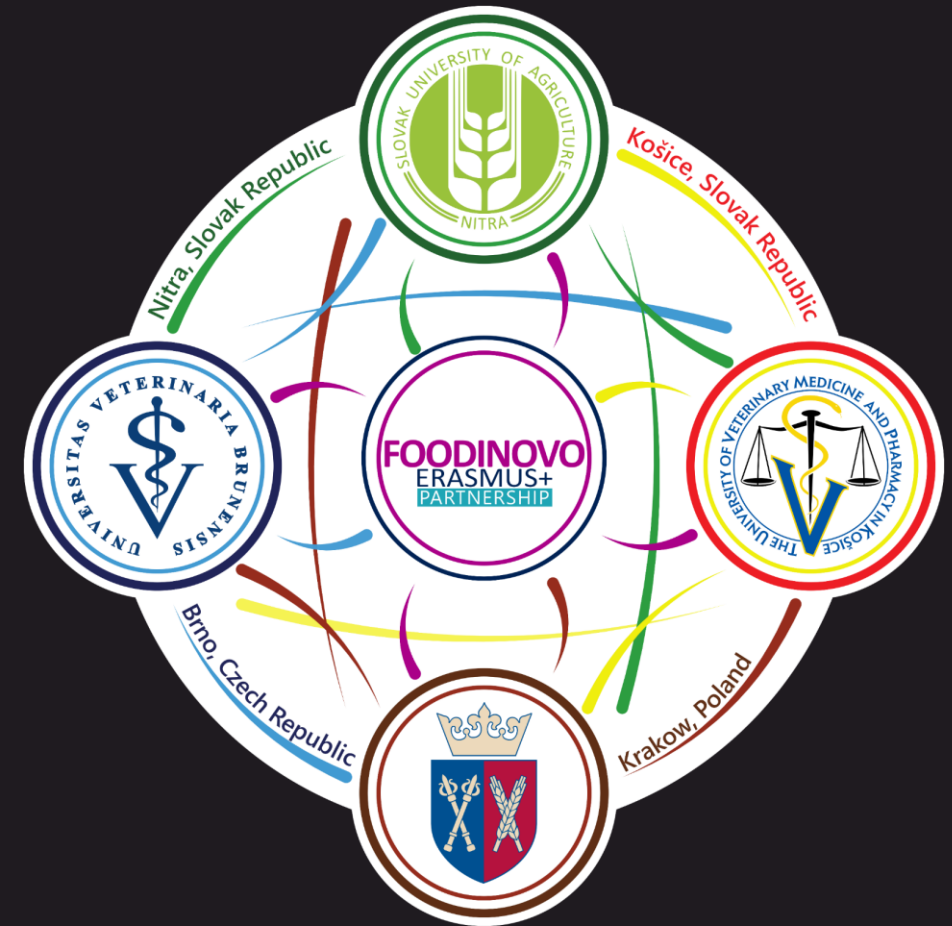


Cooling, packing, freezing of poultry meat



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Water chilling of poultry

- **Water chilling** – is used for frozen or quick frozen poultry
- **Immersion chilling** - carcasses are moved through one or more chilling tanks
- filled with circulating cold water or with mixture of water and ice.
- The first rotary chiller is used for carcasses **pre – chilling** (16 °C).
- The second chiller a large tank designed to move the carcasses through in a specific period of time in which a counter current flow of **cold water at 0-2 ° C**
- is used to lower the temperature of the carcasses.
- The maximum **final temperature of poultry is 4 °C**.
- Immersion chilling lasts **20 min**



Fig. 2

Air chilling

- used cold air for **fresh chilled poultry**. The carcasses are hung by shackles without
- being touched and moved through coolers with forced air circulation
- **Advantages** - is the low water activity and dry skin surface, both of which increase
- the shelf-life of final products - well chilled both inside and outside.
- Air chilling prevents cross - contamination between birds.
- depending on the cost of water - it may have economic and sustainability advantages
- **Disadvantages** - longer time of chilling, drying, higher weight losses.
- Drying causes dark discoloration of skin where epidermis is damaged as the consequence of scalding through a reaction between oxygen and carotenoids of the skin and subcutaneous fat.

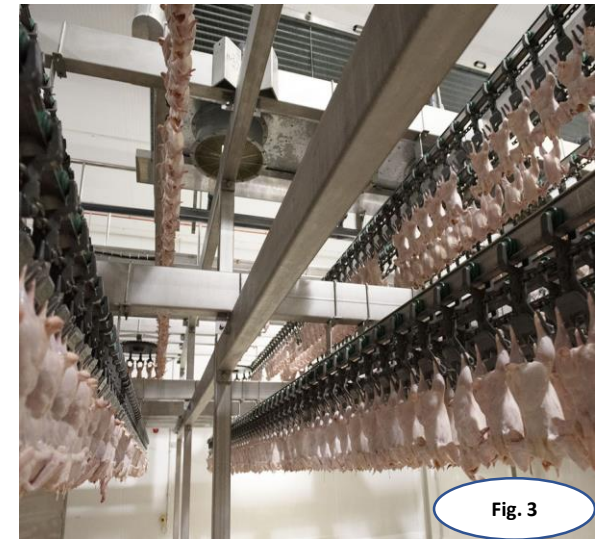
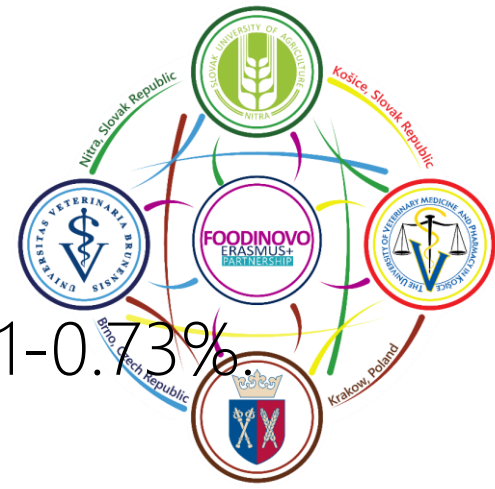


Fig. 3

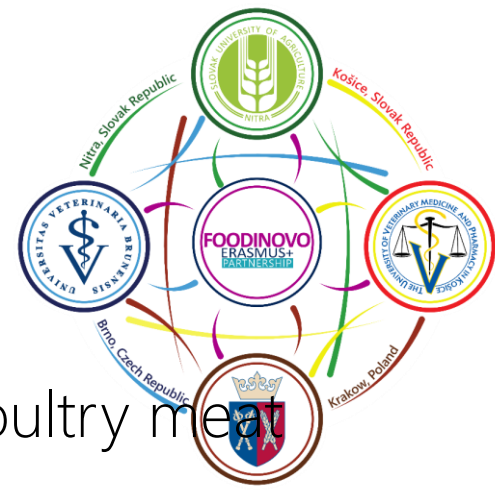
Air chilling methods



- **Chamber chillers:** air temperature is -10°C , weight loss 0.41-0.73%.
- **The in-line air chilling in tunnels (Downflow chilling):**
 - is quicker method and requires small floor areas. The air in the tunnel has a temperature of $0-2^{\circ}\text{C}$, relative humidity of 85 %, and chilling time **80 - 360 minutes**. Weight losses are higher **0.54 - 0.88%**.
- **Infrachill system** - thorough chilling is the onside of the product, its abdominal cavity and the parts having a thicker layer of meat (breast). To achieve this, an accurately directed flow of cold air is used.

Air chilling methods

- **Maturation chilling:**
 - *post mortem* biochemical processes that influence tenderness of poultry meat
 - Firstly, the surface of poultry is dried intensively for **15-20 minutes** with cold and very dry air, at a relative humidity of about **50 %**. Chilling is then completed with a flow of less cold air (**- 8 °C**), relative humidity **85-90 %**, velocity **3-5 msec⁻¹**.
 - The final temperature of the carcasses before shipment is from **-2 °C to -1 °C**.
 - All final products have the same temperature.
 - **Rapid chilling methods** - used liquid **N** or **CO₂** as refrigerants. High operating costs limit using of this methods.

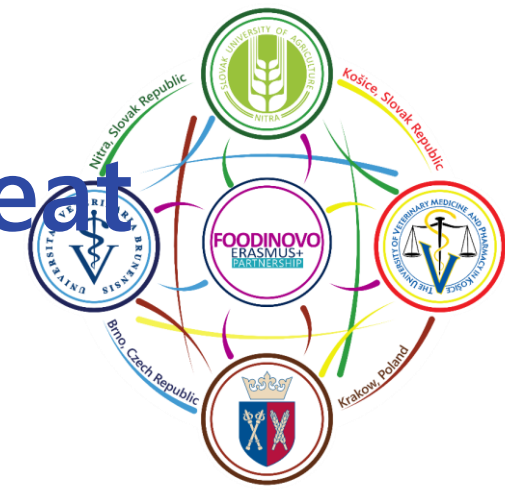


Spray chilling

- It is the air chilling complemented by various moistening techniques.
- continuous spraying of the birds with finely dispersed ice water which prevents the weight losses of poultry carcasses.
- However, if the system is not accurately adjusted spray
- chilling can result in an excessive water intake which decreases
- the quality of fresh poultry



Technologies to extend shelf life of meat



- Poultry meat industries:
 - development of technologies to extend shelf life of meat
 - to improve consumer acceptance of products of animal origin,
 - nutritional quality and ensuring safety poultry meat
-
- It can be achieved by using several different approaches:
 - freezing
 - vacuum packaging (VP),
 - modified atmosphere packaging (MAP)

Air freezing

- Is the most preferred method worldwide
- Packaged poultry products are frozen:
 - continuously (cold storage rooms) or
 - discontinuously (tunnels)
- In cold air:
 - at temperatures between -18 and -40 °C
 - air velocity between $0,5 - 4$ m.s⁻¹
 - high relative humidity 95 %
- Poultry parts become frozen to a required core temperature
- within 3 – 4 hours.



Liquid immersion freezing

- Is based on immersion of packaged poultry
- into solutions of freezant (ethylene glycol)
- at the temperatures between $-20\text{ }^{\circ}\text{C}$ and $-30\text{ }^{\circ}\text{C}$
- Using this method **poultry skin**
- becomes **cream – white** and not transparent.
- Freezing time is shortened by 50 %.



Combined freezing

- The combination of **liquid** and **blast freezing**
- Starts with immersion freezing of poultry
- at temperature from $-15\text{ }^{\circ}\text{C}$ to $-20\text{ }^{\circ}\text{C}$ for 0,5 to 1 h
- To impart a uniform white colour of the bird surface.
- Freezing is completed in a conventional blast freezer.



Plate freezing

- Plates containing refrigerant is are situated:
- **horizontally or vertically**
- Direct contact allows rapid transfer of heat from the package to the plate. Increased thickness of the product prolongs of the freezing time.
- The main disadvantage of this method is:
- **limited package geometry (regular shape, flat surface) and**
- **uniform thickness of the product with a maximum of 5 cm.**
- **Application:**
- **Individual packages of deboned poultry parts. and**
- **ready – eat poultry products**



Cryogenic freezing

- Poultry parts are exposed to an extremely cold freezant
- **boiling N** (at $-196\text{ }^{\circ}\text{C}$) or **subliming CO₂** (at $-78\text{ }^{\circ}\text{C}$)
- in an insulated chamber.
- **The rate of freezing is much greater** than that
- obtained with **air or plate freezing.**
- Is only **moderately greater** than that
- obtained with **immersion freezing.**
- High operating costs and potential operational hazard
- make this method not economical for large scale production



Individual quick freezing

- IQF – rapid freezing of small and unpacked poultry parts
- at ultra low air temperatures ($-30\text{ }^{\circ}\text{C}$ to $-40\text{ }^{\circ}\text{C}$)
- Each piece is frozen individually within 10 -12 min.

- The consumers therefore does not have to defrost
- the whole package to take out only a portion.
- IQF products do not require any defrosting before heat processing



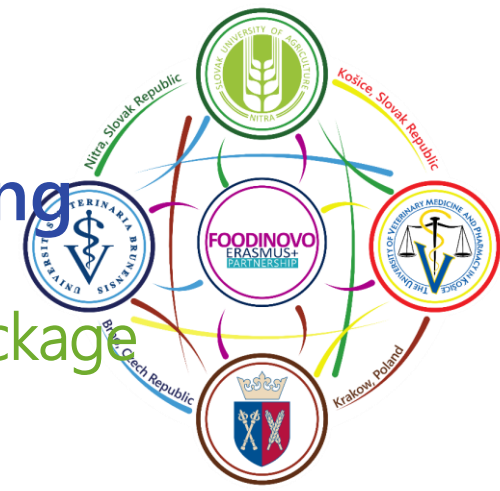
Storage of poultry meat

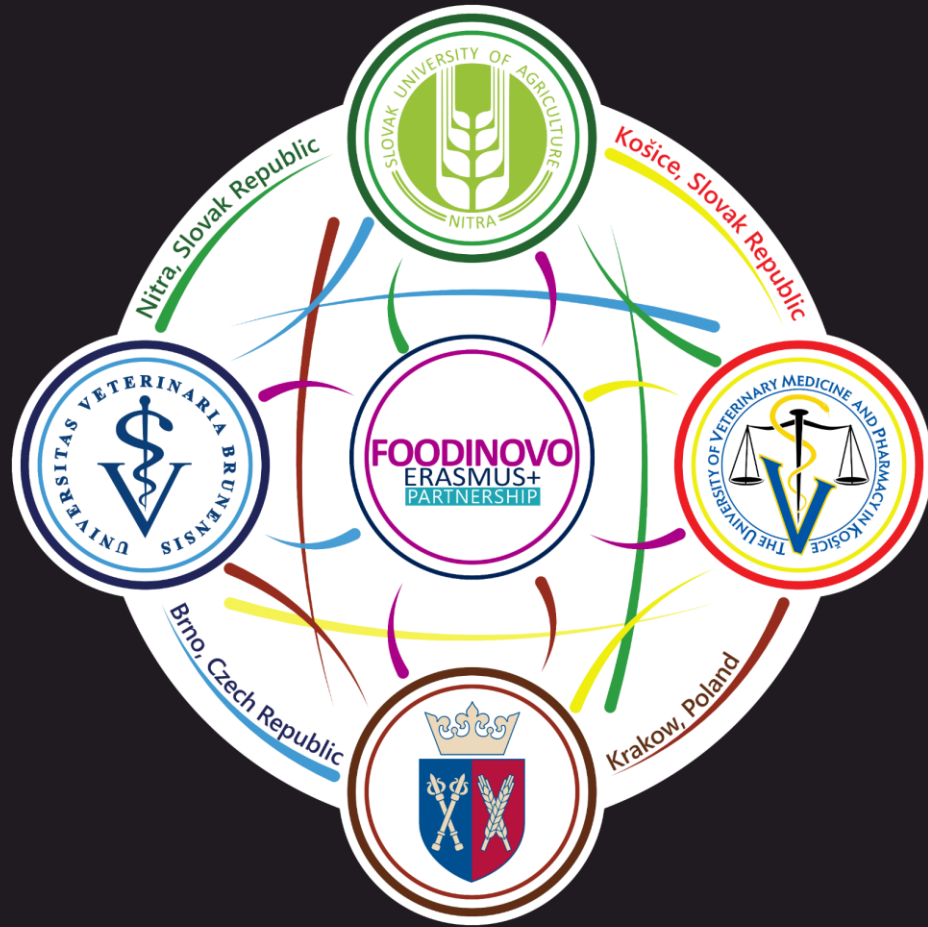
- Storage temperature
 - Fresh poultry meat: from -2 to $+4$ ° C,
 - Frozen poultry meat: maximum -12 ° C
 - Deep-frozen poultry meat: maximum: -18 ° C
-
- Deep - frozen and frozen foods
 - are packed in packaging material that protects against:
 - drying, pollution, microbial and external contamination.



Vacuum packaging and modified atmosphere packaging

- VP - machines removes O_2 from the package and then sealing the package
- O_2 and volatile substances cause spoilage, oxidation and
- loss of nutritional value of meat.
- The advantages:
 - prolongs the shelf life of food, reduces oxidation and
 - prevents the development of bacteria and fungi.
- MAP - substitution of air with a gas or a mixture of gases:
 - $CO_2 + N_2$, $O_2 + N_2$, or $CO_2 + N_2 + O_2$
 - N_2 is used to replace O_2 in packages
 - CO_2 – antimicrobial effect, prevents oxidative reactions, growth of bacteria and fungi
 - the volume of gas and product should be about 1:1





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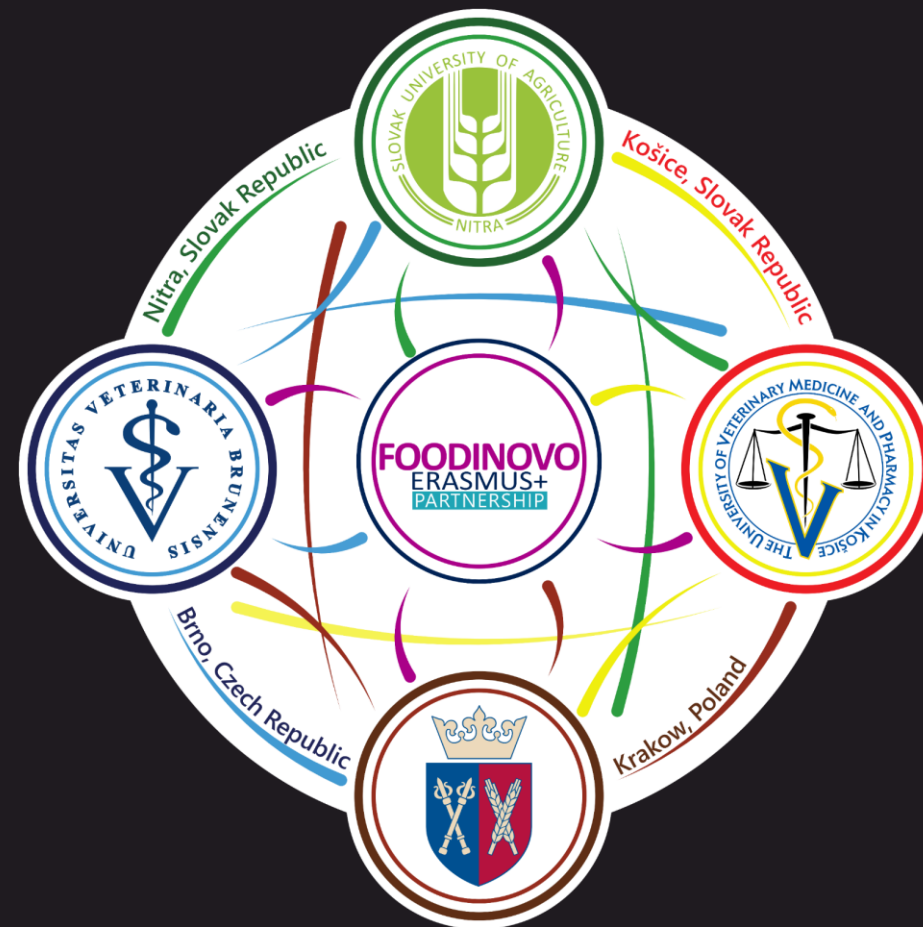
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Innovation of the structure and content of study programs profiling food study fields with a view to digitizing teaching

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