

Aging Applications on Beef Meat

Hatice Ahu Kahraman¹, Ümit Gürbüz^{*2,3}

¹ Mehmet Akif Ersoy University, Faculty of Veterinary Medicine, Department of Food Hygiene and Technology, 15030, Burdur/Turkey, h.ahuerdem@mehmetakif.edu.tr

² Selçuk University, Faculty of Veterinary Medicine, Department of Food Hygiene and Technology, 42003, Konya/Turkey

³ Kyrgyz-Turkish Manas University, Faculty of Veterinary Medicine, Department of Food Hygiene and Technology, 720044, Bishkek/Kyrgyz Republic

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Abstract:

Aging of meat is defined as a process which increases the taste and the flavor of the whole carcass or its parts naturally at refrigerator temperatures. The process is one of the oldest method used for the formation of flavor and tenderness in meat products. In the aging process, it is known that the mechanism enhancing the flavor and aroma development is caused by the increases in the density of the flavor components of the tissues by losing water and the mechanism causing the meat to be tender is caused by the breakdown of the connective tissue by the natural enzymes in muscle tissue. There are two aging methods (dry and wet aging) commonly used. Recently, dry aging in a bag, which can be used as an alternative to traditional dry aging method, is used. In the aging period, aging time, storage temperature, relative humidity and air flow are important in terms of meat flavor, shelf life, amount of shrinkage, microbial load, quality components and economic value of the meat. In this paper, aging processes and application parameters are reviewed in terms of the recent studies.

Keywords:

Aging parameters, beef meat, dry aging, dry aging in a bag, wet aging.

Sığır Etlerinde Dinlendirme Uygulamaları

Özet:

Etlerin dinlendirilmesi işlemi, tüm karkasın ya da parçalarının buzdolabı sıcaklıklarında doğal süreçle lezzet ve gevrekliğinin artırılması olarak tanımlanmaktadır. Bu işlem et ürünlerinde gevrekliğin ve lezzetin oluşumu için kullanılan en eski metotlardan birisidir. Dinlendirme sürecinde lezzet ve aroma gelişimini arttıran mekanizmanın, dokuların su kaybederek lezzet veren bileşenlerin yoğunluğunun artmasından; ette gevrekleşmeye neden olan mekanizmanın ise kas dokusundaki doğal enzimlerin bağ dokuyu oluşturan unsurları parçalamasından kaynaklandığı bilinmektedir. Etlerin dinlendirilmesinde yaygın olarak iki yöntem (kuru ve ıslak dinlendirme) uygulanmakla birlikte son zamanlara kuru dinlendirme yöntemine alternatif oluşturabilecek olan pakette kuru dinlendirme yöntemi de kullanılmaktadır. Etlerin dinlendirilmesinde, etin lezzetliliği, raf ömrü, fire miktarı, mikrobiyal yükü, kalite bileşenleri ve ekonomik değerliliği açısından önem taşıyan koşulların; dinlendirme süresi, depolama sıcaklığı, relatif rutubet ve hava akımı olduğu bilinmektedir. Sunulan bu derlemede, et endüstrisinde uygulama alanı bulan dinlendirme işlemleri ve uygulama parametreleri, yapılan çalışmalar doğrultusunda incelenmiştir.

Anahtar

Dinlendirme parametreleri, sığır eti, , kuru dinlendirme, pakette kuru dinlendirme, ıslak

Sözcükler:

dinlendirme.

* Corresponding Author: Gürbüz Ü., e-mail: ugurbuz@selcuk.edu.tr

1. INTRODUCTION

Meat has been one of the essential nutrients since the beginning of mankind. Today, the share of meats that are cut in modern slaughter houses and subjected to industrial processes in the consumption is increasing day by day, and the aging applications that do not require many technological equipment and processes in the production are gaining importance in the meat industry [1-3]. Due to the fact that the vital functions in the muscles do not disappear immediately after the cutting stage, the conversion of muscle to the meat requires a certain process. As a result of this process, the muscle is converted to meat and becomes consumable [4]. The aging method is one of the oldest methods used to enhance the tenderness and taste. Increased tenderness in meats is caused by the long-term activity of enzymes that cause proteolysis of myofibrils and connective tissue proteins. It is stated that the proteolytic effect of calpain system and calpastatin which is its specific inhibitor is a determinant factor for the meat tenderness [5]. In the aging process, it is known that the mechanism enhancing the flavor and aroma is caused by the increases in the density of the flavor components (stearic, linoleic, palmitic, oleic acid, glutamate, aspartate, carnosine, inosine monophosphate) of the tissues by losing water [6], and the mechanism causing the meat to be tender is caused by the breakdown of connective tissues by the natural enzymes in muscle tissues [7]. In this article, the aging methods used in today's meat industry, the application conditions and the problems that can be encountered during the application are examined in line with the studies conducted.

2. AGING APPLICATIONS ON MEAT

Aging of meat is defined as a process which naturally enhances the taste and tenderness of the whole carcass or its parts at refrigerated temperatures [8]. It is reported that up until the 1960s, when the packaging systems began to be used effectively, the aging method that was commonly used was dry aging. Since the 1970s, vacuum packaging has begun to be used as an alternative way of transporting, storing and aging meat primarily in the USA and then all over the world [9]. Dry and wet aging methods are widely applied for the aging of meat [10-13], and the dry aging in packages which can be an alternative to the dry aging has also been widely used in recent years [14].

2.1. Dry Aging

Dry aging is based on the principle of keeping the meat at 1-3°C and 70-85% humidity for 1 to 5 weeks (approximately 21 to 28 days) with no application of any protective packaging process. In this process, the unique flavor and tenderness occur due to enzymatic and biochemical changes on the meat [11]. In addition, a breakdown of proteins and fats in the meat results in a more intense flavor. This produces a positive effect on the consumers' preferences. For this reason, it is suggested that, rather than the scientific literature, the personal preferences are taken into consideration for the determination of aging period duration [15].

2.2. Dry Aging in Packages

In addition to the conventional methods of dry aging, vacuum bags with high water vapor permeability have been used for this purpose in recent years. In this method, it is possible to

obtain products which have similar taste to those obtained from the traditional dry aging, but with less humidity, and shrinkage and trimming loss. In this aging method, unique packages are used which have high water vapor permeability and allow higher amount of water loss in the product surface under normal atmospheric conditions than vacuum packages to ensure the conventional dry aging conditions [16].

2.3. Wet Aging

The aging in vacuum packages is also called as "wet aging". In recent years, it has been stated that the wet aging process has become the mostly used aging method in the meat industry due to increased preferability by consumers [17]. In this method, the meat is subjected to aging process in vacuum packages at 1-3°C for a couple of weeks. The length of treatment varies between 3 to 90 days [18].

3. AGING CONDITIONS

Aging conditions are very important in order for the meat to achieve the desired characteristics. The meat aging conditions consist of aging period, storage temperature, relative humidity and air flow. The flavor, shelf life, amount of shrinkage, microbial load, quality components and economic value are closely associated with the aging conditions [9].

3.1. Aging Duration

The aging duration causes differences to occur in the quality characteristics of meats. Thus, in a study in which 7-, 14- and 21-day dry aging periods are compared [12], it was stated that some of the flavor properties are increased in proportion to the aging duration, but the aging processes longer than 14 days do not usually provide an actual advantage. In another study in which 14-, 21-, 28- and 35-day dry and wet aging periods are compared [19], it was determined in the sensory evaluations made in the application days that there was no change observed in the meat tenderness and flavor. However, it was stated that, in both aging processes, a decrease of 17% in the Warner-Bratzler shear force values in all samples obtained from day 14 to day 35 was observed and the improvement of tenderness could still continue. In a study in which the meats obtained from *biceps femoris* and *semimembranosus* muscles were subjected to the wet aging method by vacuum shrinkage for 63 days, it was suggested that increased aging duration has negative effects on the color stability, but with positive effects on the tenderness [20].

3.2. Storage Temperature

Storage temperature is considered to be a significant factor in the wet and dry aging applications. Particularly, it is stated that the continuity of enzymatic reaction is directly proportional to the meat and storage temperature. For this reason, the meat to be wet or dry aged should be stored at temperatures higher than the freezing point (-2°C, -3°C). If the storage temperature is lower than -2°C, the effect of enzymes that play role in the aging process in the enzymatic reactions becomes negative. On the other hand, if the storage and meat temperature is higher than the defined values, the enzymatic reactions can occur properly, however, along with the undesirable odor and taste in the meat due to the development of microorganisms. This is particularly important due to the risk of development of pathogenic microorganisms in the dry aging application. In order to obtain

reliable products, it is important to use proper storage processes and appropriate temperatures in the aging of meats [9].

In the aging processes, different storage temperatures have been applied by many researchers [11,12,14,19,21-26]. In general, it has been observed that the storage temperature levels are in the range of 0-4°C. In the related literature, storage temperature values have been specified to be -0.6°C [21]; 0-1°C [22]; 0.5°C±0.5 [14]; 1°C [19, 23]; 2°C [12, 24]; 2±1°C [25]; 2.5-2.6°C [26] and 3.1-3.6°C [11].

3.3. Relative Humidity

The relative humidity value in the aging applications is considered to be another factor that has positive or negative effect on the quality characteristics of meats to be aged. However, it is stated that if the relative humidity is higher, undesirable odor and taste may occur due to the development of microorganisms that can cause deterioration in the meat. On the other hand, if the relative humidity is lower, the development of microorganisms will be limited, but the amount of shrinkage and trimming loss will be increased depending on high amount of dryness occurring on the product surface or not [9].

In the aging of meats, different relative humidity levels have been applied by a number of researchers. In general, it has been observed that relative humidity levels are in the range of 75-87%. The relative humidity levels applied by the researchers were 75% [12]; 78±3% [11]; 80% [14]; 83±11% [19]; 80-85% [22]; 85% [23] and 87±2.6% [26].

3.4. Air Flow

In the refrigerating rooms used to ensure the aging of meats, it is important to take necessary precautions for the effective circulation of air flow. For this reason, it is important that the compartments, which can prevent the air flow, are not utilized in the refrigerating rooms. It is stated that the air flow rate must be between 0.2 to 0.5 m/s in order to obtain the desired characteristics [27]. In a study in which two different air flow rates (0.2 and 0.5 m/s) were used in the aging process of meats obtained from beef *longissimus lumborum* muscles [28]. It was stated that the meats, which were dry aged at the rate of 0.2 m/s at 3°C, had the highest flavor rate at the end of 21-day aging process. This study comparing different air flow values emphasized the importance of the effect of proper temperature and satisfactory air flow application on the sensorial characteristics of meat.

3.5. Storage Properties

The refrigerating rooms to be used for wet and dry aging should have some unique characteristics. In the rooms in which the aging process is to be applied, it is necessary to use special wire racks or hooks to ensure that all meat preparation surfaces are contacted with air, achieve complete drying and prevent undesirable odor by minimizing the deterioration [9]. It is stated that it is necessary not to stock odorant substances such as gasoline, paint, onion and fish in the room in which the aging process is to be applied and not to use sawdust and similar materials on the surface in order not to induce air contamination [16].

4. POSSIBLE PROBLEMS TO BE ENCOUNTERED DURING THE AGING PROCESS

Depending on the environmental conditions, meat preparations may lose their desired characteristics after a certain period of time and be subjected to undesirable changes in terms of consumption. For this reason, the proper storage of meats following the slaughtering process is very important. It is important to pay attention to the following conditions in order to prevent possible deteriorations and undesirable characteristics in meats depending on the improper storage conditions to which the aging processes are applied.

Temperature: Decreasing the inner carcass temperature following the cutting process to 4-7°C within 24 hours is important both for preventing microbial growth and ensuring the ageing. The storage temperature condition to be applied during the aging process should be such that it does not interfere with the enzymatic activities of meat, does not result in freezing and minimizes the microbial growth and deterioration [9].

Refrigerating room properties and storage: It is known that most of the undesirable odors in meats are caused by the growth of bacteria, yeasts and molds on the walls and floors of the cooling rooms. It should be paid attention to ensure that the walls and floors of cooling rooms are made of suitable materials and that the meats are not stored together with materials that can result in odor change [9,16].

Insufficient sanitation procedures during slaughtering, cooling and aging processes: The undesirable odor, taste and deterioration may occur due to the contamination of meats with microorganisms during and after the cutting process. It is stated that the ultraviolet rays can be used to control of the microbial growth in meats during the aging applications [9, 11].

Shrinkage and trimming loss: The shrinkage and trimming loss in meats is increased due to prolonged aging periods. For this reason, the length of aging period should be determined taking into consideration of the structure, size and fat amount of the meat to be subjected to the aging process. It should be noted that shrinkage and trimming losses are importance in terms of economic value of the products [8].

5. CONCLUSION

Meat products obtained by the aging methods came back on the agenda and gained an industrial dimension. In the meat industry, it is necessary to comply with the required parameters, to develop the production workflow charts, to determine the chemical, microbial, physical and sensory characteristics of meats and to support them with new studies for these products to be produced in a safe and healthy matter. In addition, the consumption characteristics and economic values of the meats obtained by these methods should be studied. In this context, it is considered that the importance of aging applications in obtaining healthy, high-quality and innovative meat products will be increased in the upcoming days.

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