

Review article

Impacts of meat spoilage on economy and public health

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Abstract

The meat spoilage cause shortening of shelf life of the meat, so it has negative effect on economy on economy. The meat spoilage occurred due to microbial growth, so the meat spoilage has public health hazard. The meat preservation started with mankind from day one of living and is still carried in every type of meat such as beef, mutton fish, poultry and their products. The basic concept of the meat preservation is to increase the shelf life of the meat and meat product without deteriorating the quality and texture of the meat products by delaying the growth of different types of bacterial and fungal organism. The transformation of any meat from edible to inedible with the denaturation of the texture, quality and the taste of the product in the presence of organisms as bacterial and fungal growth that deteriorate the meat. Every year the economy of every country in the world faces a huge loss in the meat and meat products because of the meat spoilage and low level of preservation skills carried out in the handling and processing. The basic mechanisms of the meat spoilage are bacterial activity, lipid oxidation and enzymatic activity. The oldest preservation methods include drying, salting, pickling and smoking that's are helpful in the preservation with the freezing; however, with the passage of time new methods of the preservation got invented including freezing, chilling and irradiation that increased the preservation duration and their ease in application. Now a day's preservation is done for every type of the meat and meat products by using of different modern techniques such as the chilling and different types of freezing methods, ultimately increasing the shelf life, quality and texture of products by almost neutralizing the growth of bacterial organisms.

Keywords: Meat preservation, bacterial organisms, public health, economy.**1. Introduction**

The meat is the rich source of the protein that the world is utilizing, and the meat utilization is increasing day by day. The meat is the first choice of peoples all over the world including protein sources such as chicken, turkey, beef, mutton, fish, pork, camel meat and their consumption is increasing day by day and for increasing consumption we have to think about the methods through which more meat production can be achieved and also deals about the meat preservation [1-6]. The meat preservation process includes the preservation of the meat for longer time by using different methods. The meat processing plants or slaughtering houses are always built far from the city, so there is desirable need of the meat preservation for transporting it to far distances without deteriorating the meat quality [7-11]. The animal transformation involves several steps like loading of animals from farm and transporting them to the slaughter house where they are slaughtered. Any poor technique used in facilitating animals will leads to injuries and ultimately it will reduce the meat quality and causes the meat spoilage [12-16]. The Environment is surrounded by a numerous bacterial pathogens and also excess water content in the meat makes it more vulnerable for the pathogens attack ultimately cause the meat spoilage. As animal meat consumption is

increasing day by day and so do the meat spoilage losses are also increasing [17-22]. Stress during slaughtering of animal process will adversely affect the meat quality, speedup the meat spoilage activity and cause the major portion of the meat loss. The major meat constituents are fats, proteins, carbohydrates and water [23-27]. In order to minimize the meat losses that are majorly caused by the meat spoilage need to draw some new potential preservation methods in order to keep the freshness of the products. As modern era is demanding the well quality meat, that is dire need to establish some advance methods to prevent the meat spoilage to make the meat quality products to preserved for a longer time [28-32]. The major cause of the meat spoilage is rigor mortis of muscle, that term explains the hardness of muscle after the slaughtering of animal and more stress produced quicker rigor mortis. Also explained that meat contains several constituents like proteins, fats and carbohydrates that spoiled by different types of the enzymatic activity [33-38]. In Middle Ages people used different traditional methods to secure the meat from being spoiled. In that era there was less bacterial activity because there were less bacteria present in the air at that time. There was also less pollution at that time but now in advanced era the air is already polluted, so therefore, there is more meat spoilage because of the bacteria [39-

44]. The meat losses due to the meat spoilage are increasing every year greatly almost several million tons of the meat is lost every year due to the meat spoilage. New methods enable to establish a thought to urges about the economic losses and their reduction to maximize the economic gain from the meat industry [45-50].

1.1. The Causes of Meat Spoilage

There are several causes of the meat spoilage, here will discuss pre-slaughtering meat quality deterioration and post slaughtering meat quality deterioration effect. Both of these effects cause the spoilage of the meat due to poor handling and management practices [51-56]. Animals face stress while pre-slaughter period as a result, this causes the reduction level of glycogen in muscle activity and ultimately changes the pH level of the meat while glycogen content of animal muscle is broken down and lactic acid produced through anaerobic glycolytic pathway [57-61]. The meat changes to dark, firm and dry due to high level of pH. DFD caused due longer period of the stress cause the reduction of shelf life of the meat and the meat gets paler, softer and exudative due to the short time stress. When the meat is pale, soft and exudative the meat pH gets lower to 6.2 which is the point in which the protein breakdown takes place and this pH is suitable for the bacterial growth. There are basically three mechanisms for the meat spoilage; the bacterial activity, the Lipid oxidation and the autolytic Enzymatic activity [62-66].

1.2. The bacterial activity of meat spoilage

A variety of microflora such as molds, yeasts and bacteria out of which some are pathogens grow excellently on the meat and meat products. The main sources of these microflora or pathogens is intestinal tract of the animals and their skin. The pre-slaughter lookout practices, age of the animals, handling during the slaughtering, temperature control, the preservation methods and the handling by consumer are major factors on which the composition of these pathogens depend [67-73]. There are different species of the bacteria, molds and yeasts that are present in the meat before the process of the meat spoilage. Yeast species include *Cryptococcus*, *Candida* spp. while some mold species such as *Cladosporium*, *Geotrichum* and *Penicillin* spp. several species of the bacteria that are present in the meat and meat products include *Streptococcus*, *Micrococcus*, *Pseudomonas*, *Bacillus* and *Clostridium* spp. *Enterococcus* species is the most dominant specie of the bacteria [74-78]. The meat and meat products are affected with the different types of bacteria on different types of the storage conditions. Several types of the bacteria work more efficiently in the colder environment than in the hotter environment and the enteric bacteria are present on those products which were refrigerated [79-84]. Similarly, several species like *Moraxella* spp. and *Acinetobacter* spp. are the most likely to grow in the hotter environment. Several pathogens that likely to grow in the hotter environment are mostly found in the raw, salted cured products such as the hams and the uncooked beef, the reason for their growth is that they are salt resistant [85-90]. The growth of *Pseudomonas* spp. and the enteric bacteria is well favored in the cold environment at 5 Celsius and is the most prevalent in the modified environment. The *Pseudomonas* bacterial spore

can affect the shelf life of the meat only at 2 Celsius and its growth rate is much slower at 0 Celsius. Similarly several other species like *Salmonella* spp. above 7 Celsius can affect the meat quality and the shelf life but under 7 Celsius the *Salmonella* spp. growth is too slow and at the pH of 5.5-7.0 is favorable for the growth of the spoilage bacteria within the pH 5.5 to 7.0 the meat quality deteriorates because of the bacterial activity that will result in the formation of the slime, the meat will be off odour and the meat appearance also changes. There is several derivatives of the ammonia like the methylamine and others were detected in the spoilage activity and there are several types of the ketones, alcohols were produced by the bacterial activity having the sweet odour [91-96].

1.3. The Lipid Oxidation of meat spoilage

The free radical production and the oxidation of the lipids present in the meat will affect the fatty acids and the result will be presence of odour in the meat, off-flavor and the meat quality deterioration. The metabolic process gets stopped when the blood circulation gets stopped and the fatty acid present in the meat start to get oxidize after the slaughtering of the animal. The fatty acid always form double bond with the oxygen present in the air in the lipid oxidation process and the initiation, propagation and the termination are the three basic steps that involve in the lipid oxidation [97-102].

1.4. The Initiation of meat spoilage:

During the process natural catalysts like the heat and the irradiation form free radicles, when these radicles react with the oxygen present in the air form peroxy radical [103-107].

1.5. The Propagation of meat spoilage:

The peroxy radicles that were formed during the initiation process will now react with the other lipid molecules to form new free radicles and hydro-peroxides [108-112].

1.6. The Termination of meat spoilage:

The meat spoilage occurs when the free radicles that were produced in the first two steps interact with each other and form non-radicle products. The different factors that affect the oxidation of the lipids like the antioxidant vitamin E and the composition of the fatty acid. The breakdown of the hydro peroxide cause release of several products such as the acids, ketones and aldehydes. These effect causes degradation in the nutritive value and loss of colour because of their extreme effect on the carbohydrate, lipids and vitamins ultimately, they are related to several extreme pathogenic process [113-116]. Hydrolysis of the lipid in the meat can be done either enzymatically or non-enzymatically and while enzymatic hydrolysis is done with the help of several enzymes such as phospholipase and lipase, the main enzymes that are involved in the hydrolysis of the lipid in the meat are Phospholipase A1 and A2. Proteins that are susceptible to the oxidation and will produce hydro peroxides are hemoglobin, cytochrome and myoglobin and they are responsible for the non-enzymatic hydrolysis [117-120].

1.7. The Autolytic Enzymatic Activity of meat spoilage:

The main cause of the meat deterioration is the enzymes that

are present in the body. They work normal only when an animal is living and when they die or get slaughtered they are the main cause of the meat deterioration and reduced the shelf life. The meat deterioration starts when the enzymes react chemically with other compounds and act as catalyst for the chemical reaction ([16-21]. The tissue protease is an enzyme that is responsible for the flavor change and the textural change and this enzyme is released by the breakdown of the polypeptides. The Post-mortem autolysis of the meat through the digestive process is done by some enzymes such as the calpains and cathepsins [31-36]. The tenderization process of the meat is done at the low temperature growth of the biogenic amine production and the bacteria increases which also increase the proteolytic enzymes that's lead to the deterioration of the meat quality [91-96].

2. Conclusion

The meat spoilage produced very terrible effect in the past because of the poor or no preservation methods but now it became extremely easy to prevent the meat and meat products from the meat spoilage by reducing or almost inhibiting the growth of the bacterial pathogenic organisms by the using different types of the meat preservation methods.

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