

## TECHONOLGIES CONCERNING THE PROCESSING AND CONSERVATION OF NATURAL CASING INTENDED FOR FOOD INDUSTRY

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### **Abstract**

*Coming from animals with economic interest, small and large intestines are what we call the “natural casings” and they are characterized by being strong enough to withstand the pressure produced by filling them, they are permeable to water vapour and gas, absorb fumes and impregnate with a pleasant flavour, expand or contract in accordance with the amount of added content and can be closed at the ends by binding or clipping. They are subjected to a calibration process after which they must comply with the stipulations of technical specifications or manufacturing standards. Natural casings are preserved by drying and salting and must meet a number of legal requirements. The purpose of this research is to identify and monitor the obtaining and preservation of natural casings for the meat industry. Natural casings that were processed in specialized units and then traded on the domestic market were analyzed. Differences in technology are found depending on the species from which the natural casings originate, but also according to the intestinal segment subjected to processing phases. Processing defects such as holes or tearing in the natural casings can be ascertained, but also defects in preservation that may lead to downgrading or even the marketing withdrawal of the incriminated products. Salt casings can be packed in plastic or barrels with different capacities. Separately packed are wrinkled pork guts, small pork guts, small sheep guts etc. To ease the insertion in the spur pipe, the casings can be sprouted onto the plastic sticks, resulting in tubular casings. Although technology development makes it possible to produce artificial casings such as collagen, cellulose and fibrous membranes, meat products in casings from natural intestines are preferred by consumers.*

**Key words:** casings, meat products, food safety.

### **INTRODUCTION**

The casing is an assembly of proteins and lipids, having specific properties of permeability, whereby subdivision of the living matter is accomplished (Costea et al., 2004; Dubei, 2009; Marcu et al., 2009).

Natural casings are represented by small and large intestines from animals of economic interest (cattle, sheep, goats, pigs) that differ in length and caliber (Priseceanu et al., 2015; Tăpăloagă et al., 2016). They are used in the meat-making industry as guts (Petcu, 2015).

The natural casings are preserved by drying and salting and must meet the following requirements: be tied up in ties (salted ones) or packets (dried ones), be degreased, not to smell of rancid, sour or rotten, not to show holes (Georgescu, 2000).

They are characterized by being strong enough to withstand the pressure produced by filling

them, they are permeable to water vapour and gas, absorb fumes and impregnate with a pleasant flavour, expand or contract in accordance with the amount of added content and can be closed at the ends by binding or clipping.

Although technology development makes it possible to produce artificial casings such as collagen, cellulose and fibrous membranes, natural casings are especially preferred for products consumed with edible wrapping, such as sausages (Bakker et al., 1999; Zengin, 2010). Historically, intestinal segments of lamb, beef, or pig, such as the stomach, the small and the large intestines or bladder, used to be filled with the sausage mix. Being one of the most commonly consumed meat products, sausages and salamis are typically obtained from red meat or poultry meat, by chopping and mixing with appropriate spices (Zengin, 2010; Ghimpețeanu et al., 2016).

## MATERIALS AND METHODS

The purpose of this research is to identify and monitor the obtaining and preservation of natural casings for the meat industry.

In the period 2017-2018, natural casings processed in specialized units and then traded on the domestic market, were analyzed.

Depending on the species from which the natural casings originate, as well as the intestinal segment subjected to processing, differences in technology can be found.

After the processing, the natural casings of the animals intestines (guts), are salted or dried, after which they are packaged and stored until filled with a meat composition (Petcu, 2015).

Before processing, the intestines are subjected to veterinary control and only those that have been found appropriate are processed for use in the food industry (Pavel et al., 2007; Laslo et al., 2009).

Through an organoleptic examination, appreciation is made after the following criteria: the outer appearance of the casings, the colour, the consistency and the smell.

Verification of physico-chemical characteristics refers to the strength of the casings walls at an air pressure required for calibration, as well as the Nessler reaction and the determination of hydrogen sulphide ( $H_2S$ ), which must be negative.

Processing defects such as holes or tearing in the natural casings can be ascertained, but also defects in preservation that may lead to downgrading or even the marketing withdrawal of the incriminated products (Arduser et al., 2005).

## RESULTS AND DISCUSSIONS

Natural casings are calibrated and must meet the requirements of technical specifications or manufacturing standards.

Salt casings can be packed in plastic or barrels with different capacities.

Separately packed are wrinkled pork guts, small pork guts, small sheep guts etc.

Lately, to ease the insertion in the spur pipe, the casings can be sprouted onto the plastic sticks, resulting in tubular casings (Figure 1).



Figure 1. Tubular natural casings  
(www.marchard.ro)

### Processing defects

Holes result from the evisceration process, pulling guts from the mesenter, the manual or mechanical degrease performed faulty.

External dirt and debris of intestinal contents are defects produced by non-compliance with hygiene and processing technology.

Fat remnants have the appearance of fat islands or a continuous fat line (on the intestine and mesenter joining line).

The defect can be avoided by pulling the guts from the mesenter correctly, cooling the guts for further degreasing, and using special equipment or a wide knife for the best grinding of fat (Mincu, 2001; Arduser et al., 2005).

### Preservation defects

Casings redness is caused by certain salt-resistant microbial species that grow to over  $15^{\circ}C$  (*Micrococcus rozeus*, *Bacillus serratium*). Reddish guts give off a characteristic smell. Defects can be avoided by observing technology and applying rigorous hygiene measures (Pop et al., 2005).

Rust is a common defect in pigs and sheep casings. It appears on the surface of the casings, having the appearance of a lick, similar to fish scales, yellowish-brown to greyish. Rust is produced by bacteria that metabolize the iron and the calcium from salt.

Colour change is a defect of chemical nature. It occurs when casings are not well covered with salt, which causes a grey or even blackish appearance.

Casings putrefactions caused by the multiplication of putrefaction bacteria due to faulty processing and storage. The process of alteration is similar to post-mortem

putrefaction, resulting in a smell of ammonia and hydrogen sulphide, and on the surface of the casings appear sulphmethaemoglobin spots, black or bluish, of different shades (Ciobotaru, 2013).

Salt stains appear of different shapes and sizes, located on the surface of the casings preserved with large granule salt, which stick to the walls of the casings, due to the fact that the granules remain undissolved. For prevention, only salt with the right granule must be used (Parker, 2001).

Due to weakness against swelling by air or water, the weakening of casings walls strength usually accompanies the process of putrefaction. Sometimes, the resistance is also weakened by the incomplete scraping operation.

Souring is a slow acid fermentation that changes the colour of the casings from pink to grey, accompanied by the appearance of a sour odour. The phenomenon occurs in insufficiently cleaned and salted casings. The gases released dislodge the tunics that make up the walls of the casings and cause them to lose their strength, rendering them unusable.

The lack of gloss (in dry casings) is caused by the surface deposition of protein substances resulting from insufficient softening in drainage basins or as a result of drying at temperatures too low. In order to prevent the defect, it is recommended to work correctly, soaking the casings in basins where water changes frequently, drying at temperatures above 10°C.

Wrinkling is a defect present in dry casings that have not been tightly connected to the ends nor have small unobservable holes, favouring gradual loss of air during the drying process (Savu and Petcu, 2002).

Excessive drying occurs in casings subjected to the drying process at too high temperature and too low humidity or in the casings that have been exposed to direct sunlight. As a result, casings become friable and brown. Drying of casings should be done only in ventilated areas and away from direct sunlight.

### **Storage defects**

Mildew process is a defect that occurs in dry casings, processed in improper conditions, and stored in damp and non-aerated rooms. The moulds penetrate into the walls of the casings

and form a velvety white-greenish on the surface layer that emits a specific odour.

Destruction caused by insects (moths and bugs) is found in dry, dirty, poorly defatted and stored in improper conditions casings. For the purpose of prevention, perfect hygiene, good ventilation and compliance with pest control programmes, mandatory for all units of the food industry, will be maintained (Neagu, 2010).

### **Results obtained from the examination of small and wrinkled pork guts**

Small pork guts (derived from the processing of small intestines) are used for different types of cooked sausage, fresh sausage, liverwurst etc. Pig intestines have a diameter from 28/30 mm to 42/44 mm (Neagu, 2010). Wrinkled pork guts (derived from the processing of large intestines) are used for the liverwurst, dried sausages etc. For commercialization, small pork guts are divided into large, medium or small diameters.

After being obtained and cleaned, these have been subjected to a salting treatment (Figure 2).



Figure 2. Salt treatment of pork casings

The quality verification rules imply: organoleptic verification (Table 1), product temperature at reception (+2 ... +10°C), shelf

life verification on the label and visual inspection of packaging.

Usually, packing of small pork guts is made in plastics, each box having 10m of intestines. Packing of wrinkled pork guts is made in plastics, each box having 0.70m of wrinkled guts. The storage temperature is between 2 and 10°C, to avoid any changes of the products. The shelf life of salted wrinkled pork guts is two years.

Table 1. Organoleptic and physico-chemical properties of natural casings from pig intestines

Organoleptic properties	
Appearance	natural
Colour	transparent white
Consistency	firm and elastic
Smell	pleasant, characteristic, no foreign smell
Physico-chemical properties	
Having walls resistant to air pressure necessary to determine the calibre and sorting by product type (Figure 3).	



Figure 3. Checking the calibre of natural casings in pig intestines

During salt treatment and packaging, the products will be handled quickly to avoid interruption of the cold chain. At the end of the shelf life, freshness parameters of the products were tested and corresponding results were obtained at all tested samples.

### Results obtained from the examination of cattle guts

The natural cattle casings are used for different types of sausages and for traditional products. The small intestines are 36/38 mm in diameter, medium intestines are 38/40 mm in diameter, and the large ones have a diameter of 40/43mm.

After being obtained and cleaned, these have been subjected to a salting treatment. Organoleptic properties of natural casings from cattle intestines are presented in table 2.

Table 2. Organoleptic and physico-chemical properties of natural casings from cattle intestines

Organoleptic properties	
Appearance	natural
Colour	yellow
Consistency	firm and elastic
Smell	characteristic, no foreign smell
Physico-chemical properties	
Having walls resistant to air pressure necessary to determine the calibre.	

Most commonly, the cattle casings are packed in bundles, each one having 30m. The storage temperature is 2-10°C. During the 2 years of the study, no deviations from the set temperature values have been identified in the processing unit. Salted cattle casings have a shelf life of 2 years. The products will be handled quickly during salt treatment and during packaging to avoid interruption of the cold chain.

### Results obtained from the examination of sheep guts

Natural sheep's casings are used for various types of sausages. Sheep intestines have a diameter from 16/18 mm to 28 mm (Banu, 1996). Table 3 presents the organoleptic and physico-chemical properties of natural casings from sheep intestines.

Table 3. Organoleptic and physico-chemical properties of natural casings from sheep intestines

Organoleptic properties	
Appearance	natural
Colour	varies from white to grey
Consistency	firm and elastic
Smell	characteristic, no foreign smell
Physico-chemical properties	
Having walls resistant to air pressure necessary to determine the calibre (Figure 4).	





Figure 4. Checking the calibre of natural casings in sheep intestines

The results and discussions on the microbiological analysis of the intestine samples for the meat industry are presented in Table 4.

Table 4. Microbiological analyses of intestinal samples for the meat industry

Product	Test / Analysis Method		
	Enterobacteriaceae by ISO 21528-2/2017	Total number of germs by SR EN ISO 4833-1/2014	Salmonella spp. by SR EN ISO 6579-1/2017
Pork casings 10m casserole	<10 ufc/g	<10 ufc/g	Undetected / 25 g
Wrinkled pork casings 0.70m	<10 ufc/g	<10 ufc/g	Undetected / 25 g
Hindgut pork casserole	<10 ufc/g	<10 ufc/g	Undetected / 25 g
Sheep casings 10m casserole	<10 ufc/g	<10 ufc/g	Undetected / 25 g
Pork natural casing for hog's pudding	<10 ufc/g	<10 ufc/g	Undetected / 25 g
Pork casings 10m, casserole	<10 ufc/g	<10 ufc/g	Undetected / 25 g
Wrinkled pork casings 0,70m	<10 ufc/g	<10 ufc/g	Undetected / 25 g
Pork casings 10m, casserole	<10 ufc/g	<10 ufc/g	Undetected / 25 g
Wrinkled pork casings 0.70m	<10 ufc/g	<10 ufc/g	Undetected / 25 g

Samples of the packaged products are harvested and subjected to laboratory analysis.

The results obtained fall within the accepted limits for the products under study.

### Results and discussions on meat traceability for the meat industry

The way the product is batched and identified must prove good traceability (Figure 5). Therefore, when a large batch of raw materials is received in the casings processing unit to obtain meat products, the workforce must strictly follow the recommendations and directions received from the food safety manager. Smaller batches of casings, which have undergone similar conditions of temperature, humidity and hygiene, in a single working day, have been formed most of the time. There were no instances of non-compliance with traceability.



Figure 5. Salt pork casings (a) and salt sheep casings (b)

### CONCLUSIONS

Although technology development makes it possible to produce artificial casings such as collagen, cellulose and fibrous membranes, meat products in casings from natural intestines are preferred by consumers, which is why the monitoring of their quality must be carried out rigorously in all stages of their processing.

The monitoring of the storage temperature of the casings during the research has demonstrated compliance of the values established by the technical specifications, for all assortments of casings.

The microbiological analyses performed for samples of pork and sheep casings have demonstrated compliance with the values required by the technical specifications and also with the freshness parameters that have

been maintained throughout the shelf life for all the batches analyzed.

Traceability has been respected among all batches of processed casings, meaning that the staffs properly trained and aware of the importance of traceability in the food industry.

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