



## Investigating normal gelatin coating, containing garlic extract on increasing shelf life of turkey meat at refrigerator temperature (4 degrees Celsius)

**Hamid Reza Molaei**

Member of the academic staff of Islamic Azad University,  
Sarvestan branch

**Leila Moeini**

Teacher of food industry at Dr. Kamali Conservatory  
(Shiraz three districts)

### Abstract:

In this research, the effect of edible coating of garlic extract, along with ordinary gelatin, on increasing the shelf life of turkey meat in the refrigerator was investigated and evaluated. The samples were divided into six groups, including 1- uncoated or control (turkey meat immersed in sterile distilled water), 2- treated with 1.5% normal gelatin, 3- treated with 1.5% normal gelatin and 1.5% garlic extract, were divided. The samples are stored in the refrigerator for 15 days and at regular intervals (days 0, 3, 6, 9, 12, 15) microbial tests (total count of lactic acid bacteria, coliform and total count of mesophilic microorganisms) and test Chemical tests (determination of peroxide number and volatile nitrogen bases) and sensory characteristics (smell, texture, color, general acceptance) were carried out in a period of three days. The results showed that the count of lactic acid bacteria, coliform and total count of mesophilic microorganisms in the treatment groups showed a significant decrease compared to the control group. The samples showed a lower increase in (TBA-PH) compared to the uncoated sample, so according to the obtained results, the coatings prepared with 1.5% ordinary gelatin along with 1.5% garlic extract increased the shelf life of turkey meat. It was refrigerated.

**Keywords:** “turkey meat, shelf life, garlic extract, gelatin, thiobarbituric acid”.



## Introduction

There have been reports about the use of medicinal plant extracts to increase the shelf life of meat, creating a coating on the meat and having antioxidant properties has led researchers to look towards natural coatings such as chitosan and natural oils in order to increase the shelf life of meat products and also natural extracts such as garlic. The use of antimicrobial compounds has attracted the attention of researchers for two reasons. First of all, the excessive use of antibiotics has increased the resistance of some microorganisms such as bacteria to antibiotics, and the negative effects of artificial preservatives have made people less receptive to these substances. Today, the use of natural preservatives that have antimicrobial properties has a special place in the food industry, which requires protection during the preparation, storage and distribution stages so that it does not spoil, despite the recent advances in food preparation and production techniques. Also, in the field of slaughter, health and food safety is still an important issue. It is estimated that 30% of people in industrialized countries get foodborne diseases at least once a year. Therefore, there is still a need to reduce or eliminate food pathogens using different methods (Chowon et al., 2002). Today, with the increase in demand for more natural foods, the possibility of toxicity and negative side effects of synthetic additives, as well as the increase in microbial resistance of pathogens to antibiotics, have led to natural substances taken from plants as preservatives (Safaei et al., 2014). different methods of food preservation, including different physical and chemical methods, either individually or in a combined and consolidated manner in the food industry in recent years, the use of new methods Packaging and natural additives in food are expanding day by day. Today, consumers, especially in industrialized and developed countries, demand food with less synthetic ingredients, less healthy, high quality and long shelf life. Many antimicrobial compounds that are used in food films and coatings prevent microbial spoilage in food. They reduce the risk of the growth of pathogenic microorganisms. With the development of anti-microbial edible films and coatings, the use of essential oils of spices and plants as an anti-microbial compound became common. Since nowadays food products are sold in places far from the place of production, increasing their shelf life becomes more important in the case of Turkey meat. Livestocks receive pollution from many sources in the farm and this pollution is transmitted in production and processing. For these reasons, the use of preservatives has become common. Considering the side effects of using traditional preservative compounds and in order to reduce risks and economic costs, using natural substances such as essential oils and plant extracts as antibacterial compounds to control pathogenic bacteria and increase shelf life of food has been given a lot of attention. Since the above compounds have a valuable role in improving the organic properties of food, their use in food products is very beneficial (Basteven (2010)). Chitosan as a natural polymer, compatible with living tissues with the ability to decompose to Bio to healthy and non-toxic natural ingredients, anti-fungal, anti-tumor has biological function and is compatible with the environment. Chitosan can be considered as a natural element to increase the shelf life of food. Many scientists believe that chitosan prevents the growth of most bacteria. Garlic is one of the bulbous vegetables, which is very important in terms of food and medicine. It is believed that its genetic center was in Central Asia. Iran has a long history in terms of its quality and consumption, and the cultivated area of this plan is estimated to be around 10 thousand hectares. Currently, there are about 62 medicinal and health products in the Iranian market with the official license of the Ministry of Health. Garlic is known as a strong flavor in the food industry, that's why it is available in the formulation of some food products or in other forms such as canned garlic, pickled garlic, white pickled, dried garlic (Jeirani et al., 2012). Thyme is one of the plants of the mint family that is native to Iran, Afghanistan and Pakistan. This plant has been mentioned in traditional medicine as an antiseptic, anti-inflammatory, and is widely used as a flavoring agent in food. Thyme essential oil has an antimicrobial effect, which is mainly related to its phenolic compounds. The higher the amount of phenolic substances in the essential oil, the greater its antimicrobial properties (Nouri et al., 2013). Gelatin is an edible protein that is mainly processed from collagen, which is the main building block of the skin, tendons, bones, etc. of vertebrates, is obtained. The skin and bones of animals such as cow or fish are boiled in water and a solution is extracted from it with the help of acid, and this process takes several days. Then by processing this solution and drying it, gelatin is obtained. Gelatin is a solid, crisp and transparent material, and its color range is from pale yellow to tasteless and odorless white, and it has 90-85% protein, 1-2% salt, 10-15% water. It also does not contain sugar, fat and additives. Due to its unique texture, gelatin can form a reversible elastic gel in aqueous solution, therefore it is widely used in food industries. Also, it is used in a wide range of food products due to its adhesion, crystallization, shaping, emulsifying and water absorption properties. Therefore, the use of gelatin coating and wrappers due to its naturalness and the features mentioned above in the preservation of various foods has been the focus of researchers, and various studies have reported the favorable effects of gelatin coatings and wrappers.

## materials and methods

### 2-1- Materials

The meat of the turkey breast was obtained in a limited way from the slaughterhouse. Normal gelatin powder and chicken foot gelatin powder - Garlic extract - Chloroform - Methanol - Acetic acid - Starch reagent - Potassium iodide - Sodium thiosulfate - Magnesium oxide - Boric acid - Mobil Red reagent - Antifoam - Antiboiler - TBA reagent - Hydrogen chloride acid - Potassium sulfate-selenium oxide-light petroleum-sulfuric acid-distilled water-filter paper-PH meter-homogenizer-Soxhlet and Kant agar plate culture medium are prepared.

### 2-2-Preparing meat samples and coating

After appropriate segmentation, the turkey meat samples were randomly divided into 7 groups under sterile conditions and sent to the laboratory in a portable refrigerator at a temperature of 4+-1 degrees Celsius. The coating of 2% ordinary gelatin with 1.5% garlic and gelatin with 1.5% garlic extract was prepared according to Lux Caballo et al.'s (2005) method. In this way, gelatin is dissolved in distilled water in three normal levels, chicken feet and along with extracts, to a specific amount (weight and volume). For better swelling and dissolution, it was first placed at 7 degrees for 15 minutes and then heated at 55 degrees for 30 minutes and stirred with a magnetic stirrer. In order to soften and make the coatings more flexible, 0.075% by volume of glycerol is added to the solution as a softener and stirred for 10 minutes. Gelatin coating on three levels 1, 2 and 3 was obtained by weight and volume in acetic acid of 1% by volume. For better dissolution of gelatin, the solution was stirred for three hours at room temperature with a magnetic stirrer. Garlic extract was also prepared.

### 2-3 Covering samples

To create the mixture coating, gelatin solution was first prepared. Then 1.5% of garlic extract extract is added to it, and the desired samples were immersed in the combined solution of gelatin and extracts for 30 seconds, then they were taken out of the solution for 2 minutes. again for 30 seconds were immersed in the solution. Then placed for 2 hours at an ambient temperature of 20 degrees Celsius, until it dried and the coating was formed.

#### The treatment group includes:

- 1- Turkey meat without coating and (witness).
- 2- Turkey meat containing 1.5% ordinary gelatin
- 3- Turkey meat containing 1.5% ordinary gelatin and 1.5% garlic extract

After packing, the samples were stored in the refrigerator at a temperature of 4 degrees Celsius and chemical and microbial tests were performed at intervals of 0-3-6 and 9 days.

#### PH measurement

10 grams of turkey meat samples are poured into 150 ml bottles with 90 ml of distilled water and homogenized with a homogenizer at 13500 rpm for 30 seconds, and the pH of the samples is measured at room temperature with a pH meter (L'opez-Caballero, 2004).

#### Measurement of peroxide

For this purpose, iodometric method, fat extracted from 50 grams of meat sample using chloroform/methanol is used. Potassium iodide in an acidic environment leads to the regeneration of oil peroxide extracted from the sample. The released iodine is prepared by adding fresh starch reagent and titration is measured by sodium thiosulfate. Using the relationship of the amount of peroxide in the sample, it is obtained in terms of milliequivalents of peroxide per 1000 grams of oil (Horwitz, 1975).

#### Bacterial analysis

For the microbial test, 10 grams of Turkey meat sample is mixed and homogenized in 90 ml of NACL 0.85 solution, and then the desired dilutions are prepared. One milliliter of each dilution is placed in a PCA plate medium to culture bacteria using the pore plate method. The cultured samples are placed in a 37°C incubator for 48 hours to identify the total bacterial load identification solution and after the incubation period, the colonies are counted (Rezaei, 2010).

**Chemical analyses****Volatile nitrogen bases test**

Measurements of volatile nitrogen bases are carried out by the Keldal method and titration of the extract obtained from it. For this purpose, 10 grams of sample along with 2 grams of magnesium oxide are connected to the Keldal flask by adding 500 ml of distilled water, and the desired extract is added to a solution consisting of 2% boric acid and 1-2 drops of methyl red as an indicator. The resulting yellow solution is titrated with sulfuric acid until a purple color is obtained and is expressed as milligrams of nitrogen per 100 grams of sample (Khorasani et al. 2014).

**Measurement of consumption and breeding**

After preparing the samples and on the same day, the amount of fat and protein are measured. The amount of the sample is measured by the Soxhlet method. The test portion is boiled and mixed with dilute hydrochloric acid to release the non-free extracts, the obtained is filtered and dried, and then the residue is filtered with n-hexane or light petroleum. The amount of sample production is measured by the macrocaldal method. Organic matter is digested against concentrated sulfuric acid and potassium catalyst, sulfate, sulfate, and selenium acid, and organic matter is converted into nitrogenous mineral matter. Then, by performing the distillation step and measuring the amount of nitrogen, taking into account the protein factor (6.25), the total amount of protein calculated in terms of nitrogen. (Fengo, 2021)

**Measurement of thiobarbituric acid reactive compounds:**

(TBARs\_Thiobarbituric acid- reactive substances)

To measure TBARs, the method of Egan et al. in 1981 is used (Sallam, 2004).

10 grams of sample is weighed and mixed with 50 ml of distilled water. The resulting mixture is transferred to distillation flasks with 47.5 ml of distilled water. 2.5 ml of 4 normal hydrochloric acid along with anti-foam and anti-boiling materials are added to the mixture, and Erlenmeyer is connected to the distiller. The mixture is heated and 50 ml of the distilled substance and 5 ml of TBA reagent are transferred to tubes with lids and placed in boiling water after complete shaking for 35 minutes. At the same time, all these steps are repeated for the witness. After the samples were placed at boiling temperature for 35 minutes, they were cooled for 10 minutes and their optical absorbance was read in 1 cm cells against the control at a wavelength of 538 nm. The results of the TBA test were recorded in Table No. 1. (optical absorption  $\times 7.8$  (mg/kg malondialdehyde) = TBA), (Shaabani et al., 2014).

**Sensory evaluation test**

In order to evaluate the effect of garlic extract on the organoleptic characteristics (including taste, smell and general acceptance) of the turkey covered with the mentioned items, together with the control sample, it was placed in the grill and under direct heat and immediately evaluated by 12 panelists. . For the panel test on each attribute, a 5-rank evaluation system is used. (Sharifian, 2006)

**Texture evaluation**

Texture analyzer was used to evaluate the effect of garlic extract on texture.

(Pourmahdi Borujeni et al., 2016).

**Findings:**

The results of the measurement of volatile nitrogen bases showed that coating was more effective in reducing volatile nitrogen bases from bacterial products and the treatments had significant differences compared to the control. These coatings showed their antioxidant properties with a lower proxy index in coated samples compared to the control sample, and more favorable results were obtained in the turkey meat sample containing 1.5% ordinary gelatin along with 1.5% garlic extract. Based on the results of the present research, gelatin alone does not have the ability to increase the shelf life of turkey meat, but as a physical layer and synergistically with garlic extract, it can be effective in increasing the shelf life. The amount of these changes was significant compared to other treatments. In general, the turkey meat sample containing 1.5% of ordinary gelatin and 1.5% of garlic extract preserves the characteristics of the product better for up to 3 days of storage. Microbial tests (total count of lactic acid bacteria, coliform and total count of mesophilic microorganisms) and chemical tests (determination of peroxide value and volatile nitrogen bases) and sensory characteristics (smell, texture, color, overall acceptance) in a period of three days The results showed that the count of lactic acid bacteria, coliform and the total count of mesophilic microorganisms in the treatment groups showed a significant decrease compared to the control group. In terms of (TBA-PH), the samples showed a lower increase compared to the uncoated sample, therefore, according to the obtained results, the coatings prepared from gelatin containing garlic extract, the quality of turkey meat samples within 7 days in the refrigerator is suitable at 4 degrees Celsius and the shelf life of turkey meat is increased.

The results are shown in Table 1.

Table 1:

Storage temperature 0-4°C	Control treatment	Treatment (1.5% ordinary gelatin)	Treatment (1.5% gelatin covered with garlic extract)
First week (Turkey)	3/93 ± 0/2098 a	3/83±0/01155 b	3/73 ± 0/02517 c
Second week (Turkey)	2/50 ± 0/12055a	2/10 ± 0/00577 b	2/00 ± 0/02646c
First month (Turkey)	3/92 ± 0/ 02517 a	3/92 ± 0/05292 b	3/82 ± 0/02646c
Second month (Turkey)	4 ± 0/ 02646 a	3/94 ± 0/05508b	3/84 ± 0/02082 c
third month (Turkey)	4/1 ± 0/02646 a	3/85 ± 0/04041 b	3/7 7 ± 0/02082 c

1-Values are reported as mean ± standard deviation. 2- The results with different uppercase letters are statistically significant with a 5% error probability. 3- The results were compared in terms of the significance of the effect of concentrations in horizontal rows.

The statistical evaluation of the TBA index indicates that the samples containing garlic extract have the greatest effect in preventing the development of oxidation and inhibiting spoilage, therefore, this decrease in the index was observed in the refrigerated and frozen samples, the treatments of the first week and Second, they were checked at the temperature of the refrigerator and the treatment of the first, second and third months at the temperature (-18°C) degrees Celsius. Investigating changes in physical and sensory factors To investigate the sensory and organoleptic characteristics of turkey meat, four characteristics are important, which include: appearance, muscle elasticity, smell, and color. Based on this classification, characteristics such as the absence of glaze on the surface of the muscle and the quick return of the muscle to its original state, and having a deep cherry red color and the natural smell of turkey meat are known as superior sensory characteristics, and having characteristics such as the presence of glaze in some parts of the muscle and the slow return of the muscle. It is assumed to be acceptable in its initial state and having a medium red color with an unusual smell such as a mild smell of sulfur or ammonia. Having features such as: the presence of glaze on the entire surface of the muscles and the failure of the muscle to return to its original state, and having the smell of corruption, sourness or acid, and having a faint and weak red color, it is considered unacceptable, (Baston, 2010). In order to evaluate the sensory characteristics, a panel of three people whose members were educated people present in the laboratory and evaluated the samples according to their appearance, muscle elasticity, smell and color was used, and for evaluation, a scoring system was used. or three-point hedonic scale, score 1 is very bad, score 2 is acceptable, and score 3 is very good, was used, Table No. 2, (Seydim, 2006).



Table 2 ranking of sensory factors based on quality and numerical ranking

Specification					
Numerical rating	sensory quality	color	smell	elasticity	appearance
3	Excellent	Red color	Natural smell of turkey meat	Relatively quick return to the previous state	Imperceptible lack of enamel on the muscle surface
2	acceptable	medium red	unusual smell (slightly sulphurous)	Slowly return to the previous state	Sourness of some muscles
1	unacceptable	Weak red and pale	Foreign smell (sour, acid)	No recovery	The presence of glaze on the entire surface of the muscle

### Conclusion:

Biodegradable coatings with antimicrobial and antioxidant properties can be the answer for healthy and environmentally friendly packaging in food. Therefore, in the current research, we are preparing a coating of garlic extract with high antioxidant and antibacterial properties, as well as a coating containing gelatin, in order to use them to store turkey meat at refrigerator temperature. The chemical and microbial parameters of the spoilage of turkey meat were investigated. The results of chemical analyzes show that all the treatments containing coating will have a slower increasing trend in the oxidative spoilage indices compared to the control treatment. The appropriate antimicrobial property of garlic extract causes the coating treatment containing chicken feet gelatin and extract to prevent the growth of the whole microbial from the growth of spoilage microorganisms in the meat of turkey, (Molaei, 2023).

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