Meat processing

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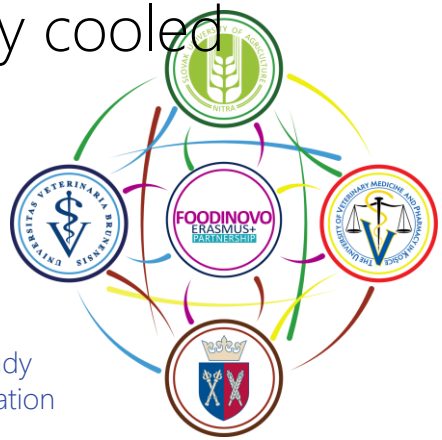
Definitions

- Raw materials (meats not processed)
  - Culinary meat – edible parts of slaughter animals obtained after slaughter and cutted in a slaughtery house which are the single muscles or muscles groups predicted as culinary raw materials /PN-A-82023:2000/+ parts of game animals (shot or slaughtered) perceived as edible
  - Raw edible fats – the fat tissue obtained during after slaughter carcass cut; not processed but only cooled down /PN-A-86940:2001/.



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Definitions

- Raw materials (from animals slaughtered) basically processed:
  - Minced meat – the product/raw material obtained from raw pork, beef, veal, lamb, muton or mixture of above meat with the tissue fat grinded (minced) through knife(sieve) of φ 2-5 mm; mixed, sized,packed, suitable for consumption after thermal treatment/PN-A-82009/1997/
  - Bacon –the half carcass of pork (of a specific breed) without head, legs parts; deboned of spine and shoulder bone; cured in brine and salt/PN- A-82023:2000/.
  - Raw fat preserve – preserved with some specific procedures/procedure (freezing, salting, brinning, smoking) /PN-A-86940:2001/.

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Definitions

- **Meat products** – the products which had lost all natural raw material charactristics:
- Meat cold cut (brined), sausages,meat cans, ready-to-eat dishes, courses, edible melted fats

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BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

- **Methods of preservation of meat products:**
- **Physical** **Physico-chemical** **Chemical**
- Brinning
- Salting
- Smoking
- Low temperatures
- High temperatures
- Chillig/cooling Drying
- Freezing Brewing
- Halfboiling
- Boiling
- Frying
- Stewing
- Roasting
- Pasteurization
- Double pasteurization
- Sterilisation

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BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

- Brining
- Brinning is the process aimed to preserve meat with chemical additives (nitrates, nitrites, salt, polyphosphates etc.) where the advantageous change of color and sensory qualities goes on. The elevating of meat durability(shelf-life) is performer with activity of chloride ions penetrating meat; of deteriorative activity of salts on microflora enzyme proteins; of NO antimicrobial activity.
- Usage for brining of nitrates causes their transformation into nitrites and then into nitric oxide. The NO reacts with haemoglobin and myoglobin to form nitrosoheamoglobin and nitrosomyoglobin which are transformed, during thermal treatment, into nirtosomiochromogen and nitrosohemochromogen which are thermally stable and dye meat product pinky-red.
- Composition of basic brining mixture: 99,4% NaCl and 0,6% $NaNO_2$;
- In a ready to handle product not more than 50 mg NO_2 or 150 mg NO_3 and NO_2 (sum); other amounts are specially dedicated to traditional products [Regulations EC 1333/2008, 1044/2015]
- Also, per 1 kg of meat product some other additives are present in a brine i.e., sugars (saccharose or glucose) and polyphosphates – not more (in ready to eat product) than 5 g P_2O_5 /kg product.

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BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

- Brinning methods:

1. Dry –mixing of meat with dry brining mixture or rubbing of mixture on meat surface than meat is placed, in cooled conditions, for 2-4 days (chopped meat) up to 1 month (smoked long shelf-life products made of one cut).
2. Wet – the brining mixture is solved in water (salting solution) and depending on the way of application onto the meat anyone can name:
    - floodplain like- the oldest method; pouring of salting solution on meat and storage in cooling conditions 3-6 days (offal) up to 2 weeks (smoked long shelf-life products made of one cut)
    - injection – to enhance effectiveness the brining solution is injected into muscles with single or multiple needle injectors
    - combined – combination of injection brine with pouring (for beacon halves, pork loins as further filling for cans)
3. Mixed – combination of two brining methods – wet and dry- meat cut are rubbed with dry salting mixture and then, after 24-48 hours, poured with salting brine; it takes 7 days at average (for pork loins, pork neck and belly bacon)

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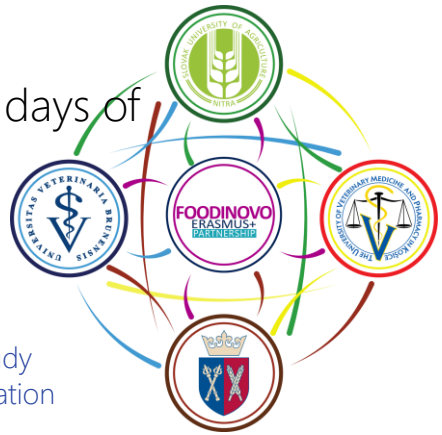
BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

- Massaging (tumbling) of meat
- When we use injection brining the next stage is so called „meat massaging" – the meat pieces fall down from a certain height, hit into each other – the myofibrillar structure is relaxed; the brine is evenly placed in the whole meat piece; the texture of meat is changed because of damaged connective tissue integrity; the water holding capacity and tenderness are increased;
- Types of meat massaging
  - vacuum massaging – the vacuum inhibits foaming; the massage is performer in cycles i.e., 15 min. massage and 45 min. Rest
  - massaging in an atmospheric pressure – up t 1 hour and then 3 days of rest



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BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

- Thermal treatment
  - Submerging of meat and its product to specific temperature at the specific conditions and time; the aim of thermal treatment is elongating of product durability (shelf-life) by killing or inhibition of microorganisms' activity, giving the specific sensory characteristics to the product and increasing of bioavailability of meat proteins for human

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BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

Thermal treatment kinds (part 1):

1. Parboiling (half boiling)- the short time subjecting of meat or offal to water treatment in temp. 80 – 100 °C ; causing denaturation of outer layer of proteins (applied to meat products with offal, some canned meat products and frozen meat products)
2. Boiling – long term treatment of meat or offal to the water and/or steam in temp. around 100 °C; causing proteins denaturation in the whole mass of the product; can be the pretreatment technological operation and the final thermal treatment operation
3. Brewing – the kind of boiling performer in temp.75 - 95 °C; in comparison to traditional boiling is characterized by meaningfully lower mass loss of product thank to outer layer of denatured proteins which prevent leakage (applied for meat products, meat-offal products and culinary meat treatment)
4. Frying – subjecting of meat outer layer to hot fat in temp. above 100 °C (the most suitable temperature range is 130-160 °C).
5. Stewing – combination of boiling and frying- meat or offal are firstly fried (to obtain the fried outer layer of product preventing leakage of inner „meat juice") then cooking with added water in temp. up to 100 °C – parallelly large amounts of sauce are originating building the integral part of a dish (meal)

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BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

Thermal treatment kinds (part 2):

6. Roasting – meat is treated with hot air (temp. 100 °C and above), in a closed dish - the dry roasted „skin" of denatured protein is formed on product surface

7. Pasteurization – hermetically packed/canned meat is treated with hot air (temp. up to 100 °C); where the vegetative forms of microorganisms die and the durability (shelf-life) of product is elongated with nutritional and flavor characteristics staying almost intact; the thermal treatment causes proteins denaturation – the geometric center of can has to be heated to 72°C, at least;

8. Sterilization- hermetically packed/canned meat is treated with hot air and steam (temp. above 100°C); where the all forms of microorganisms die ; in industry the absolute sterile state is difficult to obtain so the term of „technical sterility" is used: the destruction of all microorganism up to very small, accepted value which assumes that 1 for 10 000 cans can be eventually spoiled; the test microorganism here is the sporulating Clostridium botulinum (the exotoxin-botulin-production) which can be present in one can per 1012 cans produced.

9. Tyndalization – two times performed pasteurization with 48 hours cooling break in between;

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BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

Smoking

- Smoking is a process used for meat and its products preservation with help of smoke; there are also ongoing the advantageous changes in smoked products color and sensory characteristics
- This a specific process of meat thermal treatment where parallelly heat and chemical compounds of smoke are active;
- The smoke is obtained from half pyrolysis of wood of deciduous trees in smoke generators or from direct friction of wood
- The basic preservation substances in a smoke are formaldehyde and some phenols

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BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

Smoking methods

1. cold smoking – smoke temperature ranges from 16 to 22 °C, with relative air humidity 90-95%, speed of air 7-15 m/min.; smoking time 1-14 days depending the assortment; applied for raw smoked meat products and some meat offal added products

2. Warm smoking - smoke temperature ranges from 23 to 45 °C, with relative air humidity 70-90% speed of air 7-15 m/min.; smoking time 4-48 h; applied for some smoked whole cut meat products and parboiled sausages

3. Hot smoking – smoke temperature >45 °C; ongoing in two stages:
    1. drying of meat product surface –temp. 40-50 °C, 10-40 min.,
    2. smoking – temp. around 60 °C, 30-90 min;

4. Smoking with roasting – three stages:
    1. smoking at temp. 30-60 °C
    2. roasting at temp. 85-90 °C to internal product temp. of 45 °C
    3. smoking at temp. 70 °C to internal product temp. of 63-65 °C

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BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

Aims of application of food (meat products) additives:

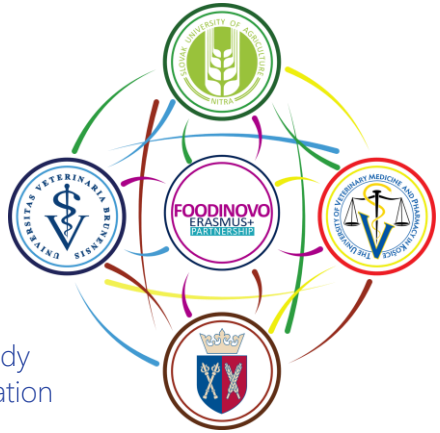
To obtain product with better quality through:

- bettering and preservation of some physical product characteristics i.e., of cohesiveness and consistency

-inhibition of some adverse changes caused by microorganisms;

-inhibition of food oxidation;

- giving the new features i.e., spreadability



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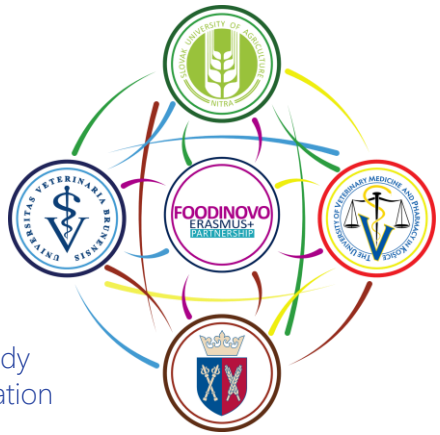
BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

1. Extenders (fillers) – have the ability to bind water; change the emulsifying properties; enlarge the product volume; Obtained from different plant and animal raw materials i.e., cereal gluten, grain flour, breadcrumbs etc.

2. Protein substitutes – protein obtained from different materials: texturized, dyed, flavored, enriched:

    1. comminuted –up to 50% of protein, partially kept structure of raw materials of origin i.e., soya flour;
    2. amorphous – obtained through protein isolation:
    3. concentrates - up to 70% of protein;
    4. isolates – up to 90% of protein. texturized – their structure resembles the meat structure- protein hydrolysates – sodium caseinate

3. Salt - NaCl – lowers water activity, inhibits microorganisms development and enzymes activity



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BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

- 4. Meat curing medium components
  - A/sodium nitrite, sodium and potassium nitrate – create the stable pinky red color of products (even after thermal treatment), are bacteriostatic; the nitrates are generally allowed in raw smoked ripening sausages of salami type
  - B/Sodium and potassium polyphosphates - stabilize emulsion, enlarge its water holding capacity; inhibit fats autooxidation; enhance crispiness of product
- 5. Antioxidants – ascorbic and isoascorbic acids and their sodium salts – allowed for meat products and short life meat products with offal where the typical curing takes place
- 6. Stabilizers and emulsifiers – ascorbic acid and the its sodium, potassium and calcium salts – allowed for cured meat products and canned meat

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BASIC TECHNOLOGICAL PROCESSES APPLIED IN MEAT PROCESSING

- 7. Thickening substances - alginates, agar-agar, carrageenan, gelatine – allowed for canned meat products to bind the thermal leakage
- 8. Substances enhancing taste and odor – glutamic acid and its salts, nucleotide salts (guanylate, inosynate), di glucono-lactone – allowed for meat and meat with vegetables canned food; to raw smoked ripening products – salami type
- 9.Natural seasonings – dried plants parts: roots, leaves, flowers and fruit with characteristic flavor; some of them act as antioxidants, have bacteriostatic effect; can be also applied as extract and oils
- 10. Liquid smoke - allows to avoid traditional smoking; added as 2% suspension, solution or emulsion during thermal treatment (water/steam) of meat product

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Types of meat products (PL)-technological groups depending the production technology

Smoked (cured)meats

- Hams
- Raw ripening ham
- High yield ham
- Smoked product"like ham"
- Shoulder
- High yield shoulder
- Loin
- High yield loin
- Smoked neck (pork)
- High yield smoked neck
- Smoked belly
- Beacon like smoked products
- Smoked lard (back fat)
- Smoked yawl

Meat products with offals

- Liver sausages
- Pate sausages
- Sausages with cereal grains (haggis type)
- Headcheeses
- Meat jellies

Block products

- Small coarsed
- Medium coarsed
- Large coarsed
- With offals
- Aspics and jellies
- Roulades

Sausages

Size of meat grain:
- Homogenized
- *Small coarsed*
  - *Raw small coarsed*
  - *Small coarsed high yield*
- Medium coarsed
  - Raw medium coarsed
  - Medium *coarsed high yield*
  - Medium *coarsed half dried*
  - *Medium coarsed dried*
- Large coarsed
  - Large coarsed high yield
  - Large coarsed dried

Type of raw material
- pork sausages
- beef sausages
- pork-beef sausages
- lamb (pork)sausages

Thermal treatment type
- Raw sausages
- Smoked sausages
- Dried sausages
- Ripened sausages

Smoked (cured) meat

- Smoked meats are the whole primal cuts formed into specific shape preserved with smoke, brine and parboiling or cooking
- General technological operations used for smoked products obtaining:
- 1. Raw material preparation (according to recipe) : deboning, straining, forming
- 2. Curing:
  - Dry - long shelf-life smoked products (time from a few to a fewtenth days)
  - Injection or/and pouring – medium and short shelf –life smoked products.
- 3. Massaging (thumbling)
- 4. Formation: placing of brined meat cuts in some specific forms/molds – i.e., thermoshortening nets
- 5. Thermal treatment:
  - A/Smoking: warm smoke; cold smoke; with roasting
  - B/Parboiling or boiling -
- 6. Cooling (water or air): to internal temp of 7 °C
- 7. Weighing, labelling, etc.

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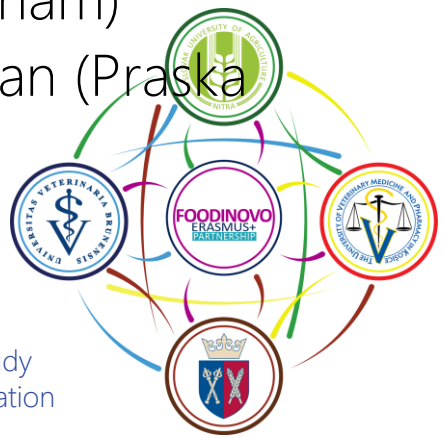
Hams

- A/ storage time –shelf-life:
  - durable (long shelf-life – even a few years in cool, dry conditions; ripening up to 1 year) – raw cured (salted); smoked and dried; canned ham
  - half durable (medium shelf-life - up to 4 weeks during handling in cool conditions) –smoked and cooked;
- B/ way of heat treatment
  - raw- salted, seasoned; ripening with added or natural microflora (Prosciutto, Spanish ham, Ganda ham)
  - smoked and cooked (pasteurized product; Polish ham)
  - canned – cured and seasoned meat sterilized in can (Praska sunka)



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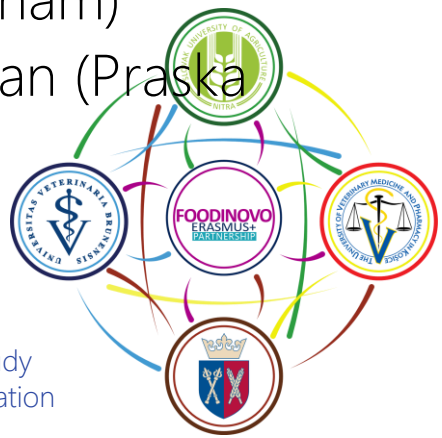

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Technological stages of raw hams production cycle:

I. Raw materials and additives preparation according to recipe (trimming, deboning,

II. Initial treatment (brinning, salting, seasoning)

III. Shaping (and weighing of nett amount of meat for each product type):

A/handmade – forming into selected shapes or placing into ageing chamber

B/half-automatic - forming into selected shapes or placing into ageing chamber with belt conveyor)

IV. Thermal and humidity treatment– depends the type of ripening proces and its time (HACCP point); mostly with controlled temperature humidity in ageing chamber or in caves (traditional products)

IX. Estimation of final product yield of production = product weight/ weight of fat-meat raw mass x100 %

X. Labelling (EU guaranteed sign) packaging, slicing

XI. Storage and shipping

https://pl.wikipedia.org/wiki/Szynka_parmenska

https://www.hurtownia-spozywcza.pl/kumpiak-dojrzewajacy-100-g-bbb.html

https://www.ganda.be/nl/alles-over-ganda-ham/assortiment/ganda-ham-met-been

Technological stages of smoked hams production cycle:

I. Raw materials and additives preparation according to recipe (trimming, deboning,

II. Initial treatment (brinning, salting, half roasting, pickling)

III. Shaping (and weighing of nett amount of meat for each product type):

A/handmade – forming into selected shapes with thermoshortage nets

B/half-automatic – filler with stuffing partial filling and hand forming of ham bar (with thermoshortage nets and collagen film)

VI. Mounting/settling– smoking carts; in room temp.; time ½ - 1 h.

VII. Thermal treatment– depends the type of ham (HACCP point): smoking, cooking, pasteurization

VIII. Chilling , cooling

IX. Estimation of final product yield of production = product weight/ weight of fat-meat raw mass x100 %

X. Packaging, slicing

XI. Storage, shipping

https://e-kocyk.pl/pl/p/SZYNKA-POLSKA-KG-WADOWICE/8014

https://www.notatnikkuchenny.pl/prazska-sunka-praska-szynka/

https://dobrowolscy.pl/podkarpackiespecjaly/szynka-krucha/?lang=en

Traditional „grey" ham production

- Not cured ham with traditional set of seasonings
- Meat raw material– pork ham or shoulder muscles with some fat cover left on
- Auxiliary raw materials – seasonings : all spices grains, salt, bay leaves, black pepper grains, dried majoran, dried thyme, dried basil, coriander, juniper grains; smoking threads, smoking nets etc.
- Pickling brine (per 1kg of ham) – ½ liter of pickling solution: water, 20 g of salt, 6 bay leaves, 10 all spices grains, some majoran, thyme (2-4 g) etc.; „fast" pickling brine (pickling time a few hours) has to contain 10% of salt

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Traditional „grey” ham production

Raw materials and pickling brine preparation

Traditional „grey” ham production

Ham after pickling – formation of shape

Traditional „grey” ham production

Hot smoking of hams

SAUSAGES

A/ storage time –shelf-life:

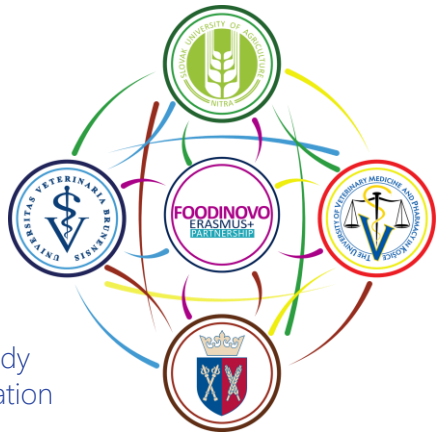
- durable (long shelf-life) –heat treated, roasted; juniper; hunter,
- half durable (medium shelf-life) – raw, smoked, fermented; salami, metka (meat spread)
- not durable –raw, not smoked-white; white raw sausage

B/way of heat treatment

- roasted, cottage' style, Resovian
- multi-hot-water -treated, smoked; Cracovian dry
- hot- water-treated (scalded); ham's sausage

C/ coarse size:

- large coarsed; ham's sausage
- medium coarsed; ordinary sausage
- small coarsed; homogenised; breakfast sausages



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SAUSAGES

Technological stages of sausages production cycle:

- I. Raw materials and additives preparation according to recipe (trimming, deboning,
- II. Initial treatment (brining, salting, half roasting, pickling)
- III. Comminution /grinding
  - A/meat grinder– sieves Ø from 3 mm to 22 mm;
  - B/cutter– rotating knives – homogenization below 3 mm
- IV. Mixing– cochlear/warm gears mixers
- V. Filling of casings:
  - A/handmade – forming into selected shapes with thermoshortage nets
  - B/half-automatic – filler with stuffing partial filling and hand forming of sausage bar
  - C/automatic – vacuum filler and vacuum combine filler (franfurters)
- VI. Mounting/settling– smoking carts; in room temp.; time ½ - 1 h.
- VII. Thermal treatment– depends the type of sausage (HACCP point)
- VIII. Chilling , cooling
- IX. Estimation of final product yield of production = product weight/ weight of fat-meat raw mass x100 %
- X. Packaging, slicing
- XI. Storage

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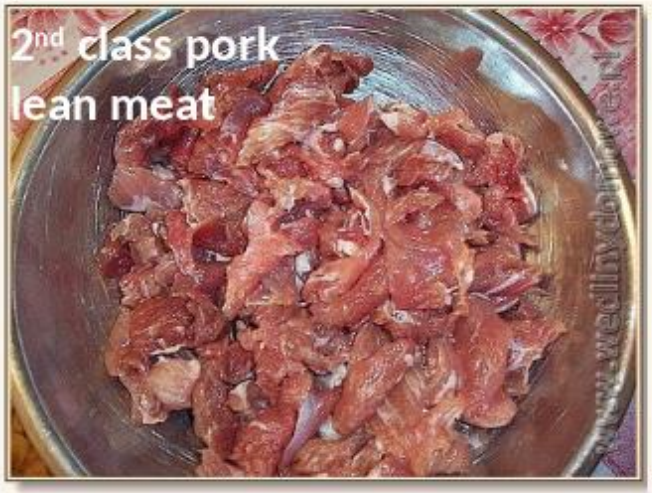
SAUSAGES

Classes of meat used for sausags production depending the sausage type (pork meat)



www.wedlinydomowe.pl

Meat products with offal

Technological stages of production of meat products with offal

- 1.Preparation of raw materials : washing of raw materials: cleaning from blood clots, skinning of pork tongues; soaking and washing in a cold water (primary salted);
- 2.Curing:(not allowed for raw materials for meat pate sausage):
  - -tongues, hearts, pork heads – cover with brine,
  - -tiny cut meats of pork and beef heads – with curing dry salt,
  - -offal, skins, blood, blood fiber, blood plasma – only salting,
- 3. Cleaning and washing of cured /salted meat raw materials in a fresh, cold, running water
- 4. Preboiling, steaming, cooling (not for raw materials for meat pate sausage) :
  - -tiny meats and offal (sorter separately)- preboiling in a small amount of water
  - -fat cut into cubes - parboiling,
  - -liver (for meat pate sausage) - parboiling,
  - -barley and buckwheat grains - cooking;
- 5. Cutting (rough): cube cutter, cutter, meat mincer;
- 6.Fine cutting (depending the assortment of product; <3mm size);
- 7. Mixing of fillings and stuffings
- 8. Filling of caseins and formation of shape: head cheeses and bowel sausages- loose packaging of stuffing to avoid thermal treatment cracking; formation of roulades into molds or into nets;
- 9. Boiling
- 10.Cooling and chilling, pressing to needed shape:
  - -bowel sausages –pate, liver – cooled with water and subsequently with air; mostly products cooled with air;
  - -head cheeses – cooled with aie and then pressed to demanded shape;
- -roulades - cooled with cold water and subsequently with air;

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Meat products with offals

Technological stages of pate production cycle:

I. Raw materials and additives preparation according to recipe (trimming, deboni

II. Initial treatment(initial thermal tratment of individual meat types)

III. Comminution /grinding

A/meat grinder– sieves Ø from 3mm to 22mm;

B/cutter– rotating knives – homogenisation below 3mm

IV. Mixing– cochlear/warm gears mixers

V. Filling of casings:

A/handmade – forming into selected shapes with thermoshortage nets

B/half-automatic – filler with stuffing partial filling and hand forming of sausage b

VI. Second thermal treatment– depends the type of product(HACCP point)

VIII. Chilling , cooling

IX. Estimation of final product yield of production = product weight/ weight of fat meat raw mass x100 %

X. Packaging

XI. Storage

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7.(all other sources mentioned in slides)

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Test questions

- 1/ what are the basic types of meat thermal treatment?

  Smoking, boiling, sterilisation, pasteurisation etc.
- 2/name a few technological stages of cured products production
- Smoking, massaging, brining/curing
- 3/name a few technological stages of sausages production
- Cutting to chosen size, smoking, curing/brinning
- 4/name a few technological stages of pates production
- Cooking, mixing, comminuting (size <3mm), roasting

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Thank you for your attention

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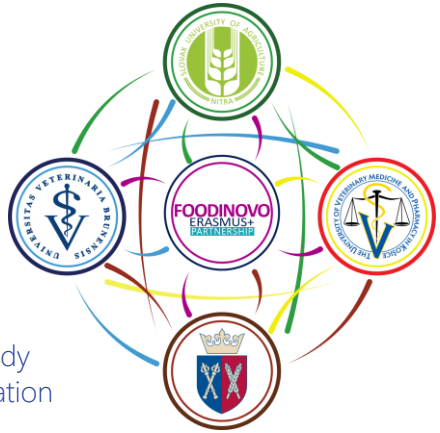

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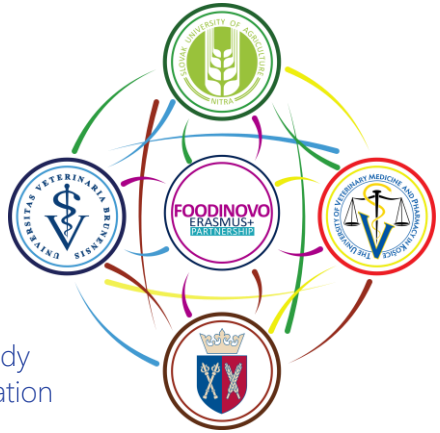

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