:
 - ⇒ resistance to mechanical stresses (eg. and mechanical picking up and washing of vegetables)
 - ⇒ easiness to selection
 - ⇒ responsiveness to standard quality properties (in large industrial production)

Stability and shelf-life

It depends on the ability to resist to the evolution of the reactions and processes that cause food degradation over storage time or the expected shelf-life (= saleability/consumption/usable time), like

- Microbial growth
- Chemical and enzymatic/biochemical reactions
- Physical processes.

Food processing has the general aim to :

- Slow down/inhibit the reactions and processes causing food degradation
- Destroy microorganisms (both pathogenic and alterative) and degradative enzymes

Stability and shelf-life

Expected stability/shelf-life

- Fresh product (es.: fresh vegetables, meat, fish): few hours/days
- Processed product: it depends on the product, from days to years. In processed products, type and intensity of processing along with packaging significantly affect they stability during storage, distribution and transportation

Food Quality Standards

Some of quality characteristics are covered in food laws and regulations.

- Failure of a food to meet regulatory requirements relating to a standard of identity, the declared quantity, declared ingredients, or label claims, can be considered as misrepresentation, misbranding, or fraud.
- The spoilage, deterioration, or decomposition of foods with the absence of any resulting harmful substance that can lead to illness or injury, can be considered as failure to meet food quality requirements based on fitness for human use or wholesomeness criteria.

Food Quality Standards

The four common standards:

1. Legal

Mandatory and set up by law or through regulations.

Legal standards are generally concerned with the lack of adulteration due to

- insects, molds, yeasts and pesticides;
- maximum limits of additives permitted;
- established specific processing conditions so that extraneous materials do not contaminate foods

Food Quality Standards

The four common standards:

2. Company or Voluntary Label Standards

Are those established by various segments of the food industry.

They represent a consumer image and may become a trademark or symbol of product quality.

Voluntary standards are generally used by private companies or supermarkets and tend to vary depending upon the particular requirements of a given label.

Food Quality Standards

3. Industry Standards.

Voluntary, used to establish given quality limits for a given commodity.

Industry standards are implemented due to the pressure from marketing organizations or by specific commodity groups where legal standards are not involved.

4. Consumer or grade standards.

These represent the consumers' requirements for a product.

How to improve Quality of Foods

1. Raw materials and ingredients

Proper choice depending on the desired final quality, safety and stability

High microbial quality and low chemical and environmental contaminants

2. Processing

Improving control of the process parameters

Optimisation of the process parameters to maximize the desired effects and minimize the process damages (heath, mechanical, etc..)

Adoption of new processing and preservation technologies

How to improve Quality of Foods

3. Adoption of prevention strategies

e.g.: HACCP (Hazard Analysis Critical Control Point), GMP (Good Manufacturing Practices), TQM (Total Quality Management), etc.

References

- **Peri C.** The universe of food quality. Food Quality and Preference 17 (2006) 3–8.
- **van Boekel M. A.J.S.** Kinetic Modeling of Food Quality: A Critical Review. Comprehensive Reviews in Food Science and Food Safety, 7 (2008), 144-158.



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