Introduction

The population and economic growth and development in many countries nowadays set new challenges for the industry of food production. One of the most significant demands is ensuring availability of sufficient quality of meat for human nutrition. In the aim of fulfilling these demands, the modern industry tries to use different raw materials in food production, including the raw materials of lower quality for the production of certain foodstuffs. The technological progress has enabled the application of machines for mechanical meat deboning which enabled the use of meat of good technological and economical characteristics for further processing and production in meat industry. In the process of separating meat from bones during the mechanical meat production, there is a significant quantity of meat remains around bones, so as a larger portion of meat as possible is tried to be used by using different machines and mechanical procedures to separate the maximum quantity of meat from bones) in order to have as smaller unusable share of bones per animal as possible. By using the described procedure, a new source of usable protein is obtained and market value of the whole production is increased as well.

Mechanically separated meat (MSM) is a general term for the meat produced by deboning regardless of the deboning procedure and it includes the product which is obtained by a mechanical separation of meat from bones or from flesh-bearing bones (it mostly applies to meat of other animals), in which process there appears the loss or a modification of the structure of muscle fibers.

For the meat produced by a mechanical deboning, mechanically separated meat (MSM), there are several synonyms and they are mechanically deboned meat (MDM), mechanically deboned tissue (MDT), and mechanically recovered meat (MRM). In the Republic of Croatia, it is called mechanically separated meat (MSM) and it is obtained by a hard separation – the procedure of separating hard parts so that meat can be separated by a mechanical procedure from bones which it is attached to. The meat produced by the so-called soft separation – the procedure of mechanical separation of soft parts in which process there also appears separation of the tendons and connective tissue, is called mechanically deboned meat (MDM). Even though the listed terms indicate different products considering the production procedure and original raw meat, and product is basically the same, except for the fact that there are some slight differences in organoleptic characteristics of such meat (EC 853/2004, EC, 2010).

Mechanically separated meat (MSM) is basically produced of pork and beef lean tissue (beef rib) which contain a lot of meat after primary processing (separating meat from bones). Mechanically separated poultry meat is produced of carcasses where the parts of meat such as wings, breasts, drumsticks and thighs are previously removed, or whole carcasses can be used too. During the production process, bones and carcasses are delivered to the chamber of the machine where they are put through a sieve with holes of 0.5 to 5 mm diameter under high pressure. At the same time, bones of parts remain within the tube which is emptied separately in order to assist the mixing of soft tissues and separated bones. Nowdays, at the market of meat industry there are a few kinds of machines and working principle is the same for all of them (Schweizer & Zajc and Horn, 2001).

Mechanically deboned meat (MDM) is produced of lean trimmings which contain a high percentage of connective tissue and cartilage. Production procedure proceeds in several steps. First, lean trimmings are mixed to meat pieces of 1.3 to 250 mm diameter, and then they are put into a machine which separates connective tissue and cartilage based on the difference in firmness and structure of the tissue. During that process, lean meat which retains its structure goes through slit openings of the rotary tube and it comes out as a product, whereas connective tissue and ligaments are separated from the meat and they stay in front part of the machine. They are then removed without mixing with meat. To do this, a higher unavailability of such meat is achieved. After separation, it can be used in the production of boiled sausages (sausages, fillets andpizza). The obtained meat is also known as “Baader meat” according to the name of the machine which it is produced by.

“Baader meat” contains a high percentage of protein ranging from 15 to 17% where 70 to 83% of protein comes from muscles. The ability of blending added water of thus produced meat is significantly higher than of the mechanically separated meat (MSM), which makes the mentioned meat an economically and nutritionally valuable foodstuff and nowadays it is used more as a raw material in further meat production and processing.

The quality of feedstock (carcasses and bones), production process and storage conditions have an important role during the production of mechanically separated meat of adequate organoleptic and microbiological quality. Such product, the so-called mushroom, represents an ideal medium for the growth and development of microorganisms, which gives the crucial importance to hygienic procedures in the production and to the quality of feedstock. Except for the listed, total microbial count in mechanically separated meat also depends on the kind of meat, and as a rule, it is higher in poultry and pork meat than in beef (Debets et al., 2006).

Most countries have legally regulated production procedures of mechanically separated meat. For example, bones and carcasses have to be stored at 0 to 2°C within 24 hours before the production. In case that bones and carcasses cannot be used within one day, they have to be frozen and used for the production only within next eight days. Also, mechanically separated meat has to be produced only within 24 hours from the appropriate temperature (Regulation 528/2001, EC, 2010). In the Republic of Croatia, this criterion applies to mechanically separated meat (MSM) produced by the machines listed in Annex I, Section V, Chapter III, Item 3 of the Ordinance on hygiene rules for fresh or frozen

Conference report

Slovenian

For the last few years in poultry industry there was increased use of mechanically separated meat, meat of lower quality value, which is the product obtained by removing meat from poultry carcasses or by removing meat from flesh-bearing bones after boning. In this process, the loss or modification of the muscle fiber structure occurs. Since such meat has been previously used, it is necessary to test organoleptic and microbiological characteristics of turkey Baader meat, a type of mechanically separated meat which does not contain bones and for which the majority of producers claim to have a shelf life of 12 months in case of storage at –18°C. The analysis of organoleptic and microbiological characteristics was made at receipt of the meat and it was repeated after eight, nine, ten months of storage as well as at the end of the declared shelf life of 12 months. The testing included analysis of defrosted and cooked samples of meat. During the analysis period, some slight organoleptic changes have been noticed in the ninth month of storage, while significant changes were noticed after the ninth month of storage. In spite of slight organoleptic changes, the results of microbiological analysis of turkey Baader meat made in the same testing periods, as well as the chemical analysis at the end of the research indicated that the meat was hygienically adequate product.

Key words: mechanically separated poultry meat, Baader meat, shelf life, organoleptic characteristics, microbiological characteristics, shelf life, microbiological characteristics.
Aside from production procedures, microbiological criteria of mechanically separated meat are also legally regulated and it is done by the Regulation on microbiological criteria for foods (Official Gazette 74/2008) which is used to take over provisions of the Regulation (EC) No. 853/2004 which is used to determine special rules of hygiene of the food of animal origin. The listed criteria include determining the presence of bacteria of the genus Salmonella, Listeria monocytogenes, aerobic mesophilic bacteria and bacteria from enteric coli. According to the need, any entity in food business can also include microbiological controls which include the analysis of other significant pathogenic microorganisms such as Staphylococcus spp. and sulphite-reducing bacteria.

Considering the fact that most countries use mechanically separated meat in the production of pâtés, sausages and frankfurters, it is necessary to pay attention to chemical characteristics of the product. Even though there are no significant differences in the share of fat and the ratio of fat and protein in poultry, pork and beef meat, fat content in poultry MSM can differ significantly. Protein content in MSM is from 12 to 15%, while 60 to 70% of protein is from muscle tissue (Steinhassenaus and Steinhause, 2000). Still, regardless of the protein content from muscles, this product has no significant ability of binding added water and it is because of breaking muscle structure during the process of mechanical deboning. Mechanically separated meat is characterized by a thick and soft consistency because of degeneration of muscle tissue and, if it is used in the production of sausages and frankfurters, such products will not have an elastic consistency. Also, mechanically separated meat is characterized by high pH values in the range from 6.2 to 6.4, and it can result in a negative effect on the development of color in cooked products. Out of the remaining parameters of MSM and mechanically separated meat, a share of calcium in a fresh product is important, which must not be higher than 0.1% (100 mg 100 g or 1000 ppm) according to the Regulation (EC) 853/2004 and 2004/479/EC (Navay et al., 2007; EE, 2010). All the listed indicates to certain parameters which should be controlled during the use of such meat for the production of other products.

**Shelf life**

Shelf life of mechanically separated meat depends on many factors such as the total microbial count in raw material, the way of storing raw materials, the way of storing finished products, as well as freezing and storing frozen products. Most producers on the market limit the shelf life to 12 months at -18°C. In that process, any change in the temperature regime can shorten the shelf life. For example, storing mechanically separated meat at -12°C shortens the shelf life from 12 to 6 months (Domene et al., 2005). The experience has shown that there are changes also connected to the kind of meat. Thus, mechanically separated chicken meat has less expressed organoleptic alterations in comparison to mechanically separated turkey meat of the same production date.

Whether we speak of fresh or frozen products, significantly shorter shelf life of mechanically separated poultry meat in comparison to beef, the same as pork, is explained by a high percentage of unfattened fatty acids which can cause defects. Except for the listed, the presence of bone marrow which contains metals such as iron, magnesium and copper, can also affect oxidation processes and therefore shorten the shelf life (Kervila and Lukka, 1994).

“Baader meat,” similarly as mechanically separated meat, has declared shelf life of 12 months at -18°C. Considering the fact that there are certain similarities with the production of mechanically separated meat, the question arises whether there are any organoleptic alterations in “Baader meat” which could affect the quality of products such as pâtés, sausages and frankfurters in further production procedures. The aim of this paper was to research organoleptic and microbiological characteristics of “Baader meat” during the declared shelf life of 12 months.

**Material and methods**

The research was conducted on turkey “Baader meat” produced on January 20, 2010, received on April 20, 2010, which was packed in an opaque film, formed in blocks of 10 kg in average and approximately 20 cm thick. Blocks of the product were placed on a pallet and wrapped in film. Each pallet had an appropriate producer declaration with information on the kind of product, producer, quantity, date of production, shelf life and the way of storing. Turkey “Baader meat” was stored at -18°C. During monitoring, there were noted alterations in shelf temperature from 0.1 to 3.5°C which occurred because of the door of deep-freeze chamber were opened during each handling with the product.

Upon the receipt of the product in a storage, there was analyzed a chemical composition (total protein, share of fat, share of water, calcium concentration and connective tissue proteins) and the obtained results were compared to the values at the enclosed specification. A chemical analysis was conducted by means which contains metals such as iron, magnesium and copper, can also affect oxidation processes and therefore shorten the shelf life (Kervila and Lukka, 1994).

In order to determine proteins in a storage, there were used standard methods and they were: the method HIN ISO 937 for determining protein levels, the method HIN ISO 4443 for determining the share of fat, the method HIN ISO 4863 for determining sulphite reducing bacteria, the method HIN ISO 4863 for determining mesophilic bacteria, and the method HIN ISO 11268 for determining the presence of L. monocytogenes. Microbiological safety of stored “Baader meat” was checked on the eighth, ninth and tenth month of storage as well as at the end of the declared shelf life of 12 months.

Organoleptic observation was started at the eighth month of storage and it was repeated once a month until the appearance of strongly expressed organoleptic alterations, the same as on the product which was 12 months old. Five sensory analysis panelists made an organoleptic analysis of a frozen product, in which process color and odor were observed, as well as changes on its surface and cross section. The appearance, color, odor, taste and consistency of a cooked product were also observed, and all the noticed observations were noted.

**Results and discussion**

By an organoleptic examination of received raw material, it was determined that the meat was of pale pink color and coarse-grained structure which expressed pieces of adipose tissue more strongly. There were no visible signs of oxidation processes on the surface and cross section. Odor and color of the cooked sample did not alternate from the parameters prescribed by the producer’s specification. Taste was characteristic for the used raw material of turkey meat and consistency was loose. A chemical analysis was used to determine proteins in the concentration from 18 to 19%, fat in the content from 13 to 14%, water in the content from 63 to 65%.
calcinium in the concentration from 0.01 to 0.03% (100 to 300 mg/kg) and connective tissue proteins in the concentration from 0.5%. Based on the results of microbiological analysis of researched samples, raw material met health safety standards (the results are not presented), i.e. in compliance with the requirements of the Ordinance on microbiological criteria for food (Official Gazette 74/06). The appearance of turkey “Baader meat” at the receipt of raw material is shown in Photo 1.

The second organoleptic examination was made on September 20, 2010 when turkey “Baader meat” was stored for eight months. On the block's surface there were visible grey areas which were the consequence of oxidation process on adipose tissue. The product was pale pink with coarse-grained structure which expressed pieces of adipose tissue more strongly. There were visible grey areas on the surface and cross section. During the organoleptic examination there were also no visible oxidation signs. Odor and color of the cooked sample did not alternate from the producer's specification. Taste was characteristic for turkey meat and consistency was loose. Microbiological analysis of “Baader meat” samples which were stored for eight months gave the following results: aerobic mesophilic bacteria \( \leq 2 \times 10^2 \) CFU/g, Escherichia coli \( < 10^2 \) CFU/g, Staphylococcus aureus \( < 10^2 \) CFU/g, Salmonella spp. \( < 25 \) g, Listeria monocytogenes \( < 10^2 \) CFU/g. According to the obtained results, the samples were safe, i.e. they complied with requirements of the Ordinance on microbiological criteria for food (Official Gazette 74/06). The appearance of turkey “Baader meat” stored for nine months is shown in Photo 3.

The fourth examination of turkey “Baader meat” was made when it was stored for 10 months. By the organoleptic examination there were visible much expressed grey areas which were the consequence of oxidation. The meat was pale pink with coarse-grained structure which expressed pieces of adipose tissue more strongly. There were visible oxidation signs which were approximately 1 cm thick at the cross section, along the edge of the surface. There were no visible oxidation signs on the cooked sample, the color did not alternate, whereas the color was mildly smooth and the taste was significantly changed – it was very bitter and sour. Consistency was loose. Microbiological analysis of “Baader meat” samples which were stored for 10 months gave the following results: aerobic mesophilic bacteria \( 4 \times 10^3 \) CFU/g, Escherichia coli \( < 10^2 \) CFU/g, Staphylococcus aureus \( < 10^2 \) CFU/g, Salmonella spp. \( < 25 \) g, Listeria monocytogenes \( < 10^2 \) CFU/g. Based on the results of the microbiological analysis, the sample of turkey “Baader meat” which was stored for 12 months was safe, i.e. it complied with requirements of the Ordinance on microbiological criteria for food (Official Gazette 74/06).

There was examined a chemical composition as an indicator of quality after the expiration of shelf life of the stored meat. The chemical analysis determined the protein concentration of 10.70% at the concentration of fat from 13 to 14%, water content from 65 to 65%, sodium concentration from 0.62 to 0.65% (from 100 to 300 mg/kg) and connective tissue proteins in the concentration of 0.5%. The obtained results of chemical analyses were in accordance with the values of the producer’s specification, according to which the quality of the tested products was satisfactory. The limited chemical characteristics of such meat during the process of storing are in accordance with the results of other authors (Stehnhausen and Steinhaus, 2005; Schüttle-Sultan and Horn, 2003; Zara et al., 2003; Trávčová et al., 2004). The obtained results of microbiological analyses are also in accordance with the results of other authors (Horáková and Lukáč, 1984). The appearance of turkey “Baader meat” stored for 12 months is presented in Photo 5.

Conclusions

Based on the results obtained during the observation of turkey “Baader meat”, it can be concluded that 12-month storage of frozen meat, according to the producer's recommendation, ensures a chemically and microbiologically safe product, but organoleptic alterations become visible after nine months of storage. The listed indicates to frozen meat of organoleptically questionable quality which is not recommendable for use in further production of meat products such as sausages, pastrami and others. Therefore, during the use of “Baader meat”, the storage of nine months since the date of production is recommended.

References


Organoleptische und mikrobiologische Veränderungen auf baader Truthahnfleisch

Zusammenfassung

Forschungsarbeiten durch Menschen entknochten Fleisches, baader Fleisch, Dauerfrist, organoleptische Eigenschaften

Cambiamenti organolettici e microbiologici della carne di tacchino “Baader”

Sommario

Parole chiave: carne di pollo presente al tempo di esame, carne “Baader”, dati di esame, caratteristiche organolettiche

Introduction
Different kinds of sausages and other meat products are produced in rural households and family farms in the area of central Istria. These are traditional products which should become recognizable Croatian productions after the project of protection of origin and geographical indication, which has been start- ed by the Association of Istria Pro- ducers and other country institutions. In the area enclosed by this research were registered households that produce pig of white meat, leaves of large white, Landrace and their crossbreeds, and traditional Tuscan sausages. The aim of this work was to present the production technology as well as quality and safety of home-made sau- sages. Samples for personal needs are produced in households while respecting minimum standards. After the products are protected and in compliance with the regulations, there is an aspiration for them to be produced in registered facilities for human consumption as quality, shelf life and safety. The paper presents the results of sensory, chemical and microbiological investigations of home-made dried sausages.

Key words: traditional meat products, sausage quality

Production and quality of home - made Istrian dry sausages

Summary
This paper presents the procedure of traditional production of home-made Istrian sausages. Procedures and recipe for sausage production at home differ depending on the household and family tradition. During the sausage making, all households use to the basic production norms aiming at quality, shelf life and safety. The paper presents the results of sensory, chemical and microbiological investigations of home-made sausages.

Keywords: traditional meat products, sausage quality

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Magnetic resonance imaging was used to observe the muscle cross-sections of the two experimental groups. The data were analyzed using two-dimensional and three-dimensional image processing techniques. The results of this study showed that the mechanical properties of the experimental groups differed significantly. The mechanical properties of the control group were similar to those of the experimental group. The results of this study provide important information for the development of new meat products.