

PORK





Meat Processing Toolkit



PORK

1.- Poultry Meat production - General Information

Large differences exist in the tenderness, juiciness and flavour of the various meat animal carcasses because of breeding, age, feeding and management. Hogs suffering from porcine stress syndrome (PSS) prior to slaughter may yield carcasses that are pale, soft and exudative (PSE) or dark, firm and dry (DFD). Exudative carcasses are watery and rapidly lose water. None of these conditions produced by ante-mortem stress renders the product inedible but both lower the palatability and eye appeal of the beef and pork and can be confused with other more serious disease conditions. Colours of the lean and fat are important characteristics of a normal, wholesome product. Most diseased or unnatural conditions will change the colour from what is considered normal for the species. The colour of the muscle tissues for pigs should be Greyish pink.

The pork meat has a protein percentage from 19 to 20 %, with an appropriate combination of the main amino acids presented in an available biologic way. The pork meat is attractive by the flavor and also an excellent source of vitamins from complex B, especially thiamin and riboflavin (B12). All meat animal carcasses are composed of muscle, fat, bone and connective tissue. The chief edible and nutritive portion is the muscle or lean meat.

The pork meat has important nutrients to the metabolism of fats, carbohydrates and proteins. All the cares must be taken to ensure meat quality and the consumer satisfaction regarding all the sanitary specifications.

The optimum amount of rest required by meat animals before they are slaughtered depends on the climate, the distance they have travelled, their method of transport and their general health. In some countries, where animals are auctioned at stock yards before they are taken to an abattoir, the rest periods are sometimes inadequate.

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There are several criteria for a good slaughter method:

- (1) animals must not be treated cruelly,
- (2) animals must not be unnecessarily stressed,
- (3) exsanguination must be as fast and as complete as possible,
- (4) damage to the carcass must be minimal.

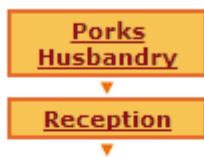
And the method of slaughter must be :

- (5) hygienic,
- (6) economical,
- (7) safe for slaughtering workers.

2.- Husbandry and Slaughtering Processing

Pork Husbandry and Slaughtering Processing

Ante - Morten Concerns



Post - Morten Concerns



2.1.-Ante - Morten Concerns

Pork Ante - morten concerns



2.1.1.-Porks Husbandry

Adequate space is required for the pigs to eat, drink, rest, sleep and move. In addition, there should be enough space for the staff and equipment to provide feed and water, manure

removal, medical treatment and other husbandry procedures. Furthermore, provisions should be made for maintaining and repairing the equipment used in the many aspects of effective husbandry.

Plans should also be made for delivering feed and water and for removing manure on a temporary basis when the regular equipment fails or is shut down for repair. At all stages, pigs should be handled with care, gentleness and patience. Training of employees and family members to properly handle pigs is very important.

To have a good weight carcass yield it is need to do the right choice of breed to be reared. An analysis technique usually taken is the gain of daily weight.

Although the gain of daily weight is a good technique, the age or the number of days necessary to reach a special processing weight is another good character that can be used to evaluate the pork growth rate. Both concepts have been accepted in countries traditionally recognized for the pork meat processing and consumption. Hogs may be killed any time after they reach six weeks of age, but for the most profitable pork production may need to be fed for five to ten months.

2.1.2.-Reception

The transport is done by trucks especially modified to this work. They must work in slow speed without sudden breaks and accelerations that may impart pain to the animals. The night transportation must be preferred to avoid animal injury and because of the cool temperature. The amount of animals into the loads is determined concerning the optimum space among each one. The animals must not be crammed or shaken (in empty gaps) inside the back of truck.

As soon as the animals arrive in the abattoir the animals are unloaded using mobile ramps that can fit to the height of the vehicle. Ramps and chutes should be strong, with no gap between the sides of the ramp and the truck. Ramps should not be steeper than 20°. In the next step, the herds are identified. The identification can ensure that any possible sanitary problem (that may occur in the slaughtering processing line) will be communicate to the responsible person and quality control measures be done.

At this point the animals that show excessive tiredness signs, high body temperature or another behavior that may indicate some abnormality are led to observation far from the others. In case of sickness confirmation, the animal must be sacrificed and the human consumption must be forbidden and ensured.

Afterward, the animals must rest to avoid undesarible alterations in the meat quality. Through this period and immediately before the stunning the animals are constantly bathed to remove the animal body dirties and make then quiet.

Twenty four hours before the stunning, the food supply is cutted to provide the stomach clearing (emptying). This is an important quality measure to reduce the hazard of contamination during the slaughtering process.

2.2.-Post - Mortem Concerns

Pork Post - mortem concerns



a.-Stunning

Special measures should be used regarding the stunning methods to ensure that the humanitarian animal death (to avoid the risk of cruelty). Animals must be stunned or rendered unconscious before they are bleeding. When religious reasons do not allow stunning, extra care is needed to ensure that bleeding causes the minimum of distress to the animal. Drugs cannot be used in the meat industry to induce unconsciousness in animals for slaughter since unacceptable residues would remain in the meat.

Generally, animals are stunned by a captive bolt pistol, by a blow from a pole-axe or in the most cases by electric shock. In recent years the dressing of carcasses has been carried out more frequently as they hang vertically rather than when supine on the abattoir floor. These changing circumstances make it rather less important to ensure that the heart is still functioning as blood can drain quite effectively from the carcass even when heart action has ceased.

b.-Bleeding

If the period between stunning and bleeding is too prolonged the meat quality level will decrease because the heart continues to pump the blood and it can increase the blood pressure and burst the vessels. It'll cause blood coagulation ("blood splash") inside the muscles as an undesirable meat character. When using electrical stunning this consequence is more probable because the electrical shock will certainly increase the blood pressure and it requires less time among the stages of stunning and bleeding.

Lambs are usually exanguinated by a puncture wound which opens the major blood vessels at the base of the neck, not far from the heart. The trade name for this process is sticking. If the sticking wound is inaccurately placed, exsanguination may be too slow, and it may be almost halted by the formation of large blood clots. Incomplete exsanguination increases the amount

of residual blood in the carcass and it may promote the growth of microorganisms. The lean meat may then appear unduly dark and the fat may become streaked with blood.

c.-Scalding

Scalding is the most important part of the dehairing process. If the temperature of the scald is too high, there can be physical damage from dehairing. Also, too hot a scalding temperature and / or too long a time in the scalding tank has been associated with a higher level of meat damage called PSE (pale, soft, exudative). This problem is completely undesirable to the process because it imparts the water loss, the color loss and the tender loss of the meat.

Three type of scalding methods are used:

- (1) Scalding in a tank of water.
- (2) Scalding by recirculating water sprinkled over the pigs.
- (3) Individual scalding with temperature steam.

The problem with steam scalding is that heat transfer can be nonuniform.

After scalding the carcass is dehaired.

After scalding for approximately five minutes at 60°C the carcass is removed to the scraping table. Once a pig is clear of the scraping table the next pig can be placed in the scalding tub.

d.-Singeing

When the method of dehairing is done by special equipment it consumes large quantities of energy and water. One alternative to dehair is to dehide the pig, but dehiding carcasses involves more work. Besides, dehairing is an interesting operation to make use of the skin as a food product. The easiest way do dehair the carcasses is singeing them.

Carcasses are singed in cabinets, which are fired by either oil or gas, depending on the production setup. Small systems can make use of gas canisters to singe the animals. Hence, each pig receives optimal treatment from the scraper blades and they are also washed to clean the residual hair.

e.-Evisceration

The evisceration consists in opening and taking out the intern limbs. At this point the main concern is taking care not to cut special limbs like stomach or intestine because it would probably contaminate the meat and compromise its consumption.

A method for eviscerating, cleaning and trimming the animal to produce a dressed carcasses is described below. It is important to have some idea of the relative weights of the components removed during slaughter. If possible, the carcass should be suspended on an overhead rail in a manner that enables the removal of the several parts of the hindlimbs just to make this stage easier. In some cases the carcass can be eviscerated on flat or rolling tables.

(1) make a long incision through the hide in the midline of the chest and abdomen, and continue the incision along the medial face of each of the limbs,

(2) remove the hide altogether if suitable equipment is available, or just remove it from the ventral part of the body and leave it temporarily hanging from the animal's back,

- (3) open the thoracic cavity with a midventral saw-cut through the breast bone or sternum,
- (4) open the abdomen with a long mid-ventral incision, and remove the penis or udder tissue, and any loose fat in the abdominal cavity,
- (5) split the pelvic girdle with a mid-ventral knife-cut or saw-cut through the cartilage that separates the pelvic bones in the midline,
- (6) cut around the anus and close it off with a plastic bag,
- (7) skin out the tail (if this was not done earlier),
- (8) separate the esophagus (which takes food to the stomach) from the trachea (which takes air to the lungs), by pulling the esophagus through a metal ring; close off the esophagus by knotting it,
- (9) eviscerate the carcass by pulling out the bladder (and uterus if present), intestines and mesenteries, rumen and other parts of the stomach, liver; after cutting through the diaphragm, remove the plucks (heart, lungs and trachea), The intestines must be directed to the viscera room where it is going to be cleaned, washed and salted to produce the casings. The casings are going to be used in the sausage production.
- (10) separate the left and right sides of the carcass by sawing down the midline of the carcass, through the vertebral column,
- (11) trim and weigh the carcass to obtain its hot weight,
- (12) wash the carcass and pin a shroud over it to smooth the subcutaneous fat.

f.-Washing

Washing of the dressed carcass is more complex than it might first appear. Apart from considerations relating to water purity and waste treatment, consideration must be given to sanitizing factors such as chlorine, organic acids and high temperature. Sanitizing agents may greatly reduce the levels of surface bacteria when the carcass is washed, but at the risk of hiding poor sanitation at earlier stages of processing. There is much to commend the philosophy of preventing initial contamination rather than removing it once it is present.

g.-Chilling

After the carcass release, it is lead immediately to the chilling room. The goal is to reduce the temperature as fast as possible to avoid the microbial growth (bacteria) that may cause meat spoilage and offer a hazard to the consumer-€™s health.

When the temperature reaches the right levels (usually with 18 hours of chilling) the carcass is led to commercialization or it goes to the boning room to continue in the process providing the manufacture of other products.

Chilled meat is usually kept for the sale in refrigerated display cabinets, either unwrapped or portioned and packaged for self-service outlets. Refrigerated display cabinets may have fan-assisted convection and/or natural convection. Fan-assisted types are better able to maintain a lower temperature as they are less affected by draughts. Cabinets should be stacked to maintain a good air flow around all meat.

h.-Boning and Cutting

As whole carcasses of beef or pork are too large to be easily transported in one piece, they are split into sides or cut into fore- and hindquarters. The development of meat processing introduced the need for cutting quarters, halves or whole carcasses into smaller pieces which, according to their quality and market value, are used for culinary purposes and processing respectively.

Halving is done immediately after the animal has been dressed and every effort should be made to saw the carcass into equal sides through the centre of the backbone. The side to be cut should be laid on the cutting table with the inside up. The primal cuts of pork are: ham, fore-end or forequarter, loin and belly.

Within each animal carcasses and associated with the different muscles there are variations in tenderness that dictate how different cuts of meat should be prepared to yield the most palatable foods. Because of these differences in tenderness, juiciness and flavour, each meat cut should be merchandised according to its availability and palatability characteristics. Consequently, different prices should be charged for different cuts from the various meat animals so that consumers have choices.

Four essential points when cutting pork are:

- . Cut across the grain of meat when possible.
- . Use sharp knives and saws for speed and good workmanship.
- . Keep the cutting table orderly and have a place for everything.
- . Be clean and sanitary in all operations.

3.- Processed Products

Pork Meat Products

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Sausage Process

The process of sausage manufacturing originated from the necessity to increase the uses of remnants of meat, fat of clearness meat parts and less nobles cuts, adding value to these products. There are many different types of sausages. The differences between them are related with the type of meat, the size of meat grinder disk, the seasonings, the casing diameter, the buds length and the presence or not of smoking.

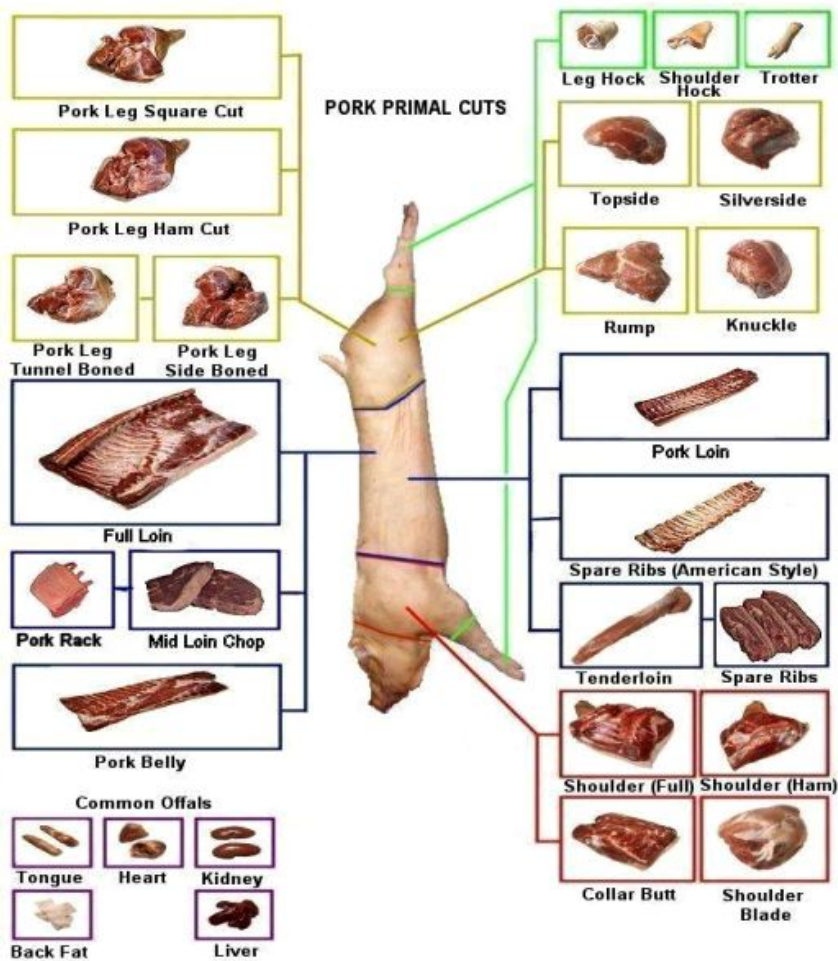
Salted products Process

The salting process act in control and reduction of microorganism, increasing the product shelf-life. They are prepared in the same way, so the process is going to be explained just one time.

Smoked products Process

The smoking process, besides adding value to the meat cuts, it also makes desirable alterations like gold outside color, smoked taste and good juiciness. The smoking process associated with salt using (sodium chloride, nitrite of sodium) and with dryer, act in the reduction and control of microorganisms, and increase the products shelf-life . The creation of new product options enables alternative chooses for the consuming market and a possible additional income source for small scale producers.

Pork Cuts Chart



3.1.- Sausage Products

Sausage Process



a.-Bonning

The goat parts are taken to the processing room where they will be boned. The carcasses of goat are split into sides or cut into fore and hindquarters. The sides or fore and hindquarters can be sold or they can be boned. You can sold the cuts or they can be used to make different products.

b.-Formulation

The seasoning, goat meat, fat and additives are weighted according to the table below.

Table - Sausage Formulation

Ingredients	Quantities
Goat meat	80 Kg
Swine Fat	20 Kg
Salt	2,50 Kg
Water	Enough to dissolve the formulation solid components
Nitrite / Nitrate	0,20 Kg (or according to specific national legislation)
Ascorbic acid / Ascorbic acid salts	0,54 Kg (or according to specific national legislation)
Other seasonings	(it varies according to the type of sausage that is going to be made)

c.-Meat and Fat Grinding

The weighted meat and fat should be cut in pieces that can be put, without difficulty, inside the meat grinder. The grinder meat disk diameter is going to be chosen according to the type of sausage that it is going to be done.

d.-Ingredients Mixture

The ingredient mixture should be done in a mixer that could make a good ingredients homogeneity with the meat and the fat, forming an homogeneous mass.

e.-Casing Preparing

The casing should be washed to take off the excessive salt. After, it should be maintained in treated water for, at least, 10 minutes. This procedure is important to casing rehydration and recuperation of elastic characteristics.

f.-Stuffing

The mass is transferred to the stuffing machine. The stuffing is made using goat casing which is put in stuffing machine end. Knots are made, spaces after spaces, that are divided using cotton wire (string). The knots length is according to the type of sausage that it is going to be made.

g.-Storage

The fresh sausage storage is made under refrigeration, because it is a perishable product.

3.2.- Smoked Products

The smoking process, besides adding value to the meat cuts, it also makes desirable alterations like gold outside color, smoked taste and good juiciness. The smoking process associated with salt using (sodium chloride, nitrite of sodium) and with dryer, act in the reduction and control of microorganisms, and increase the products shelf-life . The creation of new product options enables alternative chooses for the consuming market and a possible additional income source for small scale producers.



◦ Smoked Spare Ribs

◦ Smoked Loin

◦ Smoked Bacon



◦ Smoked Sausages

3.2.1.- Smoked Loin Processing

Goat Smoked Loin processing



a.-Boning

The goat parts are taken to the processing room where they will be boned. The carcasses of goat are split into sides or cut into fore and hindquarters. The sides or fore and hindquarters can be sold or they can be boned. You can sold the cuts or they can be used to make different products.

b.-Formulation

The seasoning, goat meat, fat and additives are weighted according to the table below.

Table - Loin Formulation

Ingredients	Quantities
Goat loin	100 Kg
Swine Fat	20 Kg
Fine Salt	3 Kg
Fine Sugar	0,50 Kg
Nitrite / Nitrate	0,20 Kg (or according to specific national legislation)
Anti oxidative substance (Sodium Eritorbate or Citric Acid)	0,25 Kg Kg (or according to specific national legislation)
Other seasonings	It may vary

c.-Salting

The prepared parts of the loin will be salty with the mixture of the described ingredients in the formulation. The salting is made by the friction of the solid components in the meat part.

d.-Cold Chamber Cure

Then, they are put inside plastic boxes or in stainless trolleys dump-cart and then, they are transferred to chilling chamber at 5°C where they have to stay during a period of four days because of the curing process.

e.-Washing

After cure, the parts are washed with drinking water for the excessive salt removal and then, they are transferred to the processing room. Hooks are used to place the parts in the cages.

f.-Smoking

The cooking and smoking process should follow four stages:

- 1 hour at 60°C with opened chimney
- 1 hour at 65°C with closed chimney
- 2 hours at 70°C, or until the inside temperature raises 68°C
- 12 hours only with cold smoke, maximum 30°C, or until the desirable smoked point.

After cooking, smoking and natural cooling of the loin, they should be put on shelves in the chilling chamber where they are going to stay until the sale moment.

3.2.2.- Smoked Sausages Processing

Smoked Sausages processing



a.-Fresh Sausages

The fresh sausage are keeping into the chilling chamber. Metallic sticks are used to place the sausage in the cages and they are taken to the smoking room.

b.-Smoking

The fresh sausage are put in smoking room for one hour at 50°C, or until it raises the desirable point.

c.-Washing

When leaving the smoking room, the sausages are taken to the cold water shower for the cooling bath and thermal shock, during approximately 10 minutes. After this, the sausage surface is dried and they must go chilling chamber.

3.2.3.- Smoked Spare Ribs Processing

Smoked Spare Ribs processing



a.-Boning

The goat parts are taken to the processing room where they will be boned. The carcasses of goat are split into sides or cut into fore and hindquarters. The sides or fore and hindquarters can be sold or they can be boned. You can sold the cuts or they can be used to make different products.

b.-Formulation

The seasoning, pork meat, fat and additives are weighted according to the table below.

Table -Smoked Spare Ribs Formulation

Ingredients	Quantities
Swine Belly	100 Kg
Fine Salt	3 Kg
Fine Sugar	0,50 Kg
Nitrite / Nitrate	0,20 Kg (or according to specific national legislation)
Anti oxidative substance	0,25 Kg Kg (or according to specific national legislation)
Other seasonings	It may vary

c.-Salting

The prepared parts of spare ribs will be salty with the mixture of the described ingredients in the formulation. The salting is made by rubbing the solid components in the meat part.

d.-Cold Chamber Cure

Then, they are put inside plastic boxes or in stainless trolleys dump-cart and then, they are transferred to chilling chamber at 5°C where they have to stay during a period of four days because of the curing process.

e.-Washing

After cure, the parts are washed with drinking water for the excessive salt removal and then, they are transferred to the processing room where strings are going to be put on the parts end. Hooks are used to place the spare ribs in the cages.

f.-Smoking

The cooking and smoking process should follow four stages:

- 1 hour at 60°C with opened chimney
- 1 hour at 65°C with closed chimney
- 2 hours at 70°C, or until the inside temperature raises 68°C
- 12 hours only with cold smoke, maximum 30°C, or until the desirable smoked point.

After cooking, smoking and natural cooling of spare ribs, they should be put on shelves in the chilling chamber where they are going to stay until the sale moment.

3.2.4.- Smoked Bacon Processing

Smoked Bacon processing



a.-Boning

The swine parts are taken to the processing room where they are going to be boned.

b.-Formulation

The seasoning, pork meat, fat and additives are weighted according to the table below.

Table -Bacon Formulation

Ingredients	Quantities
Swine Belly	100 Kg
Fine Salt	3 Kg
Fine Sugar	0,50 Kg
Nitrite / Nitrate	0,20 Kg (or according to specific national legislation)
Anti oxidative substance	0,25 Kg Kg (or according to specific national legislation)
Other seasonings	It may vary

c.-Salting

The prepared parts of belly will be salty with the mixture of the described ingredients in the formulation. The salting is made by the friction of the solid components in the meat part.

d.-Cold Chamber Cure

Then, they are put inside plastic boxes or in stainless trolleys dump-cart and then, they are transferred to chilling chamber at 5°C where they have to stay during a period of four days because of the curing process.

e.-Washing

After cure, the parts are washed drinking water for the excessive salt removal and then, they are transferred to the processing room where strings are going to be put on the parts end. Hooks are used to place the bacon in the cages.

f.-Smoking

The cooking and smoking process should follow four stages:

- 1 hour at 60°C with opened chimney
- 1 hour at 65°C with closed chimney
- 2 hours at 70°C, or until the inside temperature raises 68°C
- 12 hours only with cold smoke, maximum 30°C, or until the desirable smoked point.

After cooking, smoking and natural cooling of bacon parts, they should be put on shelves in the chilling chamber where they are going to stay until the sale moment.

3.3.- Salted products

Goat Salted Products

Goat Salted Casing Process

Proposal: casing utilization of the goat slaughtered in the own facility. The goat casings are going to be used in Sausage Processing. The casing should be transparent and it should allow the product breath, so that the humidity and smoke could enter and get away, respectively. And it should unfasten with easiness from the finished product, thus the product quality don't be damaged during prolonged storage.



◦ **Salted Cuts**



◦ **Salted Casings**

Goat Salted Cuts Process

The salting process act in control and reduction of microorganism, increasing the product shelf-life. They are prepared in the same way, so the process is going to be explained just one time.

3.3.1.- Salted Casings Processing

Goat Salted Casings processing



a.-Casing Extraction

The slaughtered animal intestines are taken out manually or with a knife relief. This procedure demands skillfulness, because the finished product quality depends on the attention in that removal. The slaughtered animal intestines are extracted carefully, without perforate them, for avoiding contamination and for reaching the minimum lenght of the casing required.

b.-Fat Removal

On the stainless table and with potable current water at ambient temperature, the parts of the intestinal treatment are separated for the next procedure. At the begging, the epíploo is removed and the thin and thick intestine are separated. Between intestinal curves, there is a variable quantity of mesenteric fat that has to be removed as much as possible because of two

reasons: one is because it could be, before processing, transformed in industrial fat; and the other because its continues around the casing causing fat oxidation, that makes the casing inappropriate for the human consumption.

c.-Evacuation of the Intestinal Content

The intestinal content is taken out manually or with an equipment with water jets. The water jets help to clean the casing too. Feces removal is made pressing intestinal curves between two fingers of one hand, while it is pulling with the other hand. Feces, normally liquefied in the portion of the thin intestine, are drained continually to a specific container.

d.-Mucous Removal

The next procedure is to put the casing inside out. The intestines are immersed in stainless tank, that contains drinking water. They are hanged with their ends in bumps disposed serial on one of tank brims. While the mucous is exposed, the intestine is gliding for a tank, slanting about 35° that contains another collector box in its end. The inside out casing are scraped for mucous removal. After the mucous removal, is made the casing washing, and then they are put in saturated brince. They are stored in saturated brince until the next day, before they were classified and salted. The mucous removal is a critical stage in the casing preparation process. If it hasn't been executed correctly, the casing could deteriorate. The brine immersion is important because this stage is the beginning of cure process, besides blood removal that stays in intestines.

e.-Salting

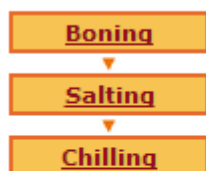
The casing is taken back from the brine and they are put in trays or in a stainless trolley where they are going to receive thick salt in excess. They have to stay in cold storage until finished salting process. The exuded has to be drained and more salt can be added, if it is necessary.

f.-Chilling

The casings, even salted, have to be stored under refrigeration, because there is a risk of deterioration.

3.3.2.- Salted Cuts Processing

Salted Cuts processing



a.-Boning

The goat parts are taked to the processing room where they will be boned.The carcasses of goat are split into sides or cut into fore and hindquarters. The sides or fore and hindquarters

can be sold or they can be boned. You can sold the cuts or they can be used to make different products.

b.-Salting

The parts are put in trays or in a stainless trolley. The salting is made by the friction of the salt in the parts and then they receive thick salt in excess. The proportion between salt and meat is three kilos of salt for each kilo of meat. The parts stay in excessive salt during one week. They have to stay in cold storage until finished salting process and the exuded has to be drained and more salt can be added, if it is necessary.

c.-Chilling

The parts, even if salted, have to be stored under refrigeration, because there is a risk of deterioration.

4.-Porks Health Cares

Several diseases can be transmitted by the meat consumption. This diseases can be classified into three groups :

- (1) Diseases that can contaminate the men by infected animals like tuberculosis and brucellosis;
- (2) Parasital diseases that can contaminate the human by the consumption of meat infested by parasite micro eggs (cisticercus).
- (3) Food toxic infection from microorganism caused by pathogenic bacteria like Salmonella, Shigella, Staphylococcus, Clostridium botulinum and Clostridium perfringens.

