MEAT QUALITY CAN BE DEFINED WITH THE FOLLOWING PARAMETERS:

- pH
- Color
- Water Holding Capacity
- Texture
- Intramuscular fat and fatty acid composition

Muscle pH:

*is the key in the conversion of muscle to meat*

- During the early post-mortem changes in muscles of slaughtered animals, the pH falls from around 7.0 – 7.2 in the muscle of a living animal to 5.5 – 5.8.
- This final value is called ultimate pH (pHu), and its values are reached at different post-mortem times depending on species, muscle type and stress, during the pre-slaughter period.
- The reason for the pH fall is the formation of lactic acid from glycogen in the anaerobic glycolysis.
pH evolution during p.m. period in the LD beef muscle:

- **Normal**
- **DFD**

<table>
<thead>
<tr>
<th>Time (hours)</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>6.5</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>5.5</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

pH evolution in some pig genetic lines:

- pH4.5
- pH3
- pHu

pH how to measure:

- To predict PSE meat: at 45 min post-mortem
- To predict DFD meat: at 24 h post-mortem
Methods to evaluate:

**SUBJETIVES**

**OBJETIVES**

**COLOR**

- Colour is a very important quality characteristic of the meat.
- Consumers related meat colour to the sensory properties of a product, or to freshness.

**Factors influencing meat colour:**
- Pigment content (myoglobin and haemoglobin)
- Ante and post-mortem conditions
- Form and type of storage

**Colour differences related to ante-mortem treatment**

![Images showing meat samples with different lightness values](image1.png)

**Sirloin: 24 h.p.m.**

**Pakaging systems**

![Images showing meat samples with different packaging systems](image2.png)

**Day 0**
- **Darfresh Skin, Vacuum**
- **Bloom Skin/Map**
- **Map Modified Atmosphere**
DETERMINATION OF MEAT COLOUR

OBJECTIVE METHODS

- Lightness: is the attribute that better reflects the pH drop and final pH of the meat (100 to 0).
- Coordinate a
- Coordinate b

COLOR

CIE Colour space

Diffuse-reflected spectrophotometry:
- Colour, colour stability and quality defects

Instrumental methods

COLORIMETERS AND SPECTROPHOTOMETERS: 450-750 nm visible region of the spectrum
- Light illuminating: illuminant C, D
- Standard observers: 2º and 10 º CIE, 1931, CIE 1967

Medium values of lightness (L*) and Chroma (C*) of 11 meat samples measured by CM200, CM2002, CM3600d, IS-CAD140B

<table>
<thead>
<tr>
<th>Animal</th>
<th>Lightness (L*)</th>
<th>Chroma (C*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poultry</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Pork</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>Lamb</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Beef 12 m</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Beef 17 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mutton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

COLOR
Pigment content: HORNSEY method

It is the ability of the meat to retain its water during cutting, heating and pressing.

DRIP LOSS: is the amount of exudate in the meat surface.

HOW TO QUANTIFY THE DRIP LOSS:
- Reference Method BY OCDE (Honikel, 1996)
- Online Method (Rasmussen and Andersen, 1996)

HOW TO PREDICT
- Electrical conductivity (Oliver et al, 1999)
- Impedances (Mushen et al, 1999; Oliver et al, 2001)
The objective is to try to measure the tenderness of the meat by objective tests:

- Instrumental or Sensory panel

- Warner-Brazler: shear force:
  (Moller, 1980)

- TPA: Texture Profile Analysis:
  (Beauv, 1978)

* This is a simple word that means a very difficult concept.

**TEXTURE**

- muscle fibres
- connective tissue
- intramuscular fat
- water
- muscular pH

TECHNOLOGIES: Texturometers: Instron
TEXTURE

OF THE MEAT

Shear Value (N)
Modul (N/cm)
Total Energy (Kg.cm)

-Up Shear Value
-Up Modul
-Up Total Energy

WARBURG-BRATZLER TEST: STANDARDIZATION ON THE PREPARATION OF SAMPLES AND COOKING METHOD

TPA (Texture profile analysis)

TEXTURE

TPA (Texture profile analysis)

TEXTURE

TPA (Texture profile analysis)
Intramuscular fat and fatty acid composition contributes to the caloric content of meat, but also have an effect on the texture and the flavour of the meat. Both components (quantity of fat and its quality) affect consumers' health.

**Chemical methodology**

**How to quantify:**

  - Acid hydrolysis + ether extraction
  - Phospholipids + Tryglicerids (Method 1)
  - Ether extraction without acid hydrolysis → Tryglicerids (Method 2)
    - Method 1 = 1.2 x method 2 (ether extraction only)
  
- **Folch method (1957)**
  - Extraction of fat using 3 : 1 mixture of chloroform : methanol
  - Extraction of all lipids
**INTRAMUSCULAR FAT AND FATTY ACID COMPOSITION**

**HOW TO QUANTIFY**
- Gas Chromatography (Díaz, 1994)

**HOW TO PREDICT**
- Physical Methodologies
- NIT Near Infrared Transmittance
- NIR Near Infrared Reflectance
  (From 800 to 2500 nm)
  (Indirect methods, they need an equation of Calibration)

Gispert et al. (1997)
Windham y Morrison (1998)

**% of Intramuscular fat**

**NIT o NIR technology**
**INTRAMUSCULAR FAT AND FATTY ACID COMPOSITION**

**GREEN IN AUTOCHTHONOUS BREEDS:**
- BLACK MAJORCA PIG AND IBERIAN PIG

**FATTY ACIDS:**
- OLEIC ACID > 55%
- LINOLEIC ACID < 15%

**% INTRAMUSCULAR FAT > 8%**

**FATTY ACID COMPOSITION OF THE MEAT IN DIFFERENT SPECIES**

<table>
<thead>
<tr>
<th>FATTY ACIDS</th>
<th>BEEF</th>
<th>LAMB</th>
<th>PIG</th>
<th>RABBIT</th>
<th>IDEAL VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturated (%)</td>
<td>41%</td>
<td>44%</td>
<td>35%</td>
<td>38%</td>
<td>&lt;</td>
</tr>
<tr>
<td>MUFA (%)</td>
<td>40%</td>
<td>40%</td>
<td>40%</td>
<td>22%</td>
<td>&lt;</td>
</tr>
<tr>
<td>PUFA (%)</td>
<td>5%</td>
<td>5%</td>
<td>20%</td>
<td>38%</td>
<td>&lt;15%</td>
</tr>
<tr>
<td>Cholesterol mg/100 g</td>
<td>70</td>
<td>70</td>
<td>60</td>
<td>60</td>
<td>&lt;</td>
</tr>
<tr>
<td>n-6/n-3</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>11</td>
<td>&lt;</td>
</tr>
<tr>
<td>P/S</td>
<td>0,1</td>
<td>0,1</td>
<td>0,5</td>
<td>0</td>
<td>0,5 o &gt;</td>
</tr>
</tbody>
</table>

**THANK YOU FOR YOUR ATTENTION**

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