Microbial evaluation of minced local chicken meat preserved in polyethylene wrap treated with cold and hot aqueous carnations extract and zinc nano particles

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Abstract:

This study aimed to evaluate the microbial nature of local minced chicken meat preserved in polyethylene wrappers treated with cold and hot aqueous carnations extract and zinc nano particles. The experiment included refrigerating the minced chicken meat at 4°C for 10 days.

The study included four treatments with different additives through which the polyethylene bags were treated: the first treatment (T), the control treatment (no additive), the second treatment (T1) cold aqueous carnations extract at a concentration of 1250 mg/ml, and the third treatment (T2) hot aqueous carnations extract. With a concentration of 1250 mg/ml, and the fourth treatment (T3) was nano-zinc with a concentration of (20) mg/ml. The minced local chicken meat was kept in the treated bags individually and stored for periods of (1, 5, 10) days in refrigeration at 4°C. After that, some tests were conducted. Microbial, the results of this study were as follows:

1- The zinc nano addition treatments recorded the lowest value in the logarithm of the total number of aerobic bacteria and E. coli compared to the control treatment of local minced chicken meat stored in cold storage.

2- Addition treatments with zinc nano and cold and hot aqueous carnations extract contributed to extending the shelf life of minced local chicken meat stored in cold storage for (10) days compared to the control sample.

Keywords: Cold and Hot aqueous carnations extract, Minced chicken meat, Microbial contamination.

Introduction

Poultry meat and its products are characterized by a high nutritional value compared to other types of meat, as they constitute a major food source of essential amino acids in human nutrition, and are a source of B complex vitamins and some mineral elements such as iron (1). Depending on the biological and chemical nature of chicken meat, it is susceptible to spoilage. As a result of contamination with bacteria from various sources, the use of chemicals and industrial materials to preserve meat and its products has become essential in order to avoid rapid spoilage of the products. However, some of them have a bad impact on human health (2). With the increase in health awareness, research centers have become interested in using natural materials that It does not have a harmful effect on the health of the consumer, as polyethylene packaging containing natural antibacterials has become of prominent importance in extend the shelf life of food products and reducing the risk of pathogenic bacteria, as attention has turned to the use of alternative and safe materials such as food additives of plant origin (3). One of the most promising mechanisms for inhibiting antibiotic-resistant bacteria is the use of effective compounds from plant extracts (4). The current study included the fruits of the carnations plant *Syzygium aromaticum,* which belongs to the plant family *Myrtaceae* and is one of the plants that has antibacterial and

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antifungal activity (5). This is because it contains the compound Eugenol, which is one of the basic compounds of carnations oil and represents about 72-90%, as studies have confirmed that it has antioxidant activity in addition to containing many effective compounds, including Kaempferol, Vanillic acid, and many active groups, including tannins, saponins, alkaloids, and phenols (6). On the other hand, the progress of nanotechnology has opened wide horizons in packaging foodstuffs and increasing the duration of preservation. The packaging processes have also shown to be safer than regular packaging processes, thus obtaining healthy and safe foodstuffs (7). Membranes containing nanoparticles were used to encapsulate foodstuffs and extend their shelf life, in addition to producing nano-foods that were shown to have different specifications from their state before adding nanomaterials to them (8).

The use of nanoparticles to transfer antibacterial properties, which increases the effectiveness of antibiotics in microbial inhibition, in addition to their single effectiveness, which is through tearing the wall and cell membrane, thus causing the death of microbial cells and disrupting their biological effectiveness, in addition to their effectiveness against all microbial species diverse in their physiological characteristics. Therefore, it can be promising in eliminating all types of microbial diseases. (9).

The aim of this study is to know the inhibitory effectiveness of the aqueous extract of the carnations plant against bacteria and prolonging the preservation period of local minced chicken meat and the effect of polyethylene covers treated with the nano-extract in prolonging the duration of cryopreservation.

Materials and methods

-Sample collection and classification:

Carnations buds, *Syzygium Aromaticum*, are considered plants that have the ability to resist bacteria and fungi, because they contain the compound Eugenol (10), which were obtained from local markets in the city of Tikrit, were collected and diagnosed by experts from the Department of Horticulture / College of Agriculture / Tikrit University, ground and preserved in airtight plastic boxes at laboratory temperature until use.

1- Hot and cold-water extraction method:

The aqueous extract of the carnations plant was prepared by completely crushing it using an electric grinder(Blender China), and then the extracts were prepared by weighing (50) grams of plant powder and adding (500) ml of cold distilled water and distilled water at boiling point for the hot aqueous extract (11) and leaving it. Cold aqueous extracts for (24) hours in the refrigerator, then filter the extract with several layers of soft cloth (filter), then concentrate the extract by evaporating the water using a rotary evaporator (English origin) at a temperature not exceeding (40) C, where a thick extract is obtained. consistency, then complete its drying using a convection oven at a temperature not exceeding 40°C, then save the final extract after drying until use (12) and (13)

Preparation of nanomaterial solutions

Concentrations of zinc nanoparticles (ZnNPs) were prepared by dissolving 200 mg of matrix in 10 ml of hot distilled water (14)

-Preparing storage bags:

Sealable polyethylene bags designated for preserving meat bearing the trade name Falcon (Falcon), of Emirati origin, were prepared and obtained from local markets in the city of

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Tikrit and treated with different concentrations of aqueous extract. Then the minced chicken meat was preserved inside them according to the sequential steps. As follow :

1- Take 800 grams of skinless local chicken meat, then chop it with an electric grinder.

2- Polyethylene bags were prepared and stained with a sterile brush using the previously mentioned treatments.

3- 200 grams of minced meat were placed in the treated bags.

4- Microbial test were performed on day (1).

5- The bags of meat were preserved by refrigerating at a temperature of 4°C.

6- Microbial tests were repeated on days (5 and 10) of preservation, respectively.

For statistical analysis:

The data were analyzed statistically through the experimental system within the ready-made statistical program (15) and using the complete random design system (CRD). The averages were chosen according to the multiple-range test by Duncan (16) to determine the significance of the differences between the averages of the factors affecting the studied characteristics at the level of (0.05).

RESULTSAND DISCUSSION:

-Bacterial tests:

Bacterial tests were conducted for samples to which different concentrations of cold and hot aqueous carnations extract and nano-zinc were added to study the extent of their effect in reducing bacterial growth in minced chicken meat stored in cold storage for 1, 5, 10 days.

-Total number of aerobic bacteria:

The results in Table (1) showed that there was no significant effect on the total number of bacteria for treatments T1, T2, and T3 during the 1-day cold storage period, as the logarithm of the total number of bacteria reached 4.93, 4.93, and 4.90, respectively, compared to the control treatment T (no in addition, the logarithm of the total number of bacteria reached (4.99) bacterial colony units/gm of chicken meat when stored for 1 day.

When stored for 5 days, there was a significant decrease at the level ($0.05 < P$) between treatments T1, T2, and T3, which amounted to 6.01, 5.77, and 5.51 bacterial colony units/g of chicken meat, respectively, compared to its value for the control sample T, which amounted to (6.79) bacterial colony units/g chicken meat.

The 10-day storage period had a significant effect in reducing the total number of bacteria for the treatments, T1, T2, and T3, which reached the logarithm of the total number of bacteria at 8.45, 8.14, and 7.29 bacterial colony units/g of chicken meat, respectively, compared to the total number of bacteria for the control sample, which amounted to (9.36) bacterial colony units/g chicken meat.

The difference in storage periods of 10, 5, and 1 days had a significant superiority over the logarithm of the total number of bacteria, as we notice that its lowest level was when stored for 1 day, then it began to rise as the days of storage passed until it reached its highest level when stored for a period of 10 days.

This is due to the content of spice and herb extracts of phenolic compounds that enables them to act as antimicrobials as a result of changing the permeability of microbial cell membranes (17)

The results of the study agreed with the findings of (18), the study of (19)and(20). These results agree with what (21) found when

using nano-extracts of both cinnamon and turmeric plants manufactured in an environmentally friendly way, as the cinnamon extract showed Nanoparticles have a greater effect against fungi compared to turmeric nanoextracts. The reason was attributed to the role of active plant compounds, which are more quantitative and qualitative in cinnamon extract, which act as various antimicrobial agents.

Table 1 The effect of storage periods on the logarithm of the total number of aerobic bacteria

Total bacteria logarithm			Treatment	Adjective
day) 10(	day) 5(	day) 1(		
a 9.36±0.57	**a 6.79±0.33**	**a4.99±0.33**	**T**	**Aerobic bacteria + standard**
b 8.45±0.33	**ab 6.01±0.33**	**a4.93±0.66**	**T1**	
bc 8.14±0.33	**bc5.77±0.33**	**a4.93±0.33**	**T2**	
bcd 7.29±0.33	**bc 5.51±0.57**	**a4.90±0.57**	**T3**	

The means bearing different letters differ significantly among themselves at the level (0.05 < P)T, control treatment without addition, T1 (cold aqueous carnations extract) and T2 (hot aqueous carnations extract), T3 (ZN Nps 20 mg/ml.

Ecoli bacteria:

The results in Table (2) showed that there was no significant effect at the level of ($p<0.05$) on the number of coliform bacteria for treatments T1, T2, and T3 in a period of 1 day with refrigeration at a temperature of 4°C, as the logarithm of the number of coliform bacteria reached 2.79, 2.80, 2.81. Compared to the control treatment T, which had the logarithm of the number of coliform bacteria at (2.81) bacterial colony units/g of chicken meat when stored for 1 day.

The effect of the 5-day storage period also had a significant effect, as a significant decrease (0.05 < p) was observed in the logarithm of the number of coliform bacteria for the treatments. The lowest value was for the T3 (nano-zinc) treatment, which was 3.22 bacterial colony units/g of chicken meat compared to its value for the logarithm of the control sample. T, which was 4.22 bacterial colony units/g chicken meat.

When stored for 10 days, there was a significant decrease at the level (0.05 < P) also for treatments T1, T2, and T3, in which the logarithm of the number of coliform bacteria reached 6.31, 6.00, and 5.47 bacterial colony units/g of chicken meat, respectively, compared to the number of Coliform bacteria for the control sample, which amounted to (6.62) bacterial colony units/g of chicken meat.

As for the effect of the storage period on the logarithm of the number of coliform bacteria, the results of the statistical analysis indicated that there was a significant (P < 0.05) superiority in the logarithm of the number of coliform bacteria, and it was at its lowest level during the 1-day period, then it began to increase as the storage period progressed to its highest level in A period of 10 days, and the results agreed with the findings of (22). By adding Fart frankincense at concentrations of 150,300,450 mg/ml to grilled lamb meat preserved by refrigeration for 0,3,6 days, results were achieved to significantly modify the preparation of microorganisms, especially the concentration of the extract.

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Table (2) The effect of storage periods on the logarithm of the number of coliform bacteria

logarithm of the number of coliform bacteria			Treatment	Adjective
day) 10(	day) 5(	day) 1(		
a 6.62±0.33	a4.22±0.33	a2.81±0.33	**T**	**Ecoli + Error**
a 6.31±0.57	ab3.93±0.57	a2.79±0.33	**T1**	
ab 6.00±0.33	Cd 3.65±0.33	a2.80±0.33	**T2**	
Bc 5 .47±0.33	bdc3.22±0.33	a2.81±0.33	**T3**	

The means bearing different letters differ significantly among themselves at the level (0.05 < P)T, control treatment without addition, T1 (cold aqueous carnations extract) and T2 (hot aqueous carnations extract), T3 (ZN Nps 20 mg/ml.

Yeasts and molds:

The difference between the treatments and the differences in the numbers of yeasts and molds were explained in Table (3), where the results show the effect of storage between the different treatments and the period of cold storage at 4°C on the numbers of yeasts and molds.

It was noted that no growth of yeasts and molds was recorded in the periods 1 and 5 days when stored in cold storage at a temperature of (4°C) and for all different treatments.

While the results of the statistical analysis in Table (3) for the treatments during storage for a period of 10 days indicated a significant decrease at the level (0.05 < P) in the number of yeasts and molds for treatments T1, T2, and T3, for which the logarithm of the number of yeasts and molds reached 2.90, 2.79, and 2.36 colony forming units. /g chicken meat, respectively, compared to the number of yeasts and molds for the control sample T, which had a log count of (3.64) colony-forming units /g chicken meat, and this is consistent with what was found (23).

Table (3) The effect of storage periods on the logarithm of the number of yeasts and molds

yeasts and molds			Treatment
day) 10(	day) 5(	day) 1(	
a 3.64± 0.33	**0±0 a**	**0±0 a**	**T**
b2. 90±0.33	**0±0 a**	**0±0 a**	**T1**
b2.79±0.33	**0±0 a**	**0±0 a**	**T2**
b2.36± 0.33	**0±0 a**	**0±0 a**	**T3**

The means bearing different letters differ significantly among themselves at the level (0.05 < P)T, control treatment without addition, T1 (cold aqueous carnations extract) and T2 (hot aqueous carnations extract), T3 (ZN Nps 20 mg/ml.

The storage periods recorded 1,5,10 significant increases (0.05 < P) in the logarithm of the number of yeasts and molds, as the results of the statistical analysis indicated that the lowest value for yeasts and molds was on days 1 and 5, then it began to

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rise as the days of storage passed until it reached its highest level. When stored for a period of 10 days.

The volatile oils in the carnations plant take two different directions in their action against fungi: they are a fungal inhibitor and the second is a fungal killer, in which the fungus dies (6). The active compounds of the carnations plant have an inhibitory ability **towards** fungi, as they interact with the proteins of the cell membrane and thus cause a change in permeability. membrane and a disruption in respiratory activities within the fungal hyphae (24). In addition to the independent role of nanoparticles in rehabilitating microorganisms, as a result of causing damage to bacterial cells and losing some of their updating functions. (25).

The results of the study disappeared with what was stated in the results of the study of (26), which concluded that the plant extracts of gujarat, eucalyptus, and mint, and their alcoholic and aqueous types, are effective in suppressing yeasts and molds by 100%, as (27) is unknown.

Conclusions

Can be concluded that preserving meat in polyethylene bags treated with cold and hot aqueous carnations extract and nano-zinc achieved high effectiveness in preserving samples and inhibiting the microbial load of minced chicken meat stored by refrigeration at a temperature of 4°C.

Recommendations:

1 -Detecting other nano-extracts and studying their effect on meat with different storage periods.

2- Applying the treatments used to prolong the storage period to other types of meat, such as sheep, cows, and fish.

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